Nokia Customer Care

Service Manual

RM-180 (Nokia N72)

Mobile Terminal

Part No: 9250815 (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	05/2006	Merja Hautaniemi	

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IMPORTANT

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

Warnings and cautions

Warnings

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

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise the GSM PA may be damaged.

ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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

Care and maintenance

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

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

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

Company Policy

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

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

Please state:

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

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Battery information

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

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

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

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

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

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

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

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

Do not dispose of batteries in a fire!

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

Nokia N72 Service Manual Structure

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1 — General Information

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Product selection

RM-180 is a tri-band GSM phone, supporting EGSM900/1800/1900 bands.

According to GSM standard 05.05 it responds to class 4 (max. 2 W) in EGSM 900, class 1 (1 W) in GSM 1800 and class 1 in GSM 1900. The device supports EGPRS (EDGE) class B as well as Bluetooth 2.0 + EDR (Enhanced Data Rate) standard. The handset has a full phase 2 Type Approval and it complies with the GSM Type Approval. RM-180 also has a full CE approval and FCC (Federal Communications Commission) approval.

RM-180 is an MMS (Multimedia Messaging Service) enabled phone with a large bright colour display and an integrated 2.0 megapixel rear camera.

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

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

RM-180 use a Symbian 8.0a operating system and support also MIDP (Mobile Information Device Profile) Java 2.0 & CLDC 1.1 (Connected Limited Device Configuration), providing a good platform for 3rd party applications.

Figure 1 View of RM-180

RM-180 product features and sales package

Imaging and video

- 2 megapixel camera (1600 x 1200 pixels) with 20x digital zoom
- Dedicated shutter key and camera activation slide
- Integrated flash (operating range up to 1.5 m)
- Flash modes: on, off, automatic, and anti red-eye
- Advanced camera modes: still, sequence, video

- Six possible capture scene settings including scenery, portrait, night and sports
- Settings, brightness adjustment, image quality, self-timer, white balance settings and colour tones
- Video and still image editors
- Movie Director for automated video production

Bearers & transport

- GPRS class B, multislot class 10
- EGPRS multislot class 10
- USB 2.0
- Bluetooth 2.0

Software platform

- Nokia Series 60 release 2.8
- Symbian 8.1

Connectivity

- Integrated Bluetooth wireless technology v.2.0
- USB 2.0 full speed via Pop-Port™ interface
- Nokia PC Suite connectivity via USB and Bluetooth wireless technology
- Local synchronisation of contacts and calendar to a compatible PC using compatible connection
- Remote over-the-air synchronisation
- Send and receive images, video clips, graphics, and business cards via Bluetooth wireless technology
- Profiles with Bluetooth connectivity: Basic Printing Profile (BPP) using Image Print or Info Print applications, Human Interface Device Profile (HID) using Nokia Wireless Keyboard application

Sales package

- RM-180 transceiver
- HS-3 stereo headset
- CA-53 USB connectivity cable
- MU-1 RS-MMC 64 MB with adapter
- BL-5C Li-ion battery cell
- AC-3 charger
- User guide
- CD-ROM (with PC-Suite)
- Carry strap

Mobile enhancements

Table 1 Audio

Enhancement	Type
Boom mono headset	HDB-4
Fashion stereo headset	HS-3
Mono headset	HS-5

Enhancement	Type
Stereo headset	HDS-3
Inductive loopset	LPS-4
Wireless headset	HDW-3
	HS-4W
	HS-11W
Wireless clip-on headset	HS-21W
Wireless image headset	HS-13W
Audio adapter	AD-15
TTY adapter	HDA-10
Music stand	MD-1

Table 2 Car

Enhancement	Type
Mobile charger	DC-4
Headrest handsfree	BHF-3
Basic handsfree	HF-3
Advanced car kit (sales pack)	CK-7W
Wireless car kit	CK-1W
Wireless plug-in car handsfree	HF-6W
Universal holder	CR-39

Table 3 Carrying

Enhancement	Type
Carrying case	CNT-676

Table 4 Data

Enhancement	Type
USB data cable	DKU-2
Connectivity cable	CA-53
Wireless GPS module	LD-1W
RS multimedia card 64 MB	MU-1
RS multimedia card 128 MB	MU-2
RS multimedida card 256 MB	MU-9
RS multimedia card 512 MB	MU-12

Table 5 Imaging

Enhancement	Type
Nokia image album	PD-1
Nokia remote camera	PT-6

Table 6 Messaging

Enhancement	Type
Nokia digital pen	SU-1B
Bluetooth QWERTY keypad	SU-8W

Table 7 Power

Enhancement	Type
Battery 970mAh Li-ion	BL-5C
Compact charger	AC-3
Travel charger	AC-4
Charging adapter	CA-44

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight (g)	Volume (cm^3)
Transceiver with BL-5C 900mAh li-ion battery back	108.8 x 53 x 21.8	126	95.9

Main RF characteristics for triple-band phones

Parameter	Unit
Cellular system	GSM/EGSM900,GSM1800/1900
Rx frequency band	EGSM900: 925 - 935 MHz
	GSM900: 935 - 960MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
Tx frequency band	EGSM900: 880 - 890MHz
	GSM900: 890 - 915MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz

Parameter	Unit
Output power	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
Number of RF channels	GSM900: 125
	GSM1800: 375
	GSM1900: 300
Channel spacing	200KHz
Number of Tx power levels	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5C	970	up to 3.5* hrs	up to 11* days

*Variation in operation times will occur depending on the 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.

Charging times

AC-4	AC-3
1 h 15 min	2 h 45 min

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15ºC...+55ºC	Specifications fulfilled
Reduced performance	-25ºC...-15ºC +55ºC...+70ºC	Operational for shorts periods only
Intermittent operation	-40ºC...-15ºC +70ºC...+85 ºC	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

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2 — Parts Lists and Component Layouts

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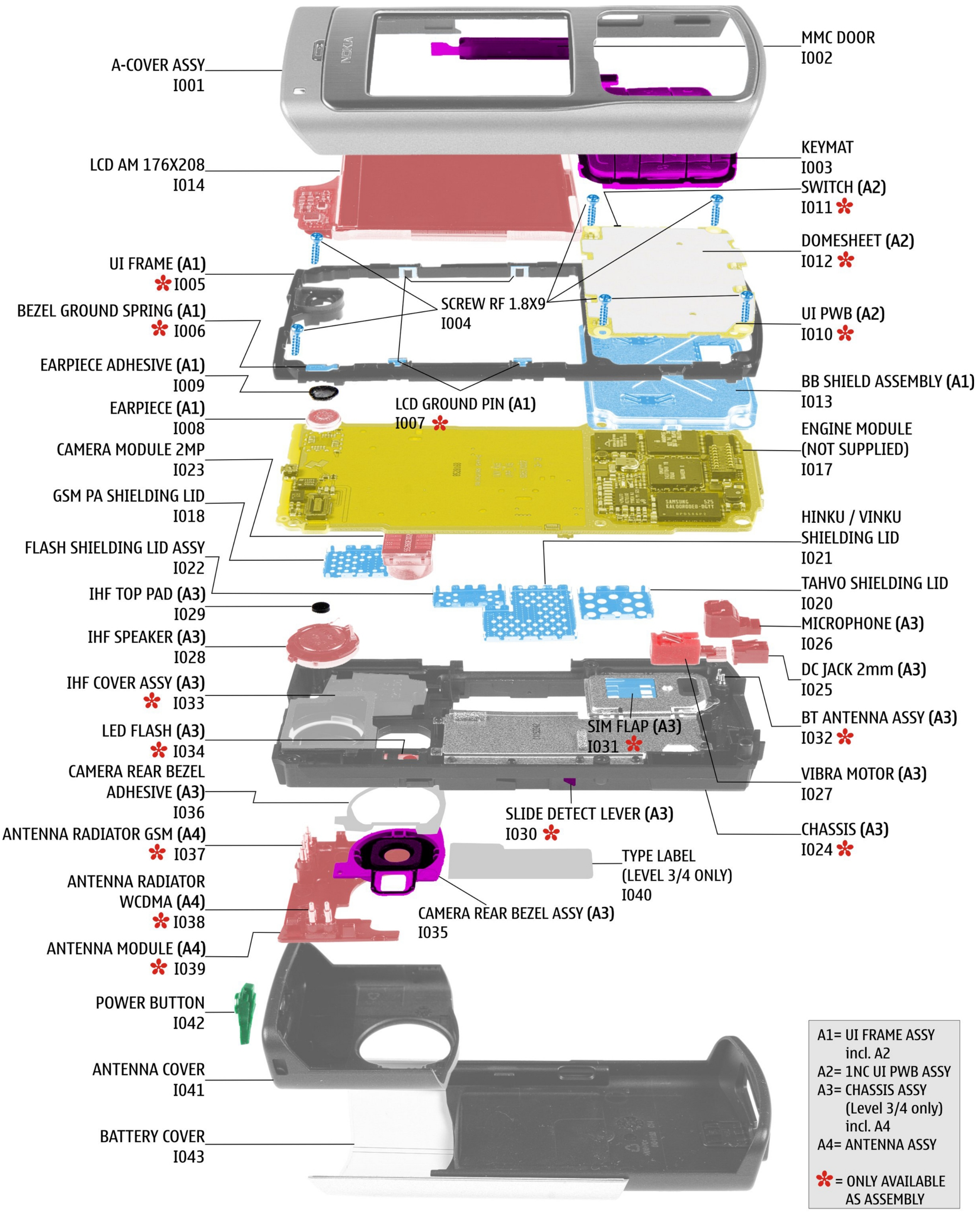
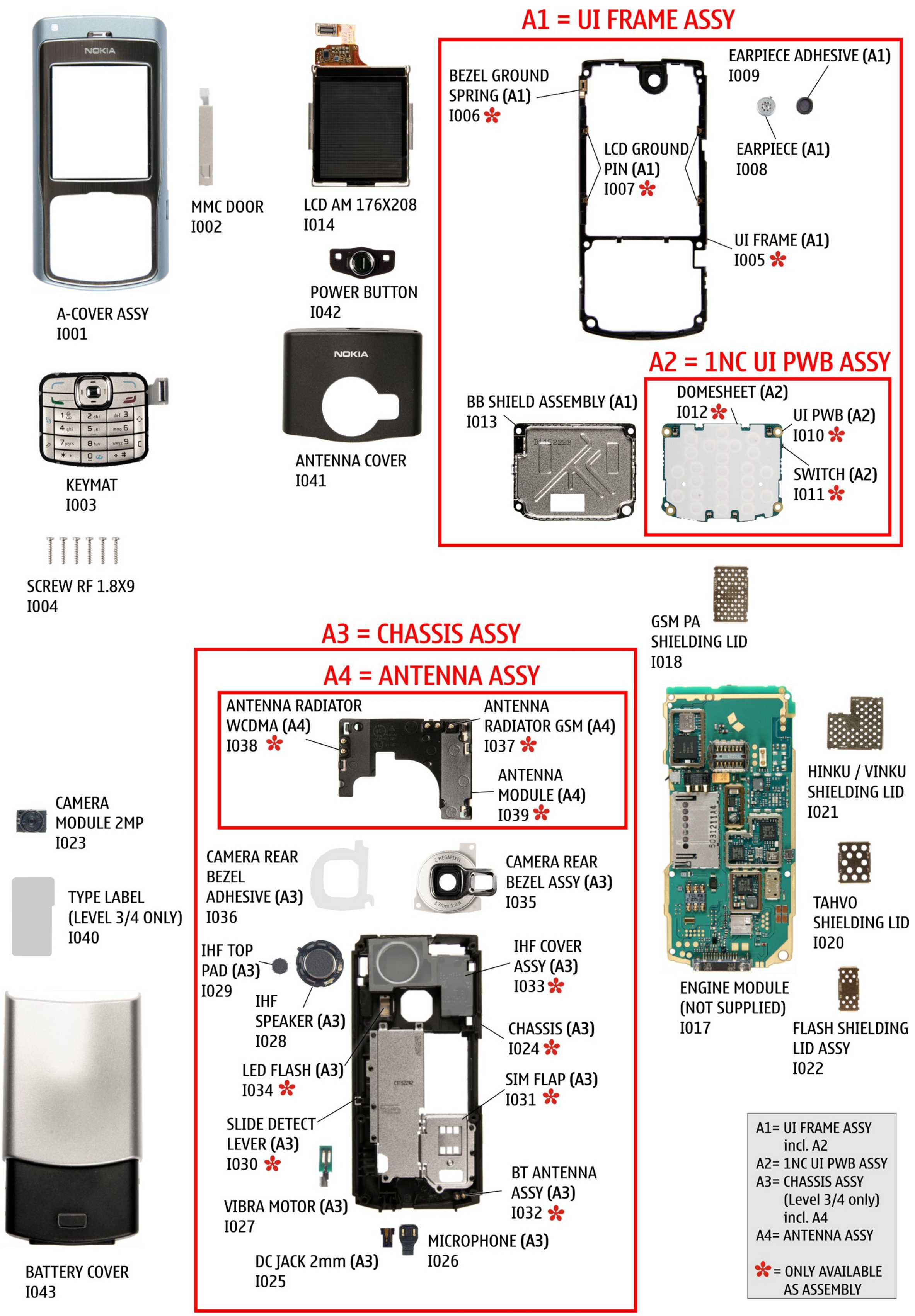
Exploded view



● ELECTRO ● SILICONE ● METAL ● PLASTIC ● PWB ● COVER

Spare parts overview



A1= UI FRAME ASSY incl. A2
A2= 1NC UI PWB ASSY
A3= CHASSIS ASSY (Level 3/4 only) incl. A4
A4= ANTENNA ASSY

✻ = ONLY AVAILABLE AS ASSEMBLY

Parts lists

Mechanical spare parts list

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

Bold = ASSY

ITEM/ CIRCUIT REF.	QTY	PART NAME
I001	1	A COVER ASSY
I002	1	MMC DOOR
I003	1	KEYMAT
I004	6	SCREW RF 1.8X9
	1	**UI FRAME ASSY**
I005	1	UI FRAME
I006	1	BEZEL GROUND SPRING
I007	4	LCD GROUND PIN
I008	1	EARPIECE
I009	1	EARPIECE ADHESIVE
	1	**1NC UI PWB ASSY**
I010	1	UI PWB
I011	1	SWITCH
I012	1	DOMESHEET
I013	1	BB SHIELD ASSEMBLY
I014	1	LCD AM 176X208
I017	1	ENGINE MODULE
I018	1	GSM PA SHIELDING LID
I020	1	TAHVO SHIELDING LID
I021	1	HINKU / VINKU SHIELDING LID
I022	1	FLASH SHIELDING LID ASSY
I023	1	CAMERA MODULE 2MP
	1	**CHASSIS ASSY**
I024	1	CHASSIS
I025	1	DC JACK 2mm
I026	1	MICROPHONE
I027	1	VIBRA MOTOR
I028	1	IHF SPEAKER

ITEM/ CIRCUIT REF.	QTY	PART NAME
I029	1	IHF TOP PAD
I030	1	SLIDE DETECT LEVER
I031	1	SIM FLAP
I032	1	BT ANTENNA ASSY
I033	1	IHF COVER ASSY
I034	1	LED FLASH
I035	1	CAMERA REAR BEZEL ASSY
I036	1	CAMERA REAR BEZEL ADHESIVE
	1	**ANTENNA ASSY**
I037	1	ANTENNA RADIATOR GSM
I039	1	ANTENNA MODULE
I040	1	TYPE LABEL
I041	1	ANTENNA COVER
I042	1	POWER BUTTON
I043	1	BATTERY COVER

Component parts list (1YA_02.1f)

Item	Side	Grid ref.		Type	Description and value		
A7003	Bot	D	10	SHIELD_ROLF_RF	SHIELD ASSEMBLY HINKU/VINKU 040-010018	~	~
A7004	Bot	B	7	SHIELD_ROLF_VCO	SHIELD ROLF VCO	~	~
A7005	Bot	E	12	SHIELD_ROLF_FLASH	SHIELD ROLF GSM FLASH	~	~
A7006	Bot	D	6	SHIELD_ROLF_TAHVO	SHIELD ROLF TAHVO	~	~
A7008	Bot	H	17	SHIELD_ROLF_GSM_PA	SHIELD ROLF GSM PA	~	~
B2200	Top	D	6	CRYSTAL_3.3X1.6_H0.9	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	~
C1470	Bot	D	15	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1471	Bot	F	18	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1472	Bot	F	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Type	Description and value		
C1473	Bot	G	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1479	Bot	E	14	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1480	Bot	D	14	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1481	Top	D	20	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1482	Top	D	20	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1483	Top	E	6	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1484	Bot	E	12	0805C	CHIPCAP X5R 4U7 K 6V3 0805	4u7	6V3
C1485	Bot	E	13	1206C_TDK	CHIPCAP 2U2 K 25V 1206	2u2	25V
C1486	Bot	E	13	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C1487	Bot	C	15	0402C	Chipcap 5% NP0	10p	50V
C1488	Bot	C	15	0402C	Chipcap 5% NP0	10p	50V
C1489	Top	E	19	0402C	Chipcap 5% NP0	22p	50V
C1490	Top	E	20	0402C	Chipcap 5% NP0	22p	50V
C1491	Top	D	19	0402C	Chipcap 5% NP0	22p	50V
C2000	Bot	C	3	0402C	Chipcap 5% NP0	27p	50V
C2002	Bot	F	3	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2003	Bot	F	3	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2004	Bot	G	3	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2005	Bot	F	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Bot	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	Bot	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2008	Bot	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2009	Bot	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Type	Description and value		
C2010	Bot	G	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2011	Top	F	1	0402C	CHIPCAP NP0 270P J 25V 0402	270p	25V
C2012	Bot	C	3	0603C_H0.95	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2070	Bot	G	14	0402C	Chipcap 5% NP0	15p	50V
C2072	Bot	I	15	0402C	Chipcap 5% NP0	15p	50V
C2100	Bot	F	2	0402C	CHIPCAP X7R 15N K 16V 0402	15n	16V
C2101	Bot	F	2	0402C	CHIPCAP X7R 15N K 16V 0402	15n	16V
C2102	Bot	F	2	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2103	Top	E	6	0402C	Chipcap 5% X7R	1n0	50V
C2104	Top	E	6	0402C	Chipcap 5% X7R	1n0	50V
C2105	Top	A	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2106	Top	A	6	0402C	Chipcap 5% NP0	27p	50V
C2107	Top	A	6	0402C	Chipcap 5% NP0	27p	50V
C2108	Top	B	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2109	Top	B	7	0402C	Chipcap 5% NP0	27p	50V
C2110	Top	A	7	0402C	Chipcap 5% NP0	27p	50V
C2200	Top	C	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2201	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2202	Top	D	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2203	Top	D	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2204	Top	E	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2205	Top	D	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2206	Top	D	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2207	Top	E	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

Item	Side	Grid ref.		Type	Description and value		
C2208	Top	D	7	0402C	Chipcap 5% NP0	27p	50V
C2209	Top	D	7	0402C	Chipcap 5% NP0	22p	50V
C2210	Top	B	7	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C2211	Top	B	6	0805C	CHIPCAP X5R 4U7 K 10V 0805	4u7	10V
C2212	Top	B	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2213	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2214	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2215	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2216	Top	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2217	Top	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2219	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2220	Top	B	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2221	Top	B	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2222	Top	B	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2223	Top	C	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2224	Top	D	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2225	Top	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2226	Top	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2227	Top	B	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2228	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2230	Top	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Type	Description and value		
C2231	Top	A	5	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2232	Top	C	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2234	Top	D	6	0402C	Chipcap 5% NP0	27p	50V
C2235	Top	D	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2237	Top	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2240	Top	B	2	0402C	Chipcap 5% NP0	12p	50V
C2241	Top	G	3	0402C	Chipcap 5% NP0	12p	50V
C2242	Top	E	5	0402C	Chipcap 5% NP0	12p	50V
C2243	Top	I	3	0402C	Chipcap 5% NP0	12p	50V
C2244	Top	G	1	0402C	Chipcap 5% NP0	12p	50V
C2300	Bot	D	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2301	Bot	D	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Bot	D	5	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2303	Bot	D	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2304	Bot	C	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2307	Bot	E	7	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2309	Bot	E	5	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2312	Bot	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2313	Bot	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2314	Top	G	7	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2315	Top	G	6	0805C	CHIPCAP X5R 4U7 M 25V 0805	4u7	25V
C2316	Bot	C	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2700	Bot	H	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C2800	Top	H	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Top	H	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Top	I	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Top	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2804	Top	G	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Top	G	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2806	Top	G	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Top	H	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2808	Top	G	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2809	Top	H	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2810	Top	G	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2811	Top	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2812	Top	H	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2813	Top	I	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2814	Top	I	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3000	Top	G	7	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3001	Top	I	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3002	Top	G	6	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3003	Top	I	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3004	Top	H	1	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C3005	Top	I	1	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3006	Top	I	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3007	Top	H	1	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3008	Top	I	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4200	Top	D	2	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4201	Top	D	1	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4203	Top	B	2	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4204	Top	C	2	0402C	Chipcap 5% NP0	100p	50V
C4205	Top	B	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4206	Top	B	1	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4400	Top	D	19	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4401	Top	D	19	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4402	Top	D	19	0402C	Chipcap 5% NP0	27p	50V
C4800	Top	D	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4801	Top	E	2	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4802	Top	G	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4803	Top	G	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4804	Top	E	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4805	Top	G	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4806	Top	E	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4807	Top	D	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Type	Description and value		
C4808	Top	G	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4809	Top	G	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4810	Top	F	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4811	Top	E	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4812	Top	E	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4813	Top	G	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C4814	Top	E	6	0402C	Chipcap 5% NP0	22p	50V
C5000	Top	B	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5001	Top	D	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5002	Top	D	4	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5003	Top	B	2	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5004	Top	D	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5005	Top	D	5	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5200	Bot	H	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7501	Bot	C	11	0402C	Chipcap 5% NP0	18p	50V
C7503	Bot	C	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7504	Bot	C	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	Bot	B	11	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7507	Bot	C	10	0402C	Chipcap 5% NP0	18p	50V
C7508	Bot	B	10	0402C	Chipcap 5% NP0	18p	50V
C7509	Bot	C	11	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7512	Bot	G	19	0402C	Chipcap 5% NP0	39p	50V
C7513	Bot	B	11	0402C	Chipcap X7R 10% 25V 0402	4n7	25V

Item	Side	Grid ref.		Type	Description and value		
C7514	Bot	G	19	0402C	Chipcap 5% NP0	39p	50V
C7515	Bot	C	9	0402C	Chipcap 5% NP0	10p	50V
C7516	Bot	C	9	0402C	Chipcap 5% NP0	150p	50V
C7518	Bot	E	9	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7520	Bot	C	11	0402C	Chipcap 5% NP0	18p	50V
C7522	Bot	C	9	0402C	Chipcap 5% NP0	150p	50V
C7523	Bot	G	18	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7524	Bot	B	9	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7525	Bot	G	18	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7527	Bot	B	10	0402C	Chipcap 5% NP0	100p	50V
C7528	Bot	B	10	0402C	Chipcap 5% NP0	22p	50V
C7529	Bot	D	9	0402C	Chipcap 5% NP0	100p	50V
C7530	Bot	B	11	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7531	Bot	C	10	0402C	Chipcap 5% NP0	22p	50V
C7532	Bot	B	11	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7533	Bot	C	8	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C7534	Bot	B	11	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7536	Bot	B	11	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7541	Bot	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7543	Bot	E	10	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7545	Bot	I	17	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7547	Bot	D	9	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7548	Bot	D	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7549	Bot	D	9	0402C	Chipcap 5% NP0	100p	50V
C7550	Bot	E	8	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7552	Bot	D	8	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7553	Bot	D	8	0402C	Chipcap X7R 10% 16V 0402	8n2	16V

Item	Side	Grid ref.		Type	Description and value		
C7554	Bot	B	6	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7555	Bot	B	6	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7556	Bot	G	16	0402C	Chipcap 5% NP0	10p	50V
C7558	Bot	E	10	0402C	Chipcap 5% X7R	1n0	50V
C7559	Bot	I	18	0402C	Chipcap +-0.25pF NP0	1p0	50V
C7560	Bot	E	9	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7561	Bot	G	17	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7563	Bot	G	17	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7564	Bot	H	18	0402C	Chipcap 5% X7R	1n0	50V
C7567	Bot	E	10	0402C	Chipcap 5% NP0	15p	50V
C7568	Bot	E	8	0402C	Chipcap 5% NP0	150p	50V
C7569	Bot	G	17	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7570	Bot	E	9	0402C	Chipcap 5% NP0	18p	50V
C7571	Bot	B	6	0402C	CHIPCAP NP0 330P J 50V 0402	330p	50V
C7573	Bot	A	6	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7575	Bot	E	10	0402C	Chipcap 5% NP0	15p	50V
C7577	Bot	E	10	0402C	Chipcap 5% NP0	15p	50V
C7581	Bot	G	19	0402C	Chipcap 5% NP0	39p	50V
C7582	Bot	D	9	0402C	Chipcap 5% NP0	100p	50V
C7584	Bot	G	18	0402C	Chipcap 5% NP0	39p	50V
C7593	Bot	G	16	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7596	Bot	C	11	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7597	Bot	F	14	TANT_6.3X3.5_H2.0	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V
C7598	Bot	B	8	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7599	Top	D	20	0402C	CHIPCAP X7R 33N K 10V 0402	33n	10V
C7600	Top	B	20	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C7601	Top	B	20	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3

Item	Side	Grid ref.		Type	Description and value		
C7602	Top	B	2	0402C	Chipcap 5% NP0	12p	50V
C7604	Bot	F	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7605	Bot	F	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7606	Bot	H	2	0402C	Chipcap 5% NP0	10p	50V
C7607	Bot	H	2	0402C	Chipcap 5% NP0	10p	50V
C7608	Bot	H	2	0402C	Chipcap 5% NP0	10p	50V
C7609	Bot	G	2	0402C	Chipcap 5% NP0	10p	50V
C7612	Bot	C	4	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7613	Bot	F	3	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C7615	Bot	C	9	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7616	Bot	F	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7617	Bot	F	3	0402C	Chipcap 5% NP0	100p	50V
C7618	Bot	F	3	0402C_H0.6	CHIPCAP X5R 100N M 16V 0402	100n	16V
D2800	Top	H	4	uBGA_289	RAP V2.21E-PA C027 UBGA	~	~
D3000	Top	H	7	PBFREEBGA40_64MB_54MHZ_MAX	FLASH 4MX16 1.8/1.8V VFBGA44 PBFREE	4MX16	~
D3001	Top	H	2	WBGA_60_8.1X6.6_H0.9	SDRAM 4MX16 1.8V/1.8V WBGA60	4Mx16	~
D4800	Top	E	4	uBGA_289	HELEN3 PS1.1E F761991A C027 UBGA289	~	~
D5000	Top	B	4	FBGA133	COMBO 512 DDR + 512M NAND FBGA133 PBFREE	32Mx16/64Mx8	~
D5001	Bot	D	4	LGA_BTHFM_ES3.6	BTHFM1.0_ES3.6 MODULE	~	~
F2000	Bot	C	2	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	Top	F	6	BATTER_RB414H	RTC CAPACITOR 15UAH 2.6/3.3V 414-SIZE	3V3	~
G7500	Bot	B	9	VCO_FDK_WB002	VCO 3610-4340MHZ 2.7V 15MA	3610-4340MHz	~

Item	Side	Grid ref.		Type	Description and value		
G7501	Bot	C	9	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V 2MA	38.4MHz	~
G7502	Bot	B	7	VCO_FDK_WB002	VCO 3296-3980MHZ 2.7V 20MA EGSM	3296-3980MHz	~
L1473	Bot	E	11	CHOKE_SER300	CHOKE 3.3UH 0R252 0A82 310 CASE SIZE	3u3H	~
L1474	Top	E	7	0805_BLM21	FERR.BEAD 0R03 42R/ 100MHZ 3A 0805	42R/ 100MHz	~
L1479	Bot	C	15	0402L	CHIP COIL 27N J Q27/800M 0402	27nH	~
L1480	Bot	C	15	0402L	CHIP COIL 27N J Q27/800M 0402	27nH	~
L2000	Bot	C	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2001	Bot	F	2	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2002	Bot	G	2	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2003	Bot	G	2	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2100	Top	E	19	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2101	Top	B	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2102	Bot	F	18	COIL_0603CS	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~
L2103	Bot	F	18	COIL_0603CS	CHIP COIL 56N J Q38/250MHZ 0603	56nH	~
L2104	Top	B	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2105	Top	B	6	0402L_XL	FERRITE BEAD 220R 0R45 0.3A 0402	220R/ 100MHz	~
L2106	Top	A	6	0402L_XL	FERRITE BEAD 220R 0R45 0.3A 0402	220R/ 100MHz	~
L2202	Top	E	7	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2203	Top	C	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2204	Top	D	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid ref.		Type	Description and value		
L2205	Top	B	5	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2206	Top	B	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L2301	Bot	E	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Bot	D	5	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L2304	Top	G	7	CHOKE_SER300 _H1.5	CHOKE 22U M 0R7 0.35A 3.0x3.0x1.5	22uH	~
L4200	Top	C	2	CHOKE_SER400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L4201	Top	E	2	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/ 100MHz	~
L4400	Top	D	19	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L4401	Top	D	19	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L5200	Bot	H	7	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7502	Bot	D	8	0402L	CHIP COIL 100N J Q16/300M 0402	100nH	~
L7503	Bot	E	10	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7504	Bot	H	19	0402L	CHIP COIL 47N J Q23/800MHZ 0402	47nH	~
L7506	Bot	H	18	0402L	CHIP COIL 12N J Q31/800M 0402	12nH	~
L7516	Bot	G	16	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
L7517	Bot	E	8	0402L	CHIP COIL 1N5 +-0N3 Q33/800M 0402	1n5H	~
L7518	Bot	G	3	COIL_LK_1608	CHIP COIL 68NH J Q12/100MHZ 0603	68nH	~
N1470	Bot	G	7	LLP6	REG LP3990YDX-1.5V LLP-6	~	1.5V
N1471	Bot	E	13	SON3024_8	STEP-UP DC/DC CONV SON3024-8	~	~
N1472	Bot	E	14	USMD5_1.47X1 .04_H0.675	VREG LP3985ITLX-2.8 NOPB USMD5	~	3V

Item	Side	Grid ref.		Type	Description and value		
N1474	Top	D	20	TFBGA_42	14XLEVEL SHIFTER ST16C32245TBR uTFBGA42	~	~
N2200	Top	C	6	TFBGA_108	RETU 3.02 TSA1GJWE TFBGA108	~	~
N2300	Bot	D	7	TFBGA_84_6.15X6.15	TAHVO V5.2 LF TFBGA84	~	~
N2301	Top	G	6	USMD8_1.69X1.69	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~
N4200	Top	D	1	USMD_10_2.458X1.899	DC/DC CONV LM3661-1.40V/1.05V NOPB	~	~
N4201	Top	B	2	USMD5_1.468X1.036	REG+ LP3999ITLX 1.8V 150MA NOPB	~	1.8V
N7500	Bot	C	11	TFBGA_84_6.15X6.15	RF ASIC HINKU310A TFBGA84	~	~
N7501	Bot	E	9	TFBGA64_H1.2	RF ASIC VINKU314A TFBGA64	~	~
N7502	Bot	H	17	RITSA_PA_REL3	PW AMP RF9292E9.2 QUADBAND	~	~
N7505	Top	C	20	LLP_6	REG LP3981YDX 2.8/ NOPB 0.3A LLP-6	~	2.8V
R1470	Top	G	4	0402R	Resistor 5% 63mW	100R	~
R1471	Top	G	4	0402R	Resistor 5% 63mW	100R	~
R1472	Top	F	3	0402R	Resistor 5% 63mW	3k3	~
R1473	Top	F	3	0402R	Resistor 5% 63mW	3k3	~
R1474	Top	G	5	0402R	Resistor 5% 63mW	33R	~
R1475	Bot	F	7	0402R	Resistor 5% 63mW	470k	~
R1486	Top	E	20	0402R	Resistor 5% 63mW	15R	~
R1487	Bot	E	12	0402R	CHIPRES 0W06 6R8 J 0402	6R8	~
R1488	Top	D	19	0402R	Resistor 5% 63mW	33R	~
R1489	Bot	E	13	0402R	Resistor 5% 63mW	3k3	~
R1490	Top	E	20	0402R	Chipres 0W06 jumper 0402	0R	~
R1491	Bot	E	12	0402R	Resistor 5% 63mW	10k	~
R2000	Bot	F	3	0402R	Resistor 5% 63mW	220R	~
R2001	Bot	F	3	uBGA11_2.15X1.65	ASIP MIC W/ESD RES +CAP+ZDI BGA11	~	~

Item	Side	Grid ref.		Type	Description and value		
R2002	Bot	G	3	0402R	Resistor 5% 63mW	10R	~
R2003	Bot	G	3	0402R	Resistor 5% 63mW	10R	~
R2004	Bot	G	3	0402R	Resistor 5% 63mW	10R	~
R2005	Bot	H	3	0402R	Resistor 5% 63mW	10R	~
R2006	Bot	G	2	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
R2007	Top	F	1	uBGA11_1.6X2.15	ASIP SILIC USB OTG / ESD BGA11	~	~
R2009	Top	G	1	0402R	Resistor 5% 63mW	100R	~
R2010	Top	F	1	0402R	Resistor 5% 63mW	220k	~
R2011	Top	G	1	0402R	Resistor 5% 63mW	120k	~
R2070	Bot	G	14	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2071	Top	E	6	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2100	Bot	F	2	FLIP_CHIP_8_1.7X1.7	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~
R2101	Bot	E	2	0402R	Resistor 5% 63mW	220R	~
R2104	Top	E	19	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2105	Top	E	19	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2106	Bot	F	18	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2107	Bot	F	18	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2200	Top	E	6	0402R	Resistor 5% 63mW	100k	~
R2201	Top	E	6	0402R	Resistor 5% 63mW	120k	~
R2202	Top	E	6	0402R	Resistor 5% 63mW	100R	~
R2205	Top	E	7	0402R	CHIPRES 0W06 2M2 J 0402	2M2	~
R2303	Top	F	6	0402R	Chipres 0W06 jumper 0402	0R	~
R2304	Top	F	6	0402R	Resistor 5% 63mW	33R	~
R2305	Bot	C	7	0402R	Resistor 5% 63mW	33R	~
R2700	Bot	I	6	uBGA8_1.47X1.47	ASIP SIM INTERFACE **LOW CAP**BGA8	~	~
R3000	Top	G	6	0402R	Resistor 5% 63mW	10k	~

Item	Side	Grid ref.		Type	Description and value		
R4400	Top	E	6	0402R	Resistor 5% 63mW	470k	~
R4401	Top	E	6	0402R	Resistor 5% 63mW	100k	~
R4402	Top	E	6	0402R	Resistor 5% 63mW	470k	~
R4403	Top	B	20	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R4406	Top	E	20	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4407	Bot	A	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4408	Bot	A	8	0402R	Resistor 5% 63mW	10k	~
R4800	Top	D	5	0402R	Resistor 5% 63mW	10R	~
R4809	Top	E	3	0402R	Resistor 5% 63mW	1k0	~
R4810	Top	E	6	0402R	Resistor 5% 63mW	15R	~
R5100	Top	G	5	0402R	Resistor 5% 63mW	10k	~
R5200	Bot	I	7	uBGA11_1.62X 2.12	ASIP EMIF04-MMC02F2**PB-FREE**	~	~
R5204	Bot	I	15	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R7501	Bot	C	9	0402R	Resistor 5% 63mW	1k0	~
R7503	Bot	C	11	0402R	Resistor 5% 63mW	4k7	~
R7504	Bot	C	11	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7505	Bot	C	9	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7506	Bot	G	17	0402R	Resistor 5% 63mW	33R	~
R7509	Bot	C	8	0402R	Resistor 5% 63mW	10k	~
R7512	Bot	H	16	0404_RAC10	RES NETWORK 0W04 2DB ATT 0404	436R/ 11R6/436 R	~
R7513	Bot	B	7	0402R	Chipres 0W06 5R6 J 0402	5R6	~
R7514	Bot	D	9	0402R	Resistor 5% 63mW	10k	~
R7516	Bot	I	18	0402R	Resistor 5% 63mW	1k0	~
R7518	Bot	I	17	0402R	Resistor 5% 63mW	470k	~
R7519	Bot	B	6	0402R	Resistor 5% 63mW	1k0	~
R7521	Bot	D	9	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7523	Bot	A	6	0402R	CHIPRES 0W06 9K1 F 100PPM 0402	9k1	~

Item	Side	Grid ref.		Type	Description and value		
R7528	Bot	C	8	0402R	Resistor 5% 63mW	470k	~
R7534	Bot	C	8	0402R	Resistor 5% 63mW	470k	~
R7541	Bot	F	4	0402R	Chipres 0W06 jumper 0402	0R	~
R7542	Bot	F	4	0402R	Chipres 0W06 jumper 0402	0R	~
R7543	Bot	F	4	0402R	Chipres 0W06 jumper 0402	0R	~
R7544	Bot	F	5	0402R	Chipres 0W06 jumper 0402	0R	~
R7549	Bot	F	4	0402R	Resistor 5% 63mW	3k3	~
R7550	Bot	F	4	0402R	Resistor 5% 63mW	3k3	~
R7551	Bot	C	4	0402R	Chipres 0W06 jumper 0402	0R	~
R7552	Bot	F	5	0402R	Chipres 0W06 jumper 0402	0R	~
R7554	Top	G	3	0402R	Resistor 5% 63mW	100k	~
R7555	Bot	B	9	0402R	Resistor 5% 63mW	220R	~
R7556	Bot	E	6	0402R	Resistor 5% 63mW	100R	~
R7558	Bot	F	3	0402R	Resistor 5% 63mW	220R	~
R7559	Bot	G	2	0402_VAR	RES VARISTOR 14/90V 3PF 0402	14/90V	~
R7560	Bot	A	17	0402R	Chipres 0W06 jumper 0402	0R	~
S4401	Top	E	21	SWITCH_EVQP 7A01K	SM SW TACT SPST 12V SIDE KEY 2.2N	~	~
S5200	Bot	I	14	SWITCH_SPVN 220100	SM SW DETECTOR SPST-NO 5V 1MA	~	~
S5202	Bot	A	9	SWITCH_SPVM 110201	SWITCH DETECTOR SPVM	~	~
T7501	Bot	B	10	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
T7502	Bot	H	16	TRANS_LDB15	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~
T7503	Bot	B	7	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
V1470	Bot	F	14	SC_89	DI SCH DUAL 0.4V 1MA SOT490	~	~
V1471	Bot	E	13	DIODE_PMEG3 002	SCH DI PMEG3002 30V 500MA SOD882	~	~

Item	Side	Grid ref.		Type	Description and value		
V1472	Bot	E	12	SC_75A_H0.95	MOSFET N 20V 350MA SOT416	~	~
V2000	Bot	C	3	BGA4_1.01X1.07	ASIP TVS BGA4	~	~
V2300	Bot	C	7	VMT3_R	TR DTC143ZM N RB=4K7 RBE=47K VMT3	~	~
V4400	Top	B	20	PT202MR0MP	DI PHOTO PT202MR0MP 620NM 1.25X2	~	~
V7501	Bot	E	6	SOD323F	SCH DI 30V 2A SOD323F	~	~
V7502	Bot	C	15	SOD882	BZX884-AA	~	~
X1470	Bot	E	16	SOCKET_DMD10413	CAMERA MOD.SOCKET 2X7POL SPR P1.4	~	~
X2001	Bot	F	1	SYSCON_MQ202_NK_14R3	SM SYSTEM CONNECTOR 14POL	~	~
X2060	Top	A	9	TRACEABILITY_PAD	MODULE ID COMPONENT 2.8X1.8X0.3	~	~
X2070	Bot	H	14	LYNX_BATT_CONN_H7.0	SM BATTERY CONN 3POL SPR 12V 2A	~	~
X2700	Bot	H	6	SIM_CONN_470191501	SM SIM CONN 6POL P2.54 H1.5	~	~
X4400	Top	F	2	SMK_4309_B_B_16P_V8	SM CONN 16P SPR P1.3 50V PWB/PWB	~	~
X4401	Top	B	19	JST_R_JAVK_G_1_R3	SM CONN 2X12F P0.4 30V .3A PWB/PWB	~	~
X5200	Bot	H	11	MOLEX_MMC_P03_3D0545_001	CONN SMC RS-MMC 6POL P2.5	~	~
X5207	Bot	H	4	ANT_CLIP_M3E14601	SPRING CLIP M3E14601 NSJ-3 HD925	~	~
X5208	Bot	B	5	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X5209	Bot	B	4	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X5210	Bot	A	4	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~
X5211	Bot	A	5	CONTACT_PAD_2.95X1.95	SM CONN VIBRA SPACER PAD 2.8X1.8	~	~

Item	Side	Grid ref.		Type	Description and value		
X5212	Bot	C	16	POGO_CNO_5117_3077H	CONN 2POL SPR 6.6X6.8X2.5	~	~
Z2000	Top	E	1	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
Z2001	Top	E	1	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
Z2003	Top	E	1	FERRITE_0402	FERRITE BEAD 0.6R 600R/100MHZ 0402	600R/ 100MHz	~
Z4400	Top	D	2	uBGA25_2.47X 2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4401	Top	G	3	FC6_1.65X1.15	ASIP 2-CH MIC EMI/ESD **PB-FREE**	~	~
Z4402	Top	E	7	uBGA25_2.47X 2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4403	Top	F	7	uBGA25_2.47X 2.47	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z7500	Bot	F	14	FERRITE_FBMJ1608	FERRITE BEAD 0R01 28R/100MHZ 0603	28R/ 100MHz	~
Z7503	Bot	H	18	ANT_SW_M043B	ANT.SW+3SAW 880-960/1710-1990MHZ	~	~
Z7504	Bot	I	16	FILTER_SAW_2.1X1.7_H0.8	SAW FILTER 897.5 +-17.5MHZ 2.0X1.6	897.5MHz	~

Component layouts

Component layouts (1YA_02.1f)

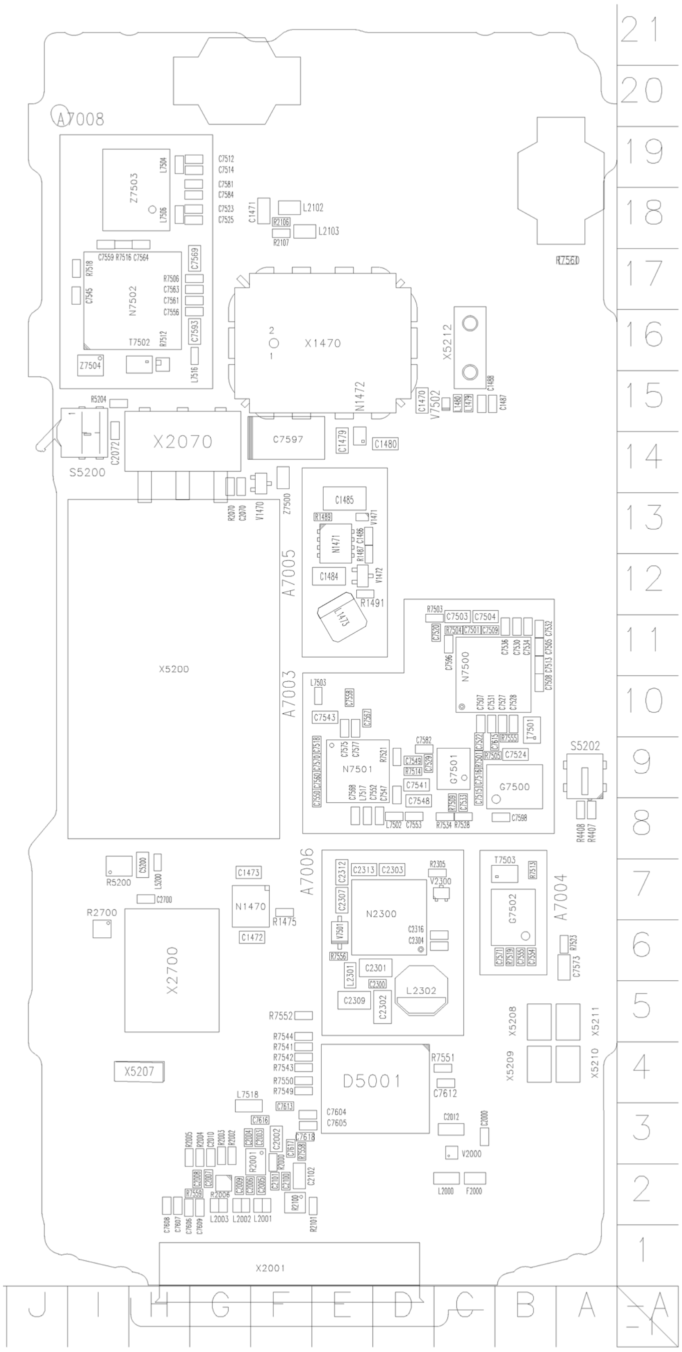


Figure 2 Component layout - bottom view (1YA_02.1f)

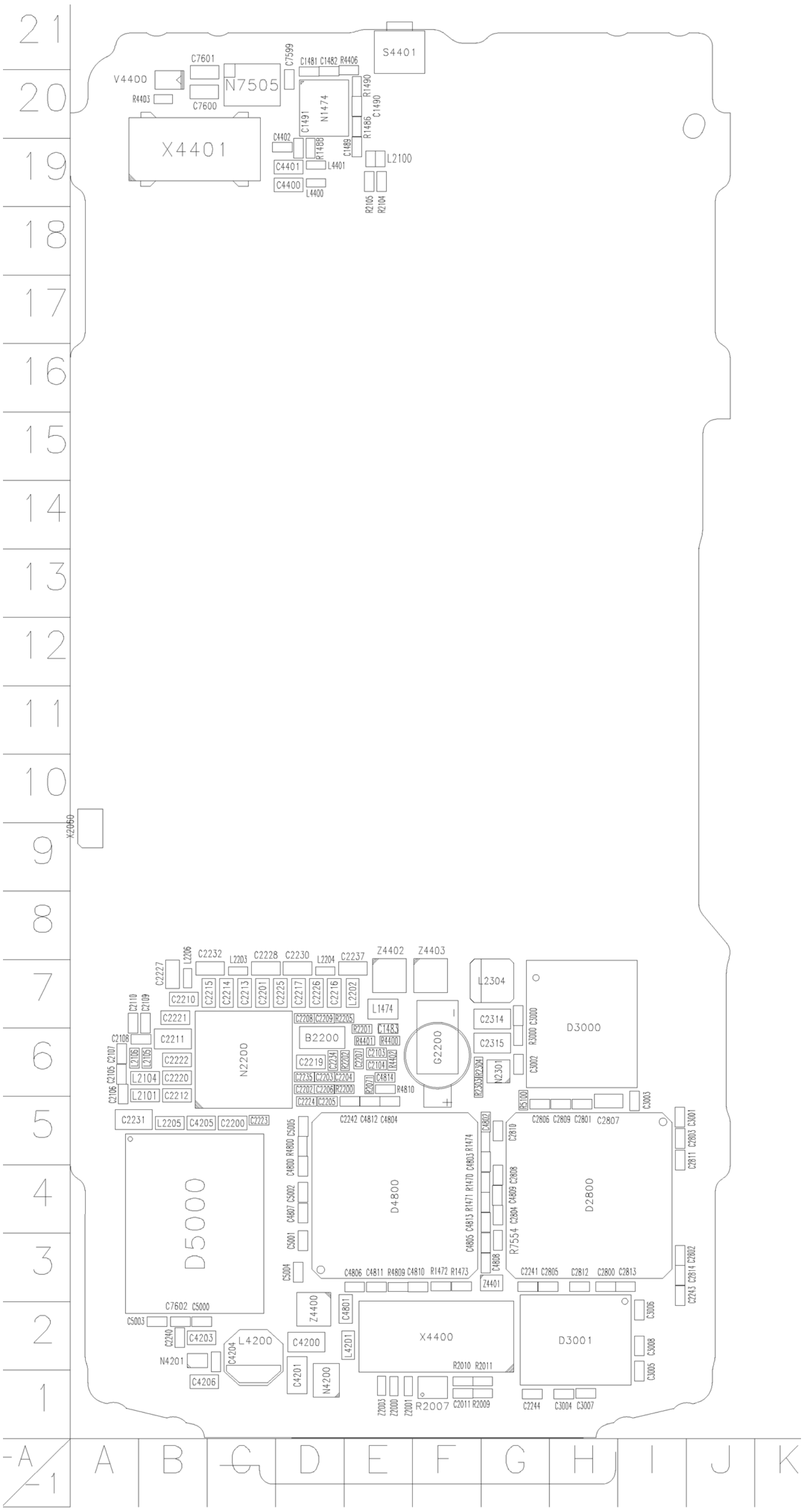


Figure 3 Component layout - top view (1YA_02.1f)

3 — Service Software Instructions

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Table of Contents

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Phoenix installation steps in brief

Prerequisites

Recommended hardware requirements:

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

Supported operating systems:

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

Context

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

Phoenix installation contains:

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

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

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

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

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

To use *Phoenix*, you need to:

Steps

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

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

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.

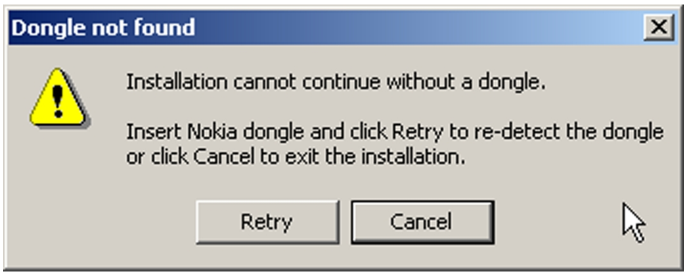
Installing *Phoenix*

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:



Installation cannot continue without a dongle.

Insert Nokia dongle and click Retry to re-detect the dongle or click Cancel to exit the installation.

Figure 4 Dongle not found

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

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

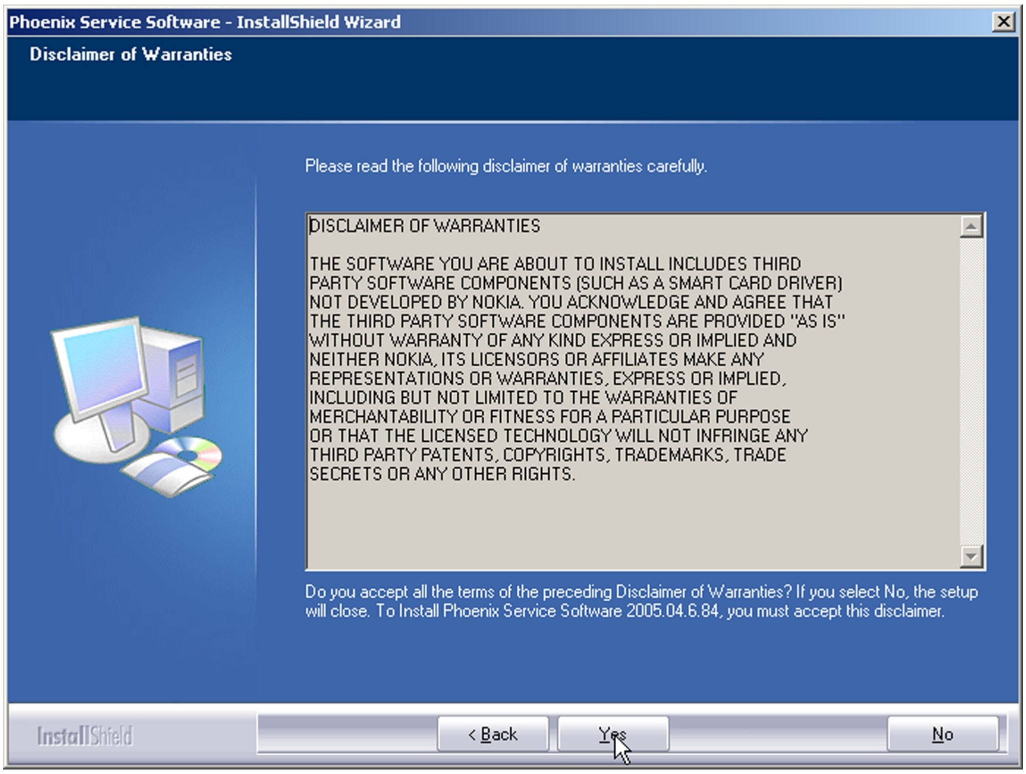
For more detailed information, please refer to *Phoenix* Help files.

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

Steps

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

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



Please read the following disclaimer of warranties carefully.

DISCLAIMER OF WARRANTIES

THE SOFTWARE YOU ARE ABOUT TO INSTALL INCLUDES THIRD PARTY SOFTWARE COMPONENTS (SUCH AS A SMART CARD DRIVER) NOT DEVELOPED BY NOKIA. YOU ACKNOWLEDGE AND AGREE THAT THE THIRD PARTY SOFTWARE COMPONENTS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND EXPRESS OR IMPLIED AND NEITHER NOKIA, ITS LICENSORS OR AFFILIATES MAKE ANY REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR THAT THE LICENSED TECHNOLOGY WILL NOT INFRINGE ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADEMARKS, TRADE SECRETS OR ANY OTHER RIGHTS.

Do you accept all the terms of the preceding Disclaimer of Warranties? If you select No, the setup will close. To Install Phoenix Service Software 2005.04.6.84, you must accept this disclaimer.

Figure 5 Disclaimer text

4. Choose the destination folder.

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

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

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

   The process may take several minutes to complete.

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

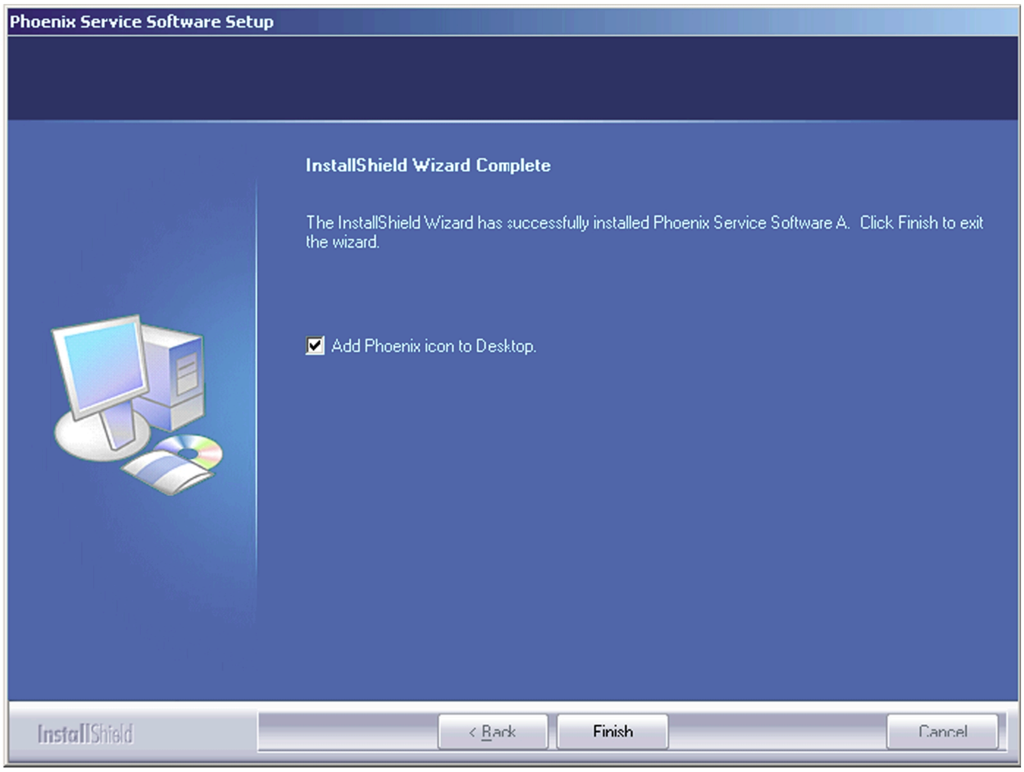
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.

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

   After the reboot, all components are registered.

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

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



Phoenix Service Software Setup

InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Phoenix Service Software A. Click Finish to exit the wizard.

☑ Add Phoenix icon to Desktop.

Figure 6 InstallShield Wizard Complete

Next actions

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

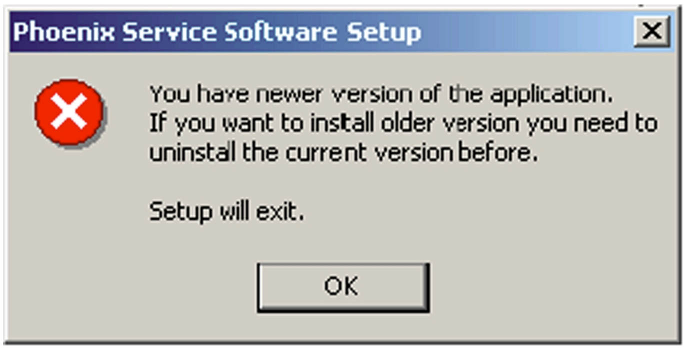
- installing phone model specific data package for *Phoenix*
- configuring users and connections

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.



You have newer version of the application.
If you want to install older version you need to uninstall the current version before.

Setup will exit.

Figure 7 Installation interrupted

- Always follow the instructions on the screen.

Steps

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

Results

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

Uninstalling *Phoenix*

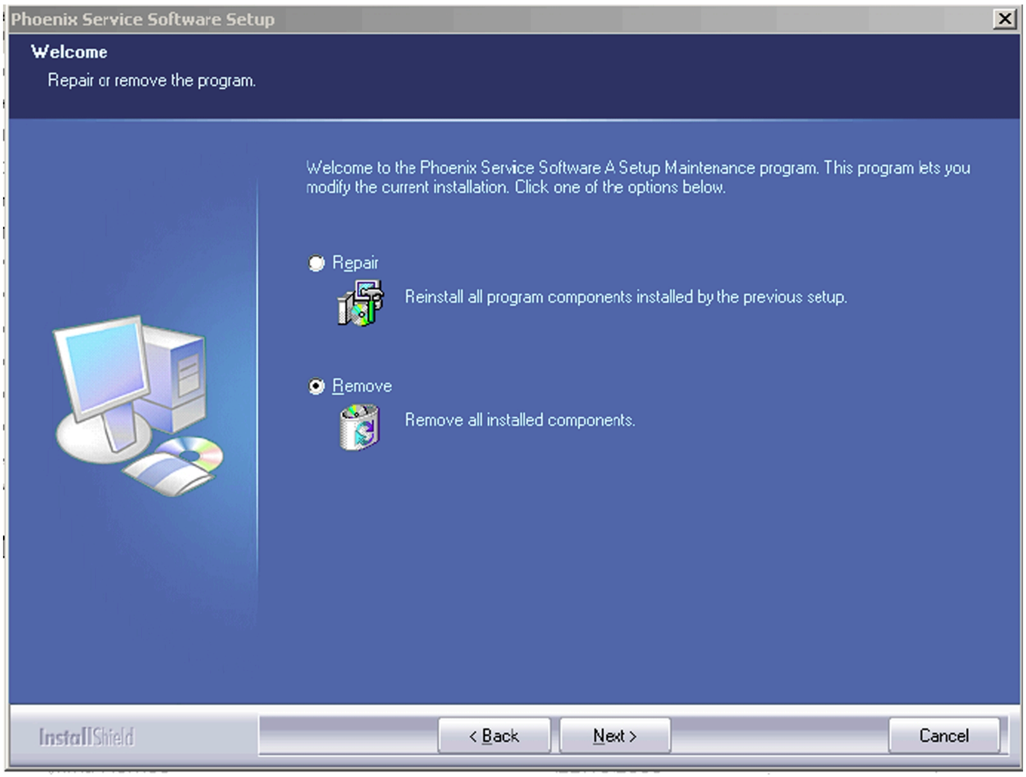
Context

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

Steps

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

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



Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

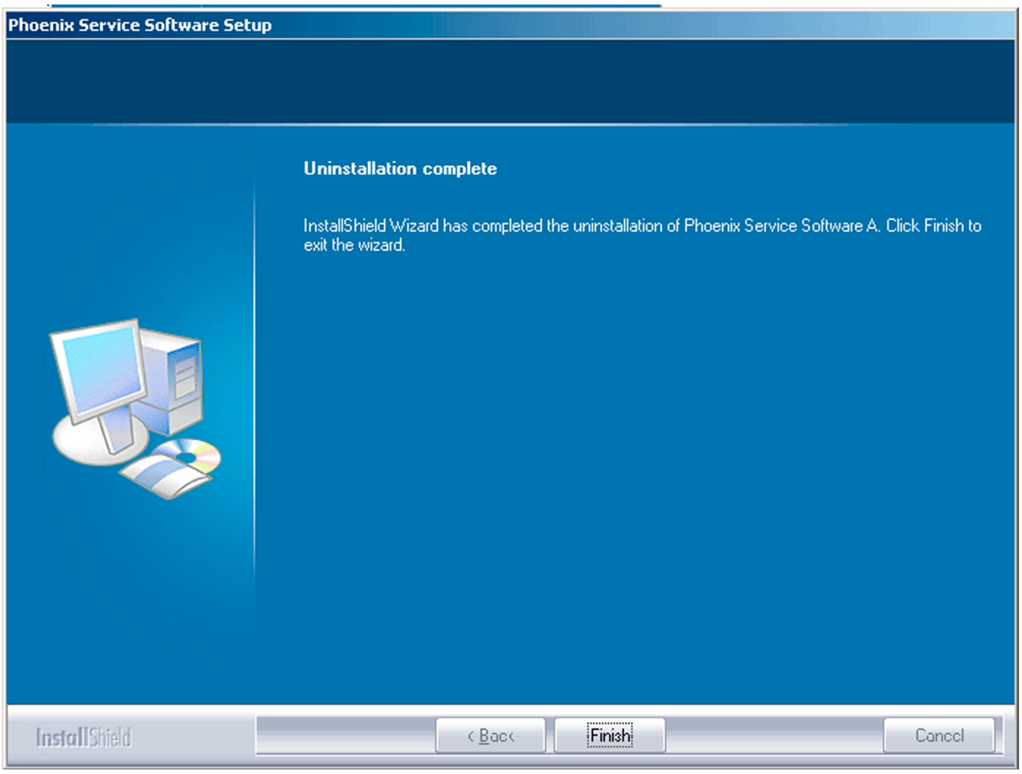
○ Repair
Reinstall all program components installed by the previous setup.

● Remove
Remove all installed components.

Figure 8 Remove program

The progress of the uninstallation is shown.

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



Uninstallation complete

InstallShield Wizard has completed the uninstallation of Phoenix Service Software A. Click Finish to exit the wizard.

Figure 9 Finish uninstallation

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

Repairing *Phoenix* installation

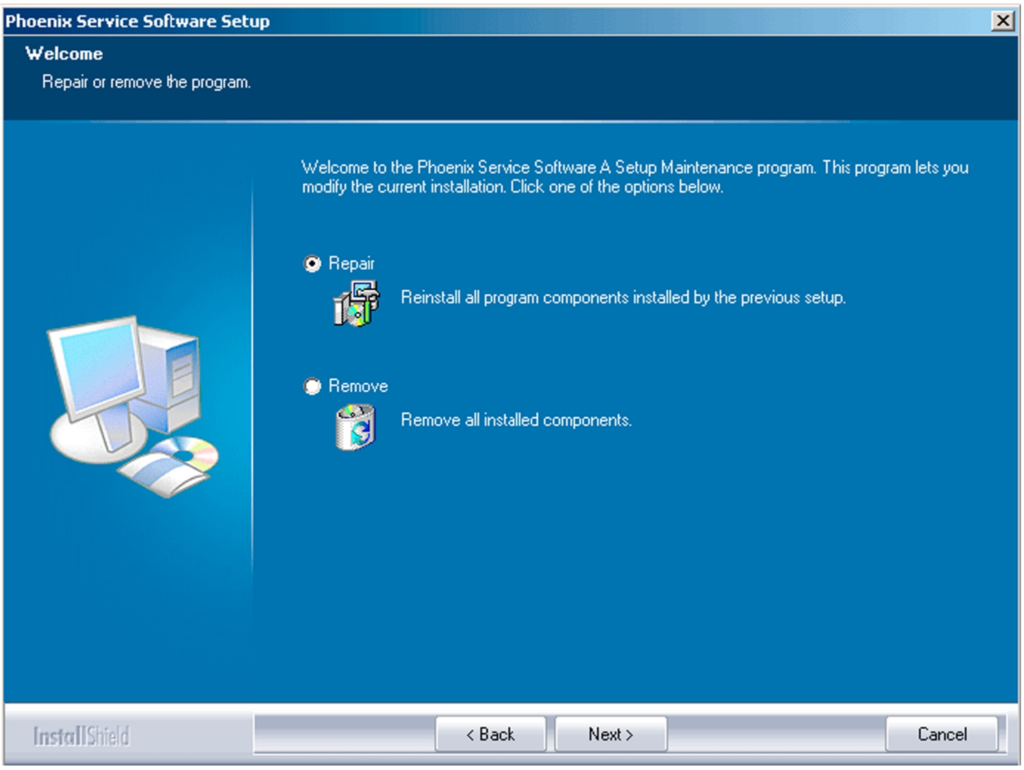
Context

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

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

Steps

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



Phoenix Service Software Setup

Welcome

Repair or remove the program.

Welcome to the Phoenix Service Software A Setup Maintenance program. This program lets you modify the current installation. Click one of the options below.

● Repair

Reinstall all program components installed by the previous setup.

○ Remove

Remove all installed components.

Figure 10 Repair program

Phoenix reinstalls components and registers them.

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

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

Phone data package overview

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

The phone data package contains the following:

- Product software binary files

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

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

Installing phone data package

Prerequisites

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

(XX-XX = type designator of the product)

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

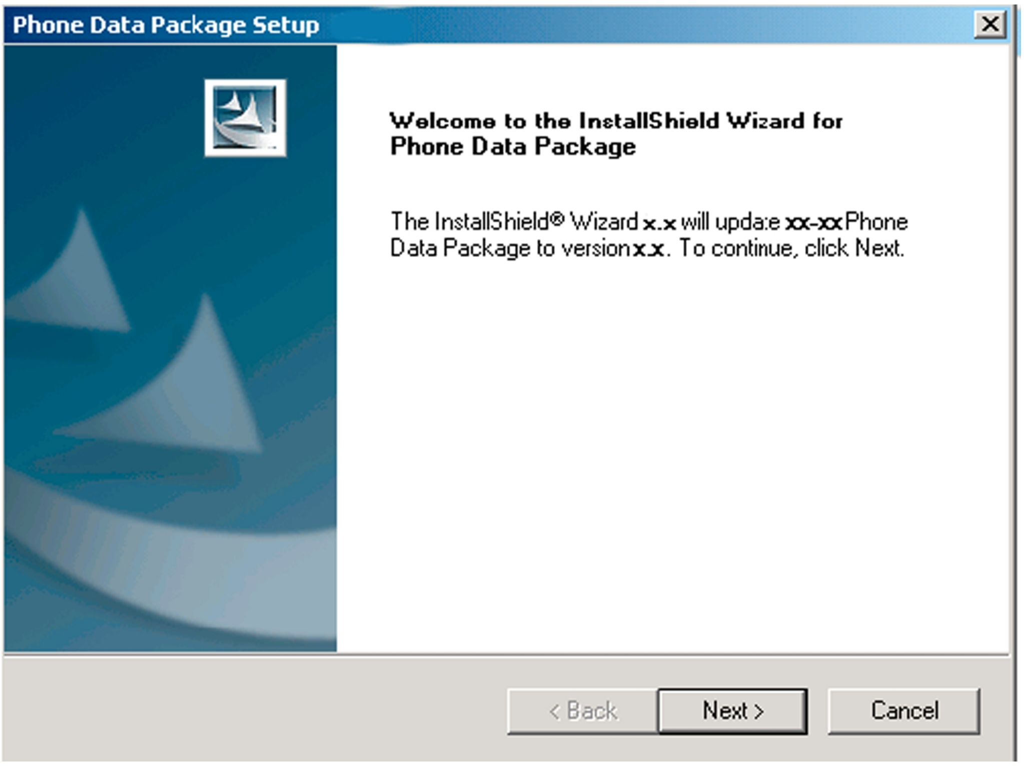
> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt*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

Steps

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

   Wait for the installation files to be extracted.

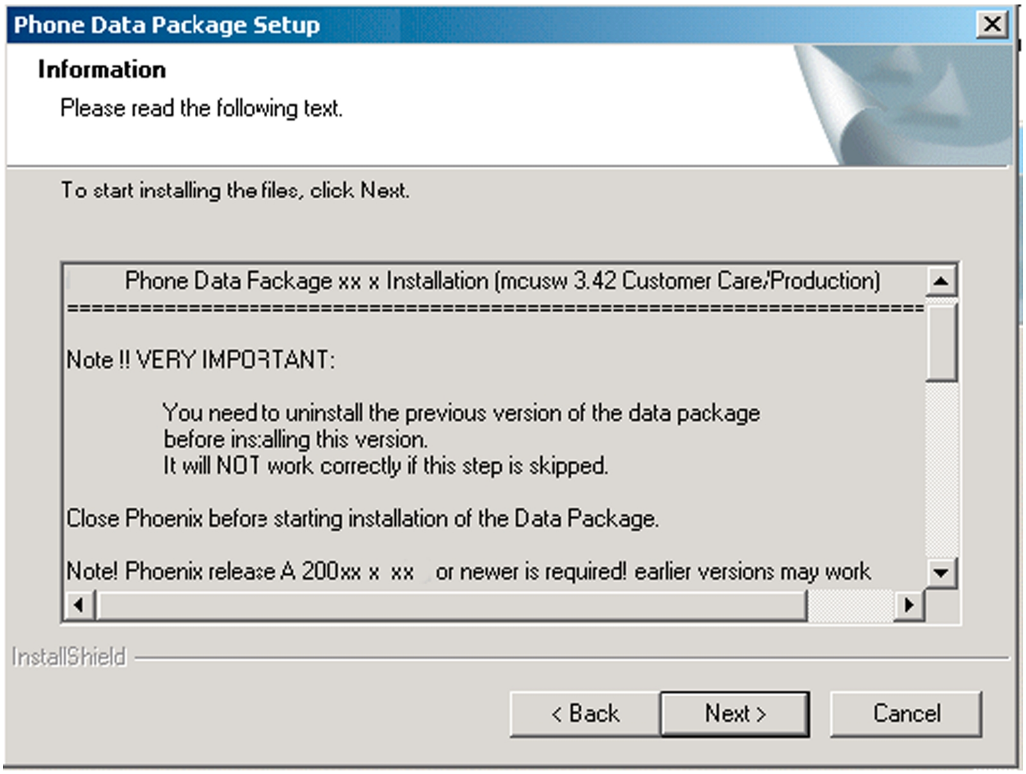
2. Click **Next**.



Welcome to the InstallShield Wizard for Phone Data Package

The InstallShield® Wizard x.x will update xx-xx Phone Data Package to version x.x. To continue, 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.



Information

Please read the following text.

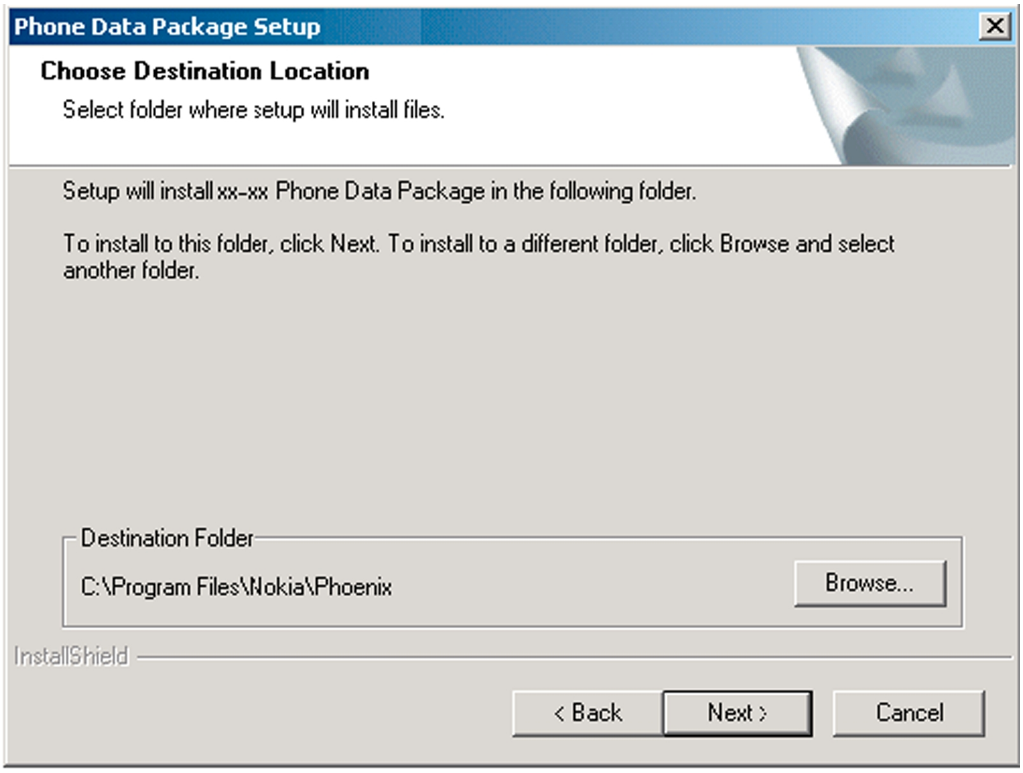
To start installing the files, click Next.

```
        Phone Data Package xx x Installation (mcusw 3.42 Customer Care/Production)
=======================================================================

Note !! VERY IMPORTANT:

              You need to uninstall the previous version of the data package
              before installing this version.
              It will NOT work correctly if this step is skipped.

Close Phoenix before starting installation of the Data Package.

Note! Phoenix release A 200xx x  xx    or newer is required! earlier versions may work
```

Figure 11 Data package setup information

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

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



Phone Data Package Setup

Choose Destination Location

Select folder where setup will install files.

Setup will install xx-xx Phone Data Package in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

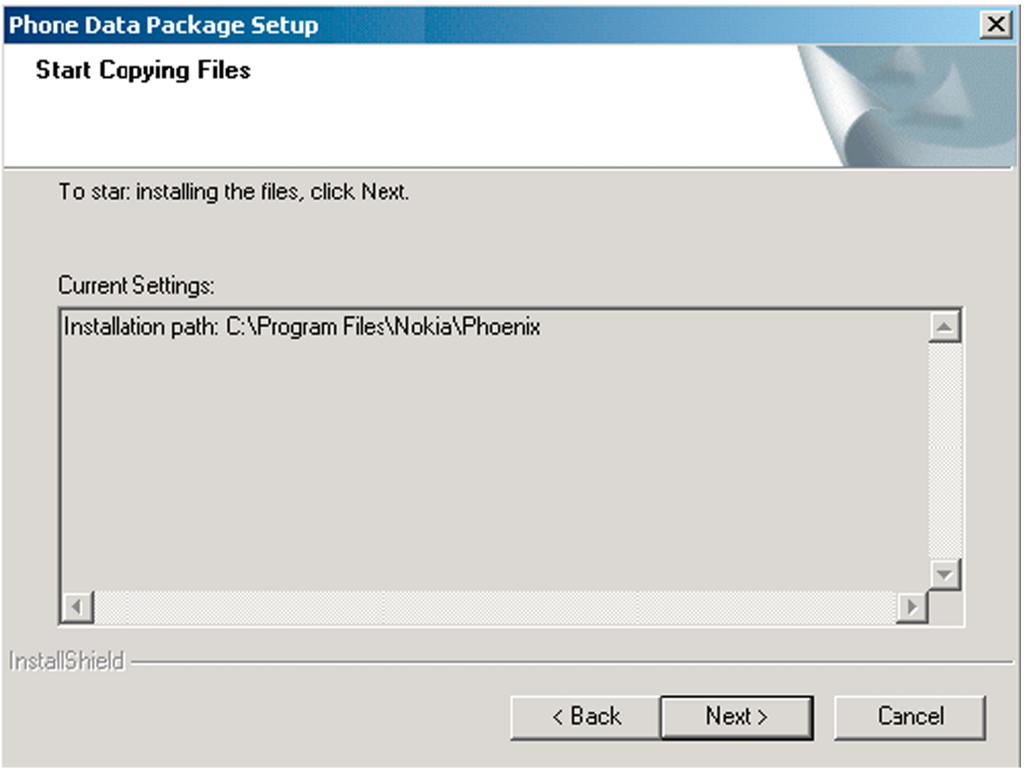
Destination Folder

C:\Program Files\Nokia\Phoenix

Figure 12 Data package destination folder

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

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



Phone Data Package Setup

Start Copying Files

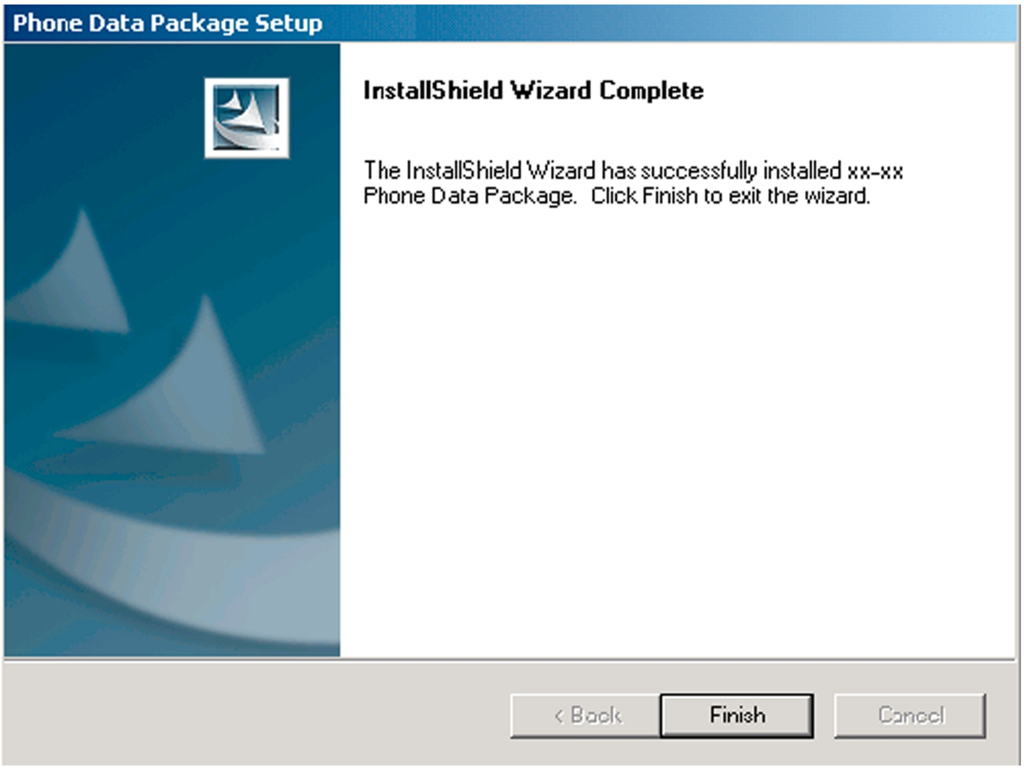
To start installing the files, click Next.

Current Settings:

Installation path: C:\Program Files\Nokia\Phoenix

Phone model specific files are installed. Please wait.

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



The InstallShield Wizard has successfully installed xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 13 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

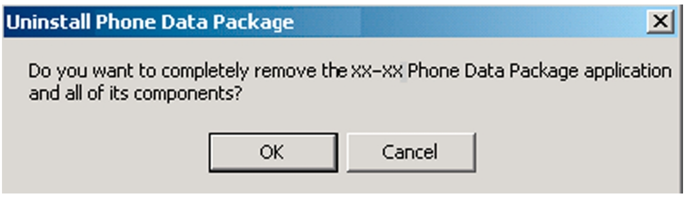
There is no need to uninstall an older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

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.

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

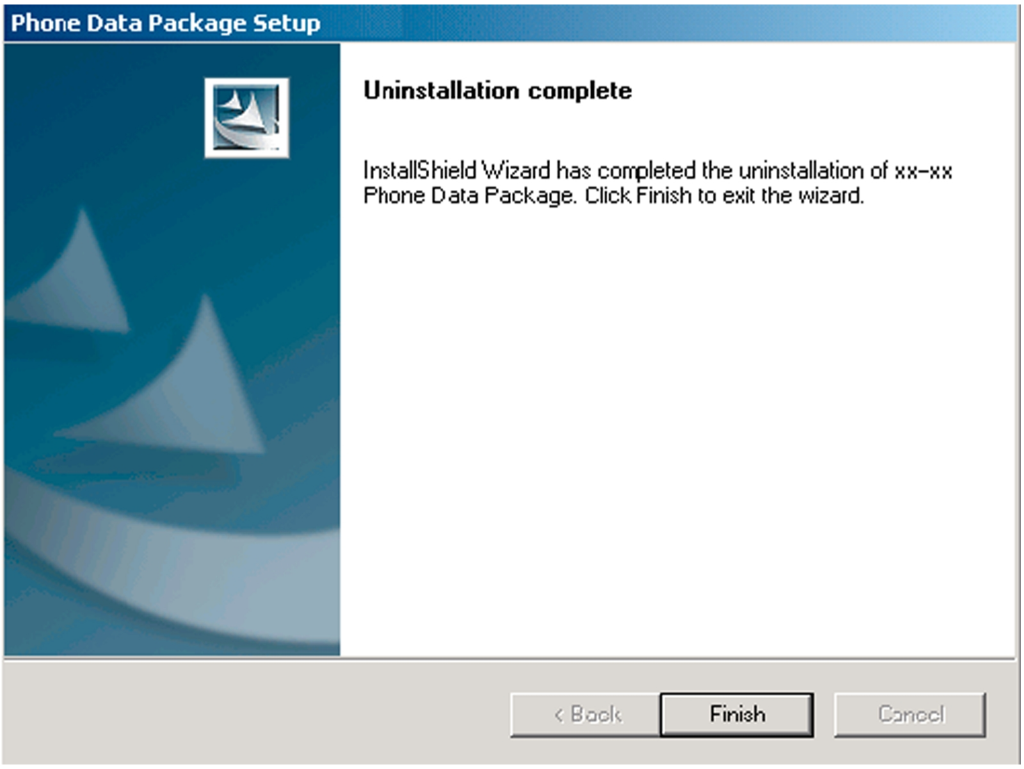


Uninstall Phone Data Package

Do you want to completely remove the xx-xx Phone Data Package application and all of its components?

Figure 14 Uninstalling phone data package

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



Phone Data Package Setup

Uninstallation complete

InstallShield Wizard has completed the uninstallation of xx-xx Phone Data Package. Click Finish to exit the wizard.

Figure 15 Finishing data package uninstallation

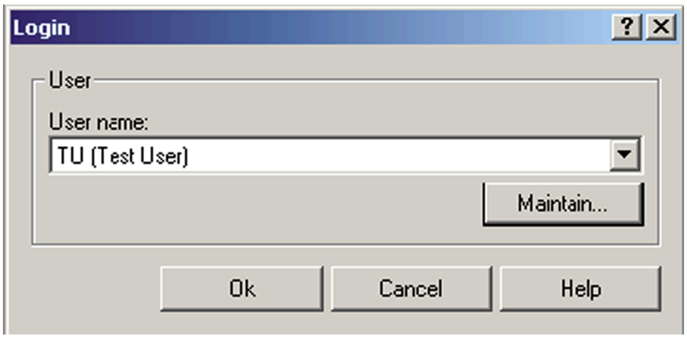
Alternative steps

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

Configuring users in *Phoenix*

Steps

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



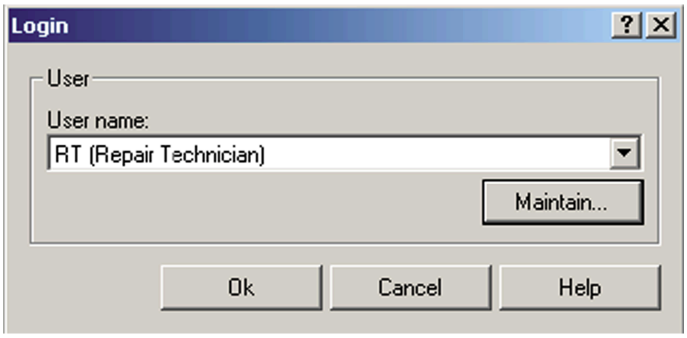
User name: TU (Test User)

Figure 16 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**.



User name: RT (Repair Technician)

Figure 17 New user configured

Managing connections in *Phoenix*

Context

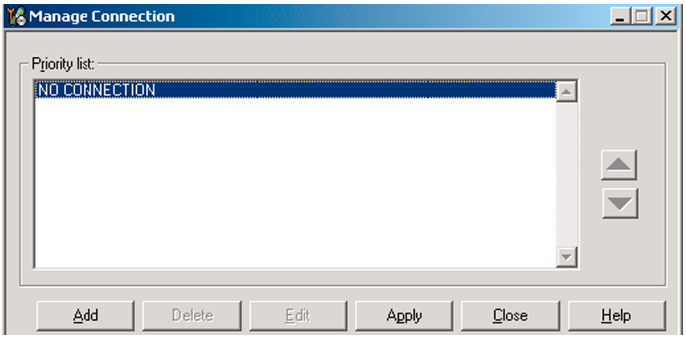
With the **Manage Connections** feature you can edit and delete existing connections or create new ones.

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

Steps

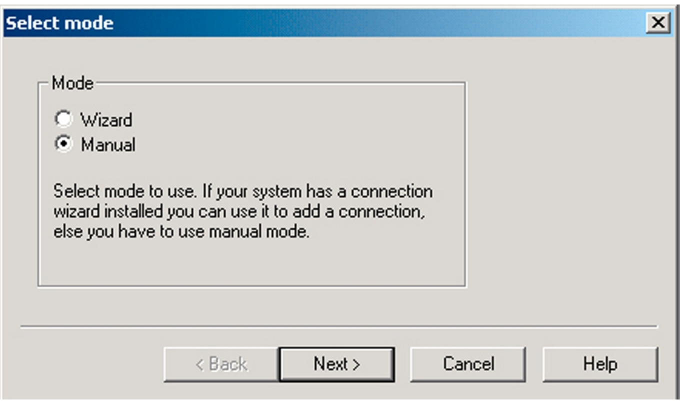
1. Start *Phoenix*, and log in.
2. Choose **File→Manage Connections...** .

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



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

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



Select mode to use. If your system has a connection wizard installed you can use it to add a connection, else you have to use manual mode.

Figure 18 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**.

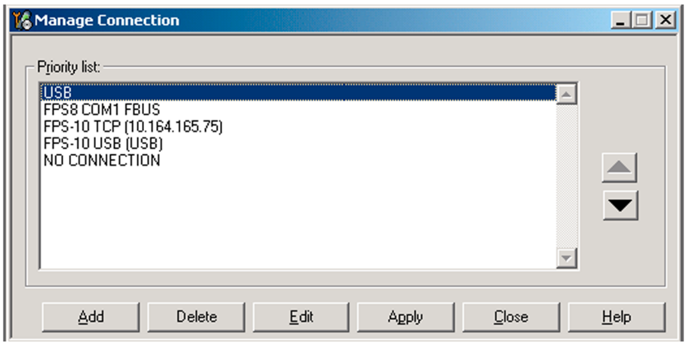
iii For an FPS-8 flash prommer, choose the following connection settings:
  - Media: FPS-8
  - PORT_NUM: COM Port where FPS-8 is connected
  - COMBOX_DEF_MEDIA: **FBUS**

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**.



Priority list:

USB
FPS8 COM1 FBUS
FPS-10 TCP (10.164.165.75)
FPS-10 USB (USB)
NO CONNECTION

Figure 19 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 20 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:

V 2.0436v19.1 , 18-10-04 , RM-1 , (c) NOKIA. / V 2.39.126 , 18-10-04 , RM-1 , (c)

Figure 21 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).

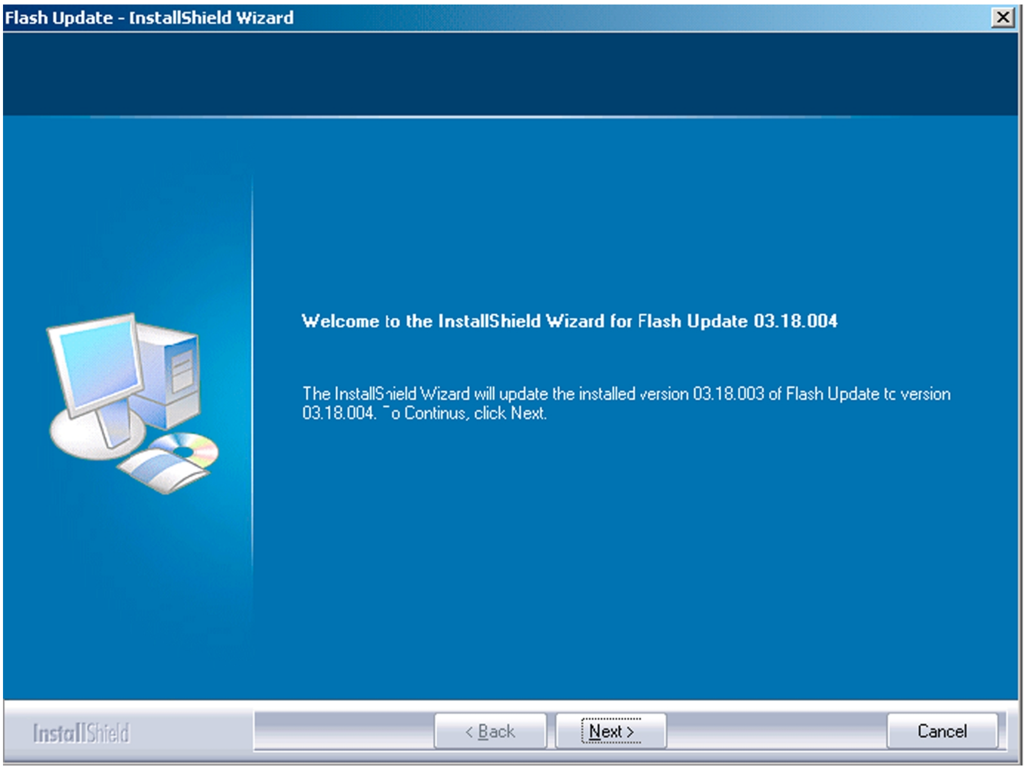
  Normally, it is enough to install *Phoenix* and the phone-specific data package because the installation always includes the latest flash update package files for FPS-8 and FPS-10.
- A separate installation package for flash support files is available. The files can be updated according to these instructions,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

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*).



Welcome to the InstallShield Wizard for Flash Update 03.18.004

The InstallShield Wizard will update the installed version 03.18.003 of Flash Update to version 03.18.004. To Continue, click Next.

Figure 22 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.

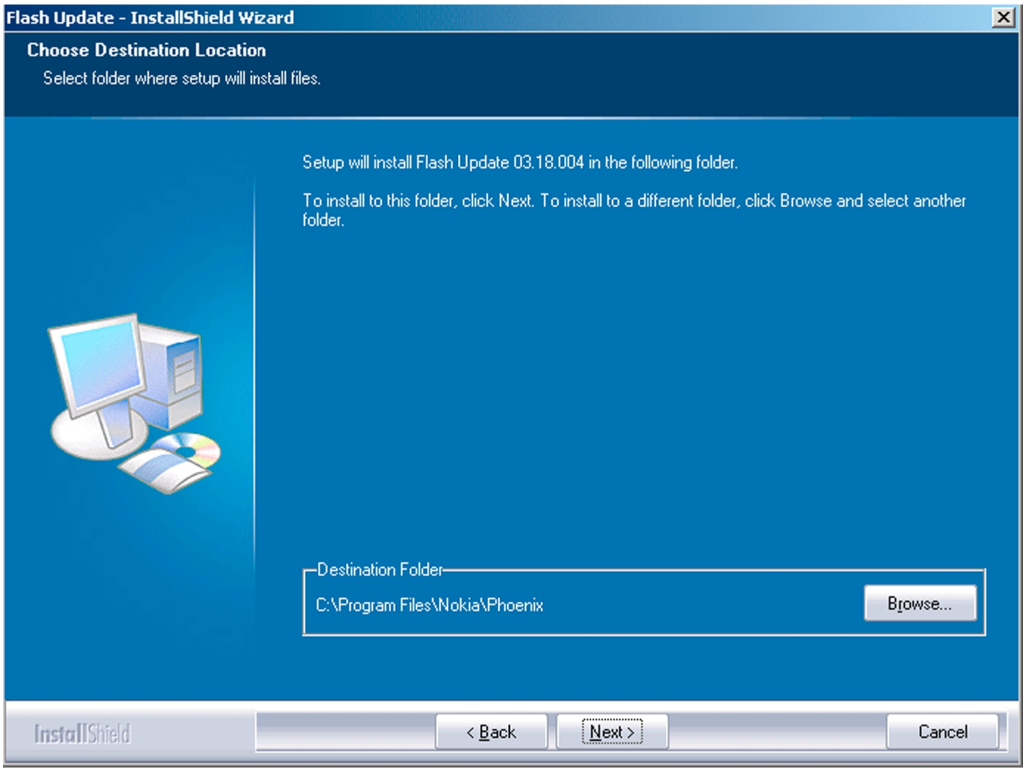
You have newer version 03.18.004 of the application.
If you want to install older version 03.18.003 you need to uninstall the current version before.

Setup will exit.

Figure 23 Flash installation interrupted

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

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



Flash Update - InstallShield Wizard

Choose Destination Location

Select folder where setup will install files.

Setup will install Flash Update 03.18.004 in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

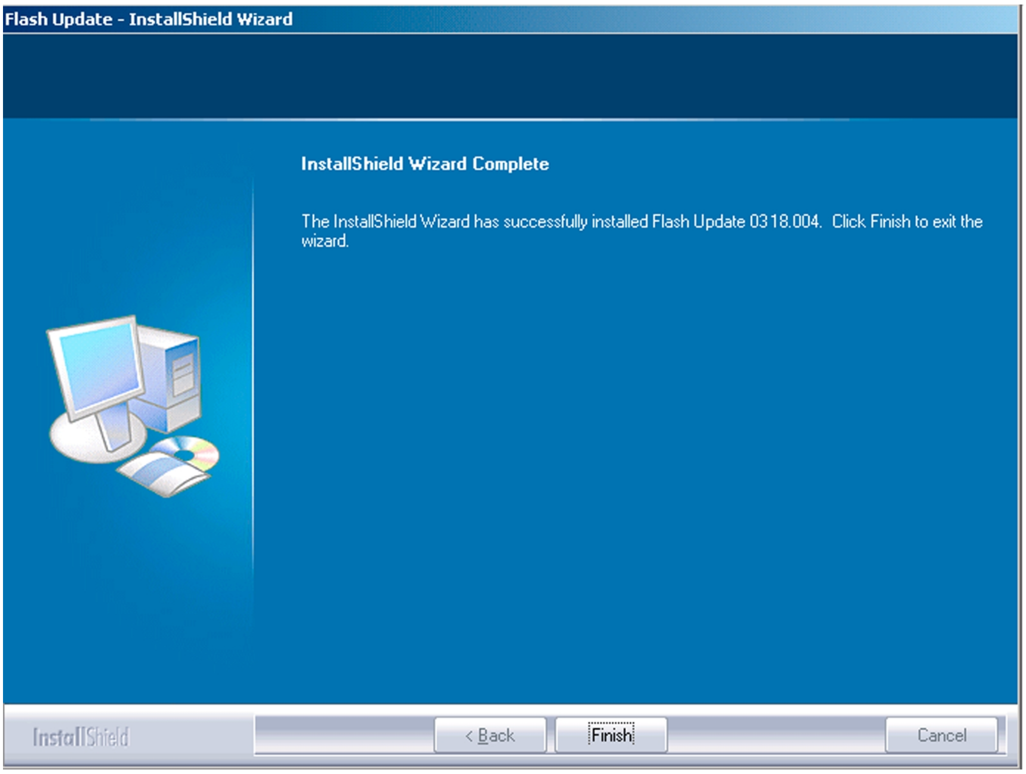
Destination Folder

C:\Program Files\Nokia\Phoenix

Figure 24 Flash destination folder

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

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



InstallShield Wizard Complete

The InstallShield Wizard has successfully installed Flash Update 0318.004. Click Finish to exit the wizard.

Figure 25 Finish flash update

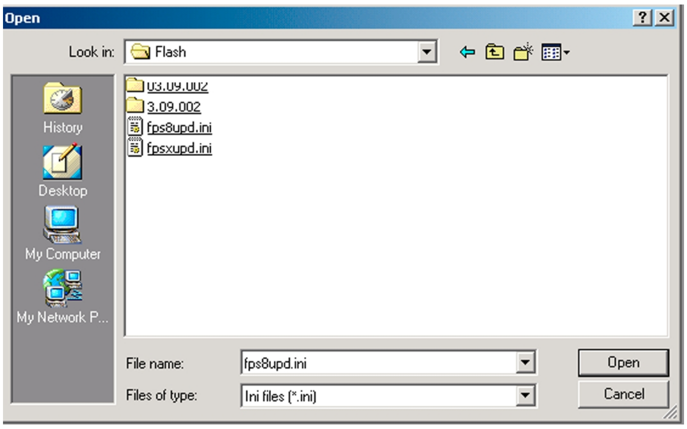
Next actions

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*.



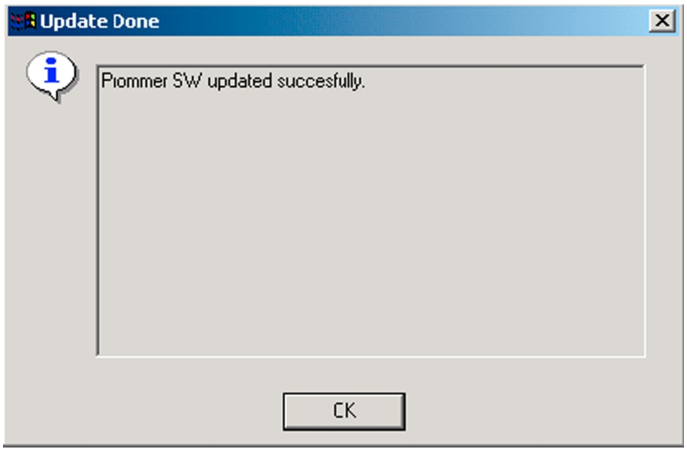
File name: fps8upd.ini

Files of type: Ini files (*.ini)

Figure 26 Flash directory window

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.

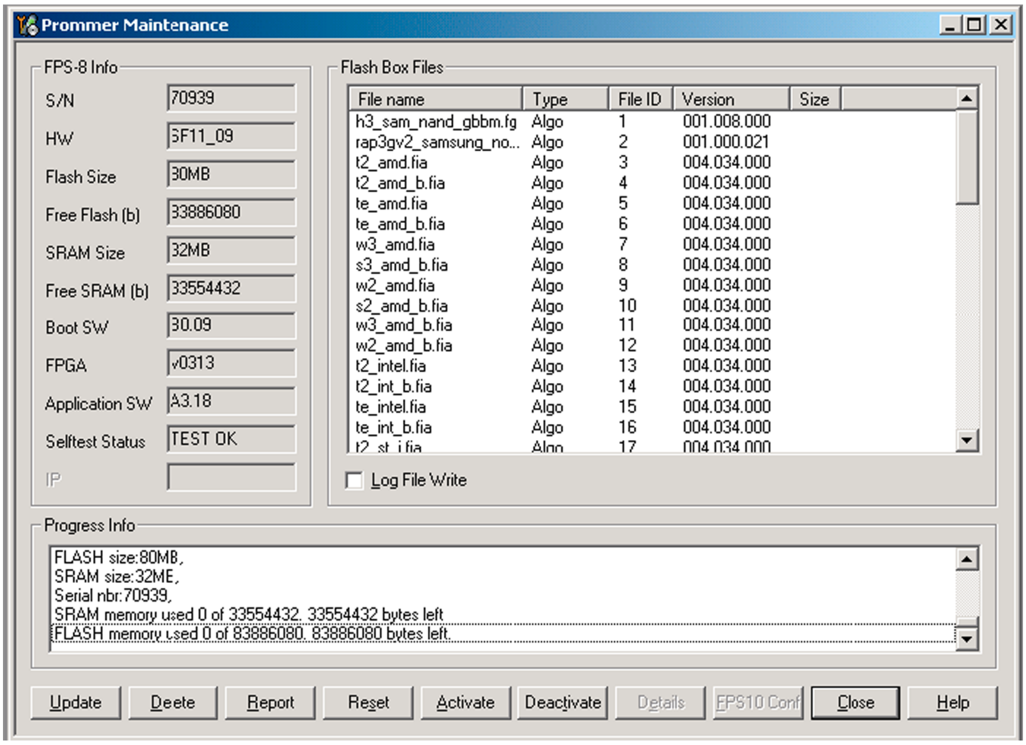
5. Click **OK**.



Prommer SW updated succesfully.

Figure 27 Prommer software update finished

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



S/N: 70939
HW: 5F11_09
Flash Size: 80MB
Free Flash (b): 83886080
SRAM Size: 32MB
Free SRAM (b): 33554432
Boot SW: 30.09
FPGA: v0313
Application SW: A3.18
Selftest Status: TEST OK
IP:

File name	Type	File ID	Version	Size
h3_sam_nand_gbbm.fg	Algo	1	001.008.000	
rap3gv2_samsung_no...	Algo	2	001.000.021	
t2_amd.fia	Algo	3	004.034.000	
t2_amd_b.fia	Algo	4	004.034.000	
te_amd.fia	Algo	5	004.034.000	
te_amd_b.fia	Algo	6	004.034.000	
w3_amd.fia	Algo	7	004.034.000	
s3_amd_b.fia	Algo	8	004.034.000	
w2_amd.fia	Algo	9	004.034.000	
s2_amd_b.fia	Algo	10	004.034.000	
w3_amd_b.fia	Algo	11	004.034.000	
w2_amd_b.fia	Algo	12	004.034.000	
t2_intel.fia	Algo	13	004.034.000	
t2_int_b.fia	Algo	14	004.034.000	
te_intel.fia	Algo	15	004.034.000	
te_int_b.fia	Algo	16	004.034.000	
t2_st_i.fia	Algo	17	004.034.000	

☐ Log File Write

```
FLASH size:80MB,
SRAM size:32MB,
Serial nbr:70939,
SRAM memory used 0 of 33554432. 33554432 bytes left
FLASH memory used 0 of 83886080. 83886080 bytes left.
```

Figure 28 ***Prommer Maintenance*** **window**

Activating FPS-8

Context

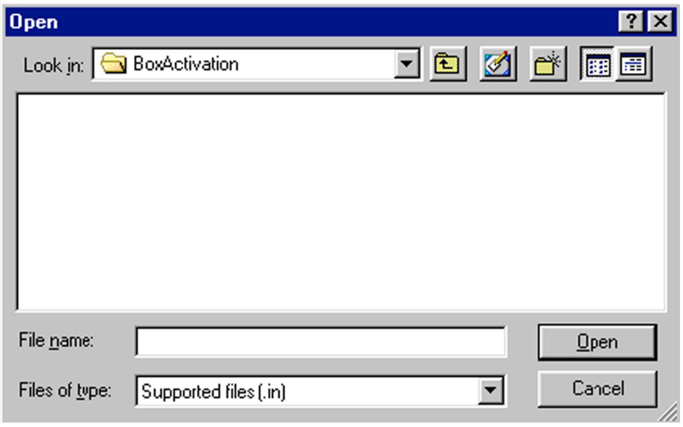
Before FPS-8 can be successfully used for phone programming, it must first be activated.

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).

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**.



Look in: BoxActivation

Files of type: Supported files (.in)

Figure 29 Box activation

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

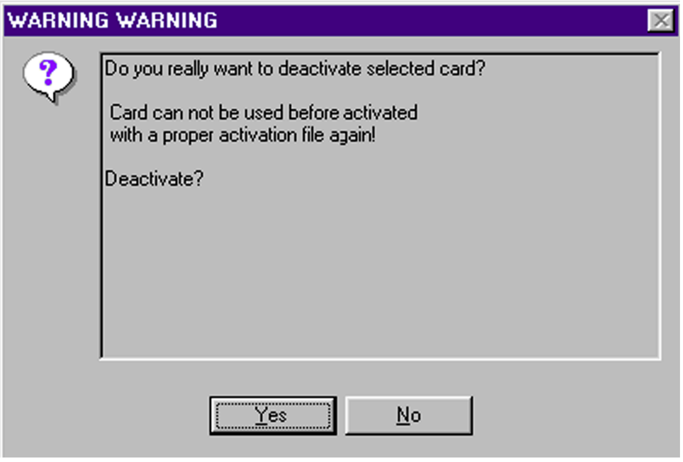
Deactivating FPS-8

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**.



Do you really want to deactivate selected card?

Card can not be used before activated
with a proper activation file again!

Deactivate?

Figure 30 Deactivation warning

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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Table of Contents

List of Figures

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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-180, refer to various concepts.

	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

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.

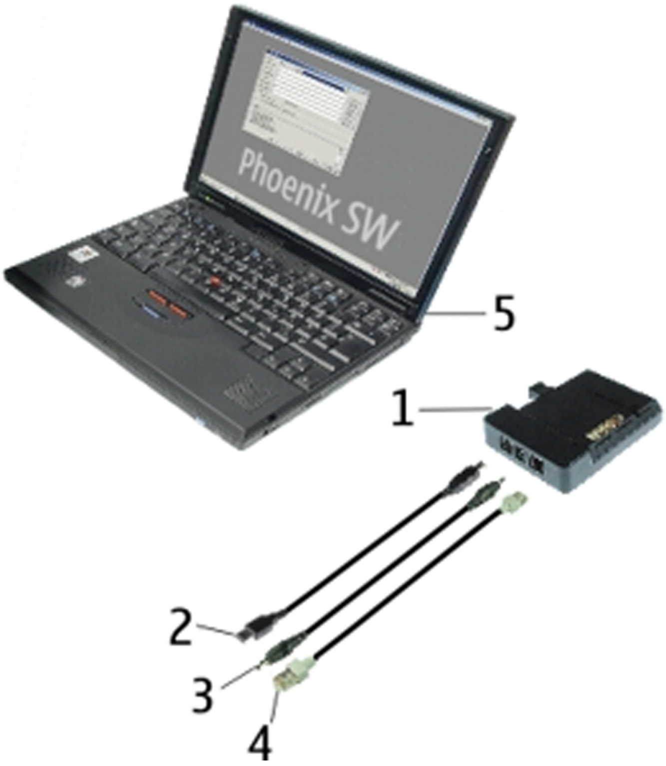
The unit has the following features:

- 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.

<table>
<tr><td rowspan="2"></td><td>DKU-2</td><td>USB connectivity cable</td><td></td></tr>
<tr><td colspan="3">USB to system connector cable.</td></tr>
<tr><td rowspan="2"> </td><td>FLS-4S</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
</table>

	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-14	Flash adapter	
	Flash adapter FS-14 is used for phone testing and flashing. FS-14 is used with the generic flash adapter base SS-60/62 and control Unit CU-4 or interface adapter SS-46. When flashing or system testing the phone, the adapter is attached to replace the phone own battery. All functions (as well as the calibration voltages, current and the protections for over voltages, over current and voltage polarity), are performed by CU-4. Flash adapter FS-14 main features: • VBATT supply interface • USB / FBUS multiplexed interface to the phone • Supply voltage for light source		
	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		

MJ-70	Module jig	

Module jig MJ-70 is designed for engine testing. It can be used for flashing and RF, battery and system testing.

Module jig MJ-70 main functions:

- CU-4 interface adapter to phone
- USB / FBUS multiplexed interface to phone
- UI Interface to phone
- STI and XTI test interface
- GSM RF-interface

All functions, except USB / FBUS multiplexing, are performed in CU-4. For instance, adjusting calibration voltages and current, and all protections for over current, over voltage and voltage polarity.

PCS-1	Power cable	

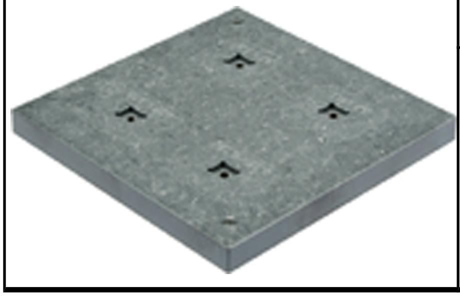
The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled operating voltage.

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.

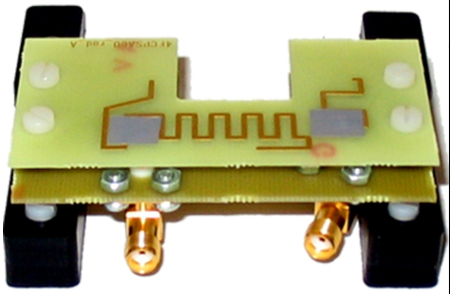


RJ-104	BTHFM rework jig	

RJ-104 is a rework jig used when servicing the BTHFM module. It is used together with rework stencil ST-37.

RJ-94	Soldering jig	

RJ-94 is a soldering jig used for soldering and as a rework jig for the engine module.



SA-95	RF coupler	

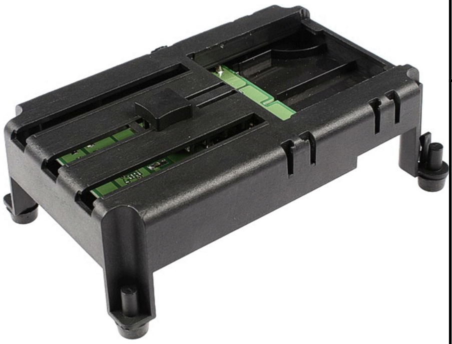
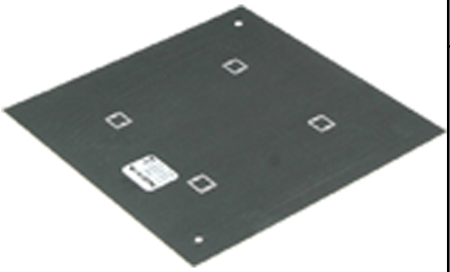
SA-95 is an RF coupler for GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-95:

GSM900 TX	Att. (dB)	GSM900 RX	Att. (dB)
880 MHz	3.2	925 MHz	2.8
897 MHz	3.2	942 MHz	2.0
915 MHz	3.2	960 MHz	2.5
GSM1800 TX	Att. (dB)	GSM1800 RX	Att. (dB)
1710 MHz	5.6	1805 MHz	4.5
1748 MHz	4.9	1843 MHz	4.2
1785 MHz	4.6	1880 MHz	3.9
GSM1900 TX	Att. (dB)	GSM1900 RX	Att. (dB)
1850 MHz	4.3	1930 MHz	5.0
1880 MHz	5.1	1960 MHz	4.6
1910 MHz	5.3	1990 MHz	5.7

SPI-1	Soldering paste injector	

	SPS-1	Soldering Paste Spreader	
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers and B-to-B connectors.		
	SS-15	Camera removal tool	
	The camera removal tool SS-15 is used to remove/attach the camera module from/to the camera socket of the phone PWB.		
	SS-34	Flex opening tool	

<table>
<tr><td rowspan="2"></td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-68</td><td>Antenna cover opening tool</td><td></td></tr>
<tr><td colspan="3">SS-68 is a tool for removing the antenna cover.</td></tr>
<tr><td rowspan="2"></td><td>ST-37</td><td>BTHFM rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-37 stencil is used with RJ-104 BTHFM rework jig.</td></tr>
<tr><td rowspan="2"> </td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>XCS-1</td><td>Service cable</td><td></td></tr>
<tr><td colspan="3">The XCS-1 service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.</td></tr>
<tr><td rowspan="2"></td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"></td><td>XRS-6</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector approximately 610 mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB</td></tr>
</table>

Service concepts

Flash concept with FPS-10

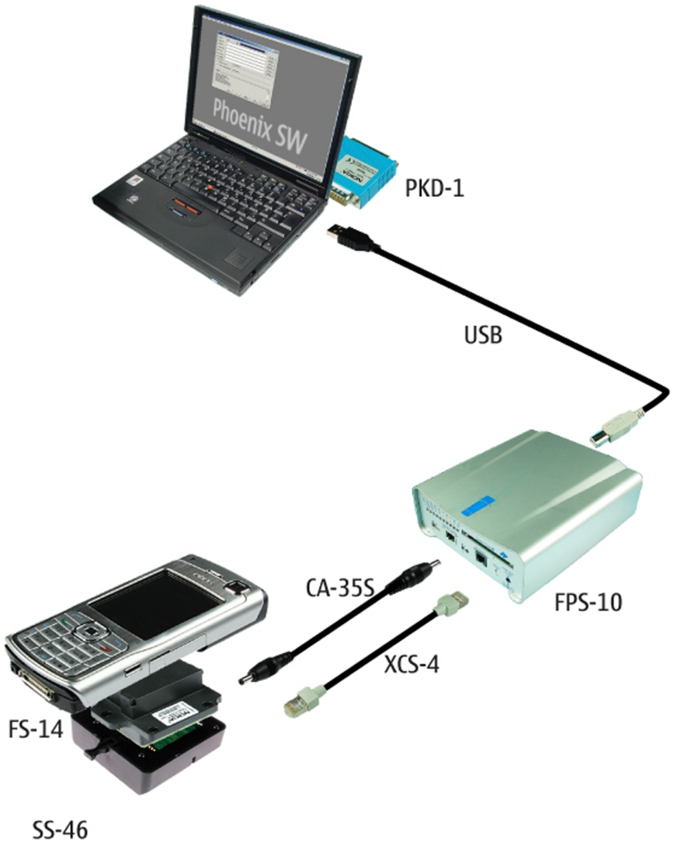
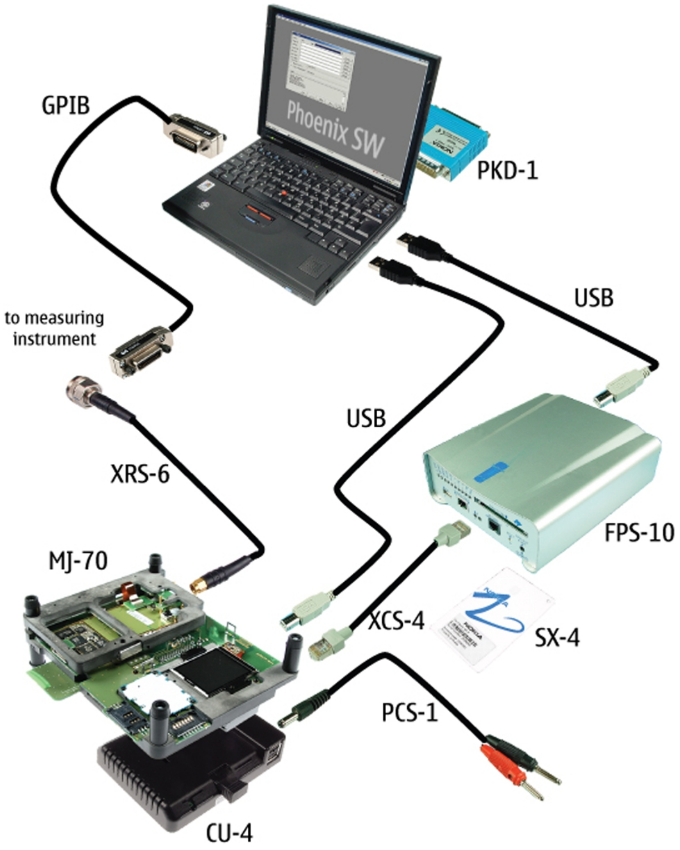


Figure 31 Basic flash concept with FPS-10

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

Item	Type	Description
1	FS-14	Flash adapter
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

MJ-70 module jig concept



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

Figure 32 MJ-70 module jig service concept

Item	Type	Description
1	MJ-70	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
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 33 POS flash concept

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

Service concept for RF/BB testing and tuning

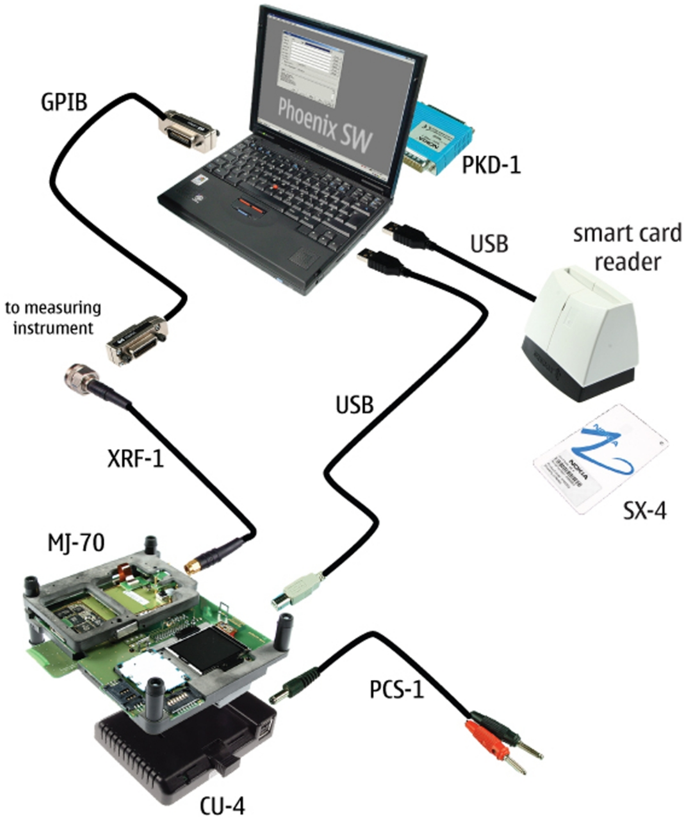


Figure 34 Service concept for RF/BB testing and tuning

Item	Type	Description
1	MJ-70	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	XRF-1	RF cable
8		GPIB control cable
9	PKD-1	SW security device
10		RF shield box

Note: Item 10 not shown in the picture.

CU-4 flash concept with FPS-10

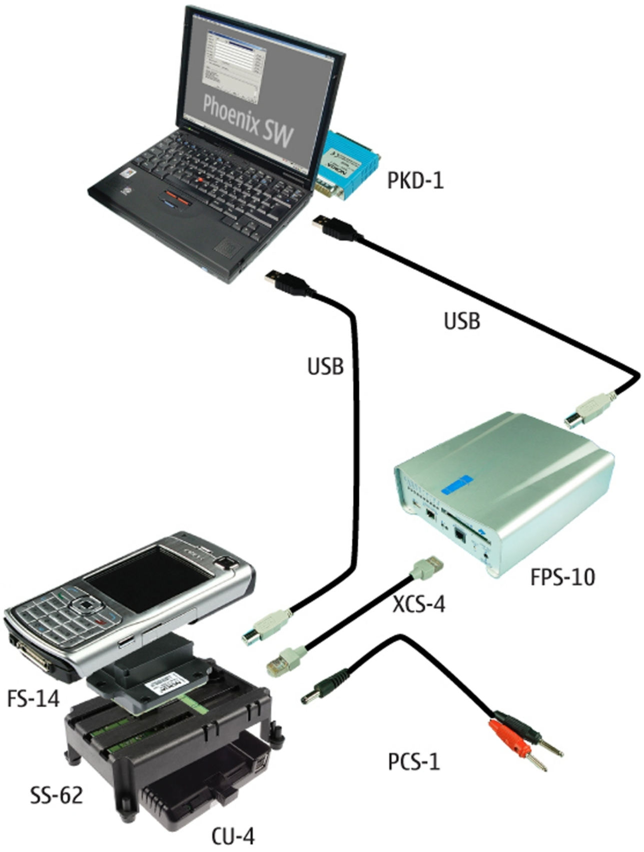


Figure 35 CU-4 flash concept with FPS-10

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

Item	Type	Description
1	FS-14 + SS-62	Flash adapter + generic flash adapter base for BB5 products
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

RF testing and BB testing/tuning

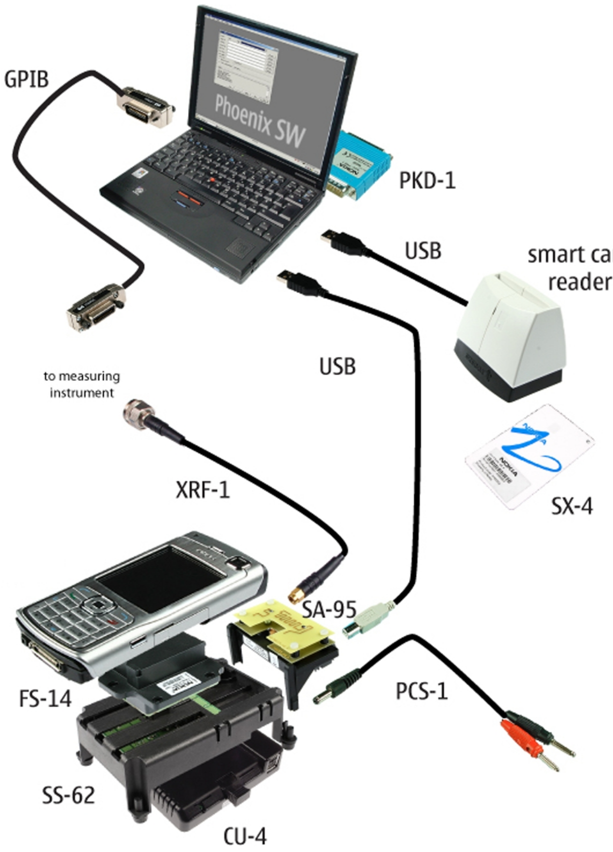


Figure 36 RF testing and BB testing/tuning

Item	Type	Description
1	FS-14 + SS-62	Flash adapter + generic flash adapter base for BB5 products
2	CU-4	Control unit
3	SA-95	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	XRF-1	RF cable
10	PKD-1	SW security device
11		RF shield box

Note: Item 11 not shown in the picture.

LAN connection flash concept

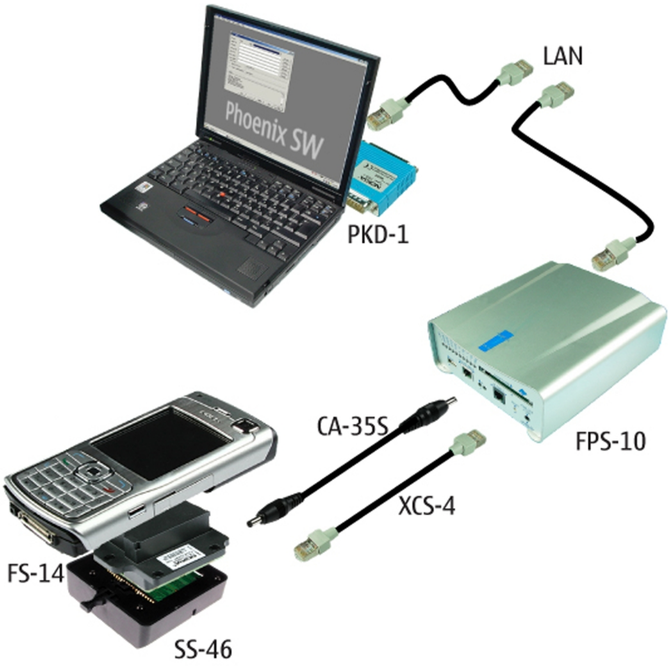


Figure 37 LAN connection flash concept

Item	Type	Description
1	FS-14	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

5 — Disassembly/Reassembly Instructions

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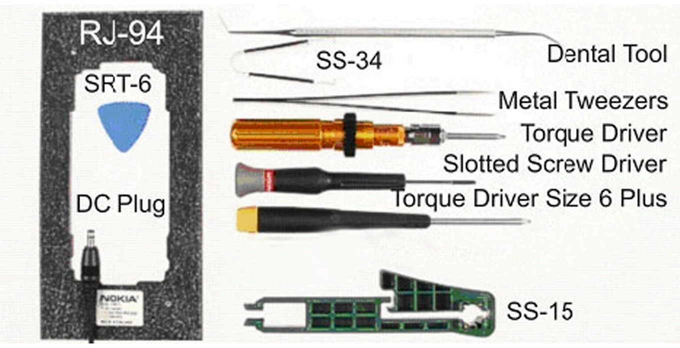
Disassembly / reassembly instructions

Prerequisites

Required tools for disassembly:



Note: Reassembly takes places in the reverse order.

Note the reassembly-specific instructions in steps **11.**, **16.**, **18.**, **25.**, **29.**, and **31.**.

Steps

1. Always protect the window with a plastic film.

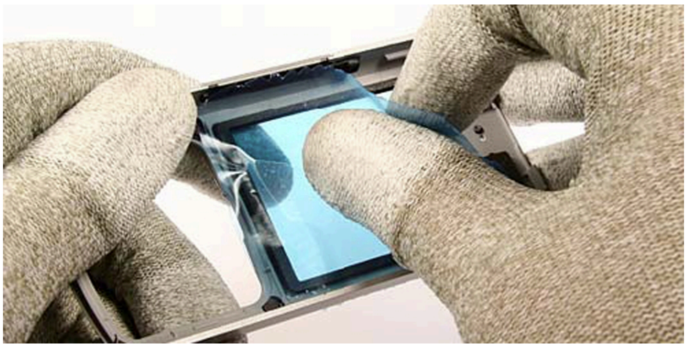
2. Remove the **Battery Cover**.

3. Place **SRT-6** between the **A-Cover** and Chassis; release the 4 plastic clips beginning from the bottom side as shown.

4. Remove the **Keymat**.

5. Protect the **LCD** with a plastic film.

6. Protect the inner side window of the **A-Cover** with a film.



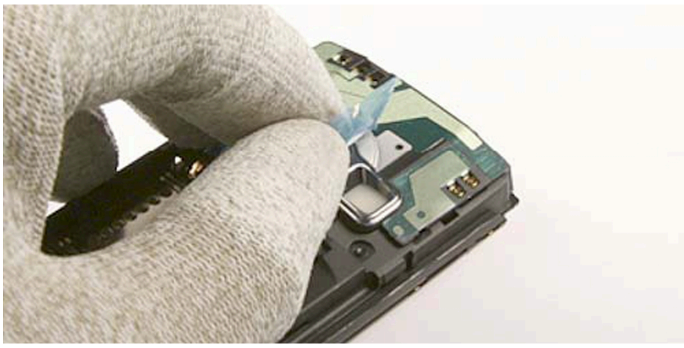
7. Remove the **MMC door** from the **A-Cover**.

8. Insert **SRT-6** between the **Antenna Cover** and the **Chassis Assy**, and open the **Antenna Cover** clips.

   Note: Additional force may be required to open the clips.

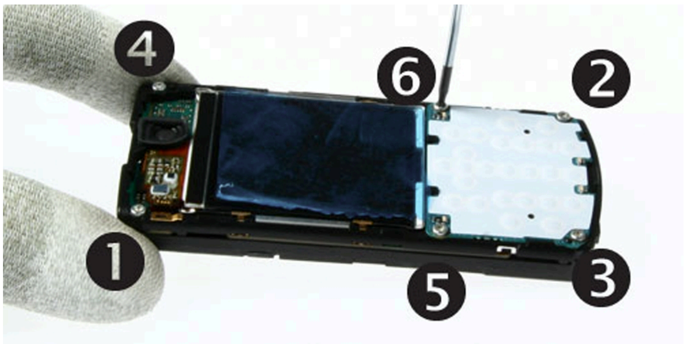
9. Use the tweezers to remove the **Power Button**.

10. Protect the **Camera Rear Bezel Assy** with a plastic film before turning the unit.

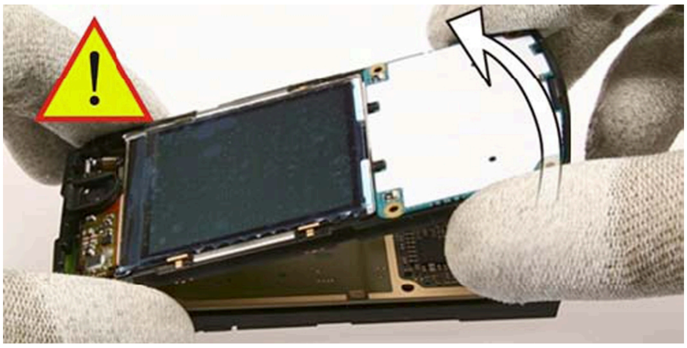


11. Unscrew the 6 Torx size 6 plus screws in the order shown.

    Note: When reassembling, use the reverse order and the torque of 25 Ncm.

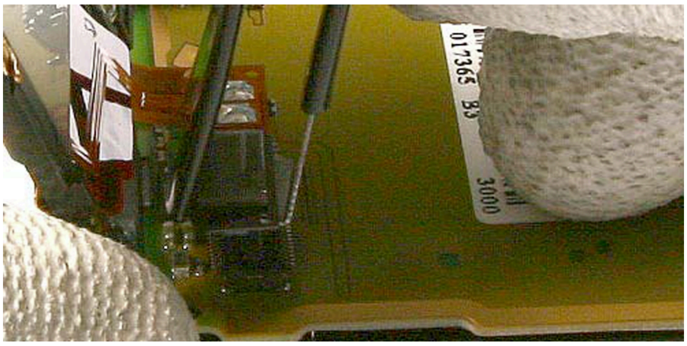


12. Lift the **UI Frame** from the Chassis. Be careful not to damage the flex foil of the **LCD**, which is still connected.



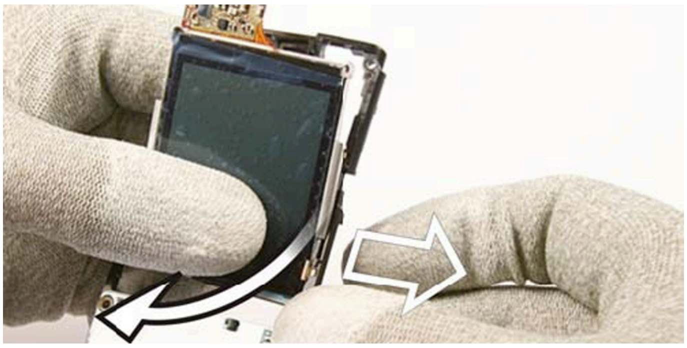
13. Open the flex connector with the **SS-34** flex connector opening tool.

    Note: Be careful not to damage the surrounding components when using the tool.

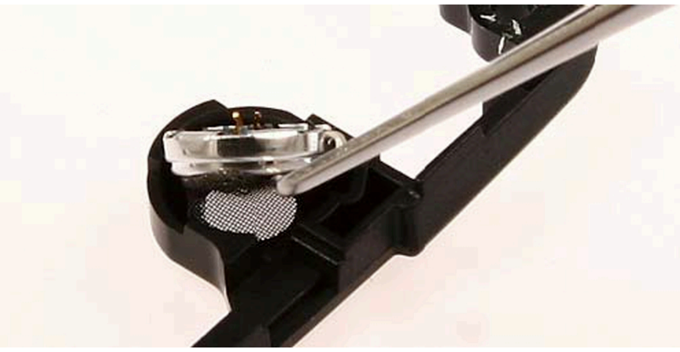


    After you have opened the flex connector, you can remove the **UI Frame**.

14. To open each clip of the **LCD** from the **UI Frame**, carefully move the **UI Frame** sideward while pulling the **LCD** forward.



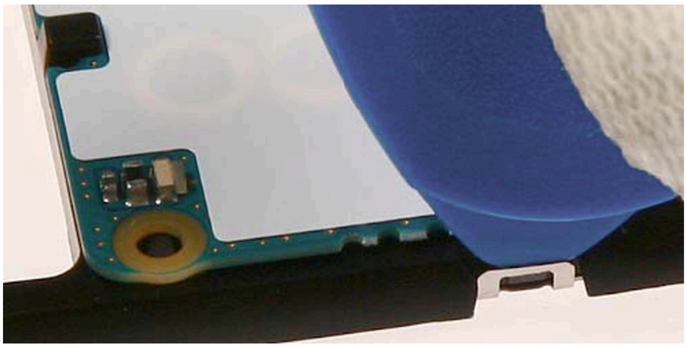
15. Use the dental tool to remove the **Earpiece**.



16. Use the tweezers to remove the **Earpiece Gasket** from its compartment.

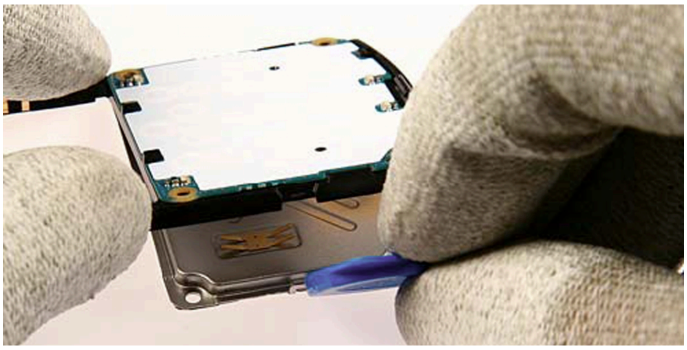
    Note: When reassembling, always use a new gasket.

17. Use **SRT-6** to unlatch the **BB shield**.

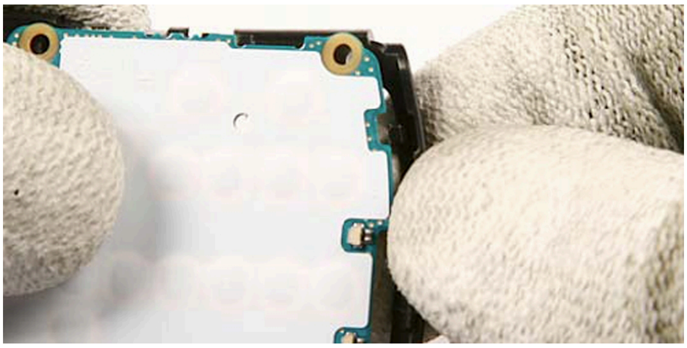


18. To remove the **BB shield** from the **UI Frame**, hold the frame in your left hand and push down the **BB Shield** with **SRT-6**.

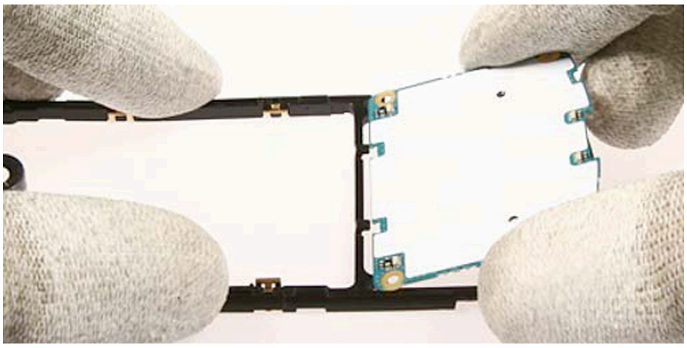
    Note: When reassembling, always use a new **BB Shield**.



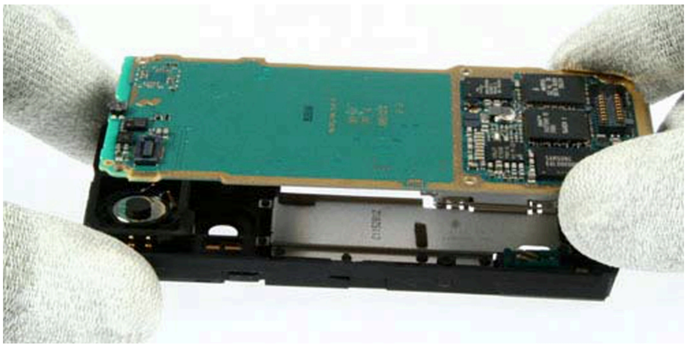
19. To unlock the **UI PWB** from the **UI Frame**, carefully pull the PWB upwards.



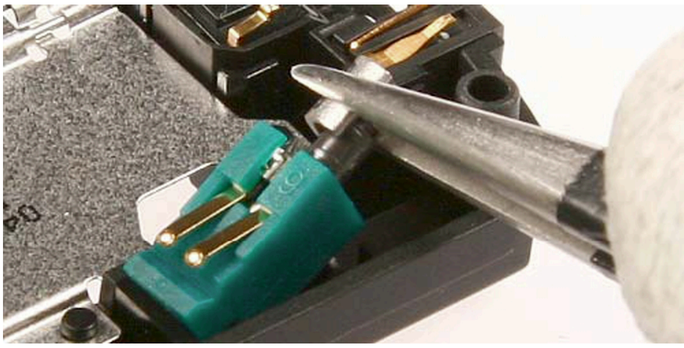
20. Remove the **UI PWB**.



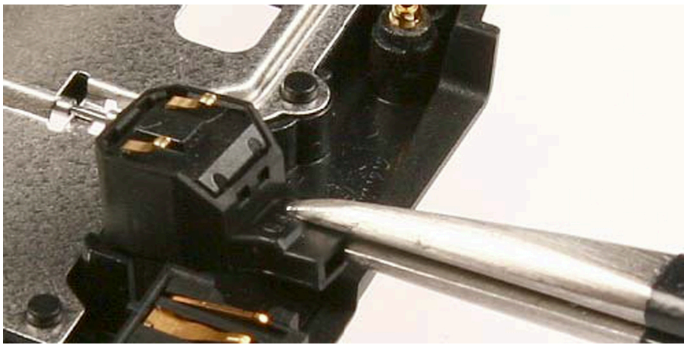
21. Remove the **Engine Module**, and place it onto the **RJ-94** jig.



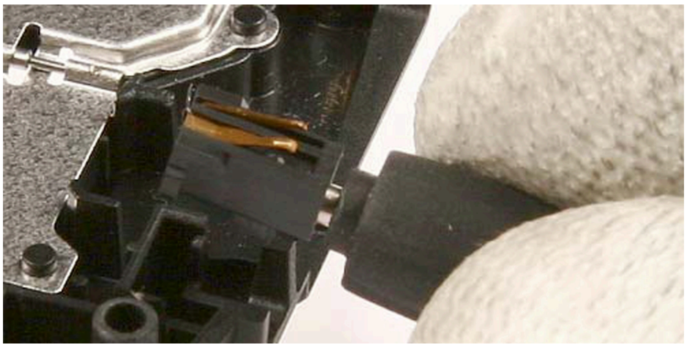
22. Use the tweezers to remove the **Vibra Motor**.



23. Use the tweezers to pull out the **Microphone**.

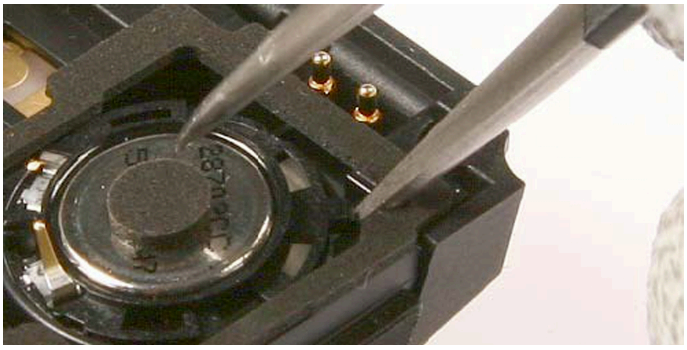


24. Use the **DC plug** to remove the **DC Jack**.

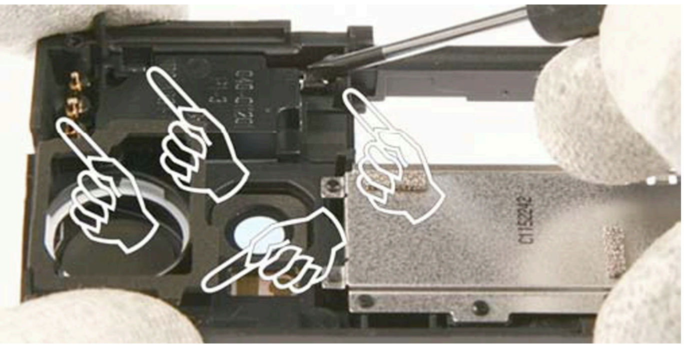


25. Use the tweezers to lift out the **IHF speaker**.

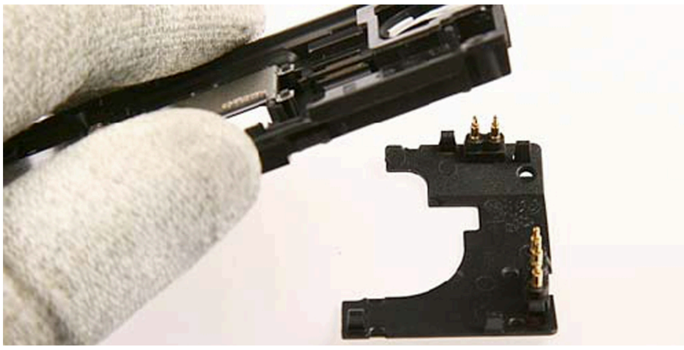
    Note: When reassembling, note the guide pin.



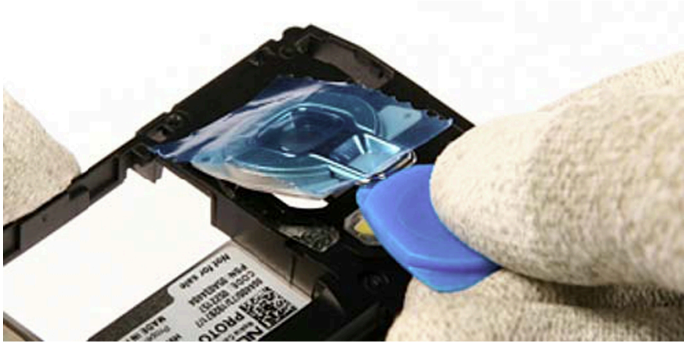
26. Unlock the 5 plastic clips of the **Antenna** in the places shown.



27. Carefully separate the **Antenna** from the **UI Frame**.



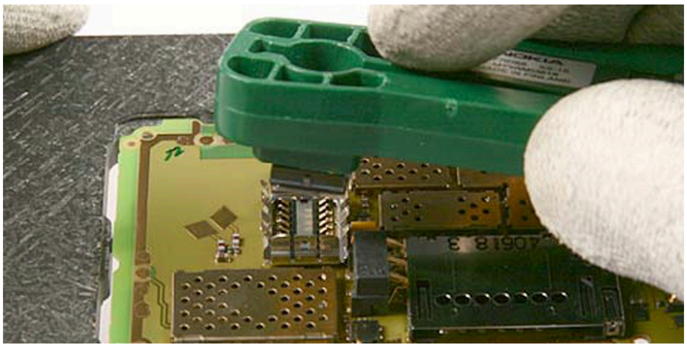
28. Use **SRT-6** to lift out the **Camera Rear Bezel Assy**.



29. Use **SRT-6** to completely remove the residues of the **Camera Rear Bezel Assy** adhesive.

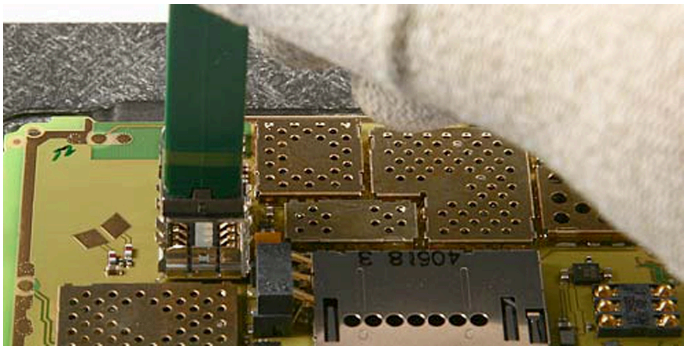
    Note: When reassembling, always use new adhesive.

30. To prevent mechanical stress to the PWB, place the **Engine Module** onto **RJ-94**, and use **SS-15** to remove the **Camera** module.

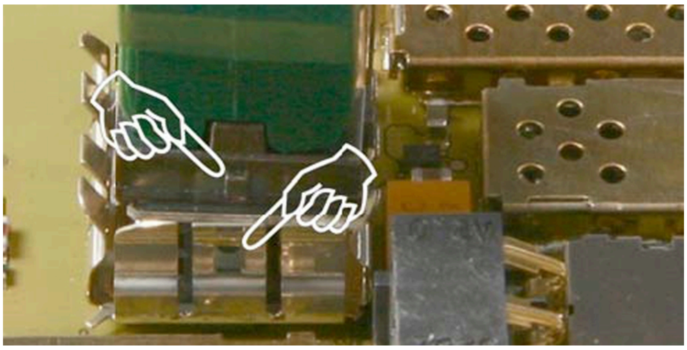


31. **Attention:** The following steps are for reassembly only!

- Use the assembly side of **SS-15** to fit the **Camera** module back into its compartment.



- When reassembling, note the correct position of the **Camera** module.



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6 — BB Troubleshooting and Tuning Guide

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Table of Contents

List of Tables

List of Figures

Baseband troubleshooting

Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths. The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.

Troubleshooting flow

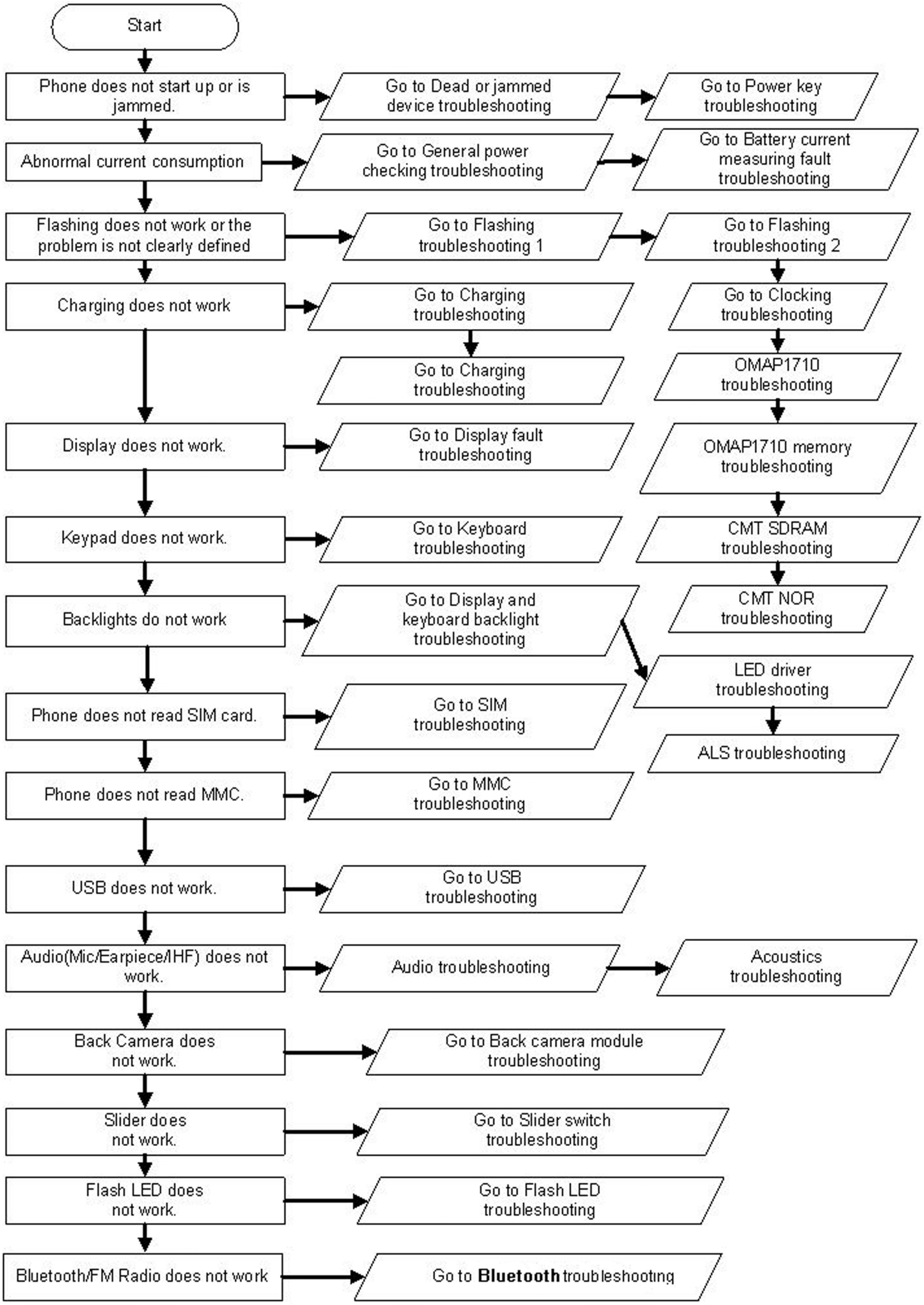
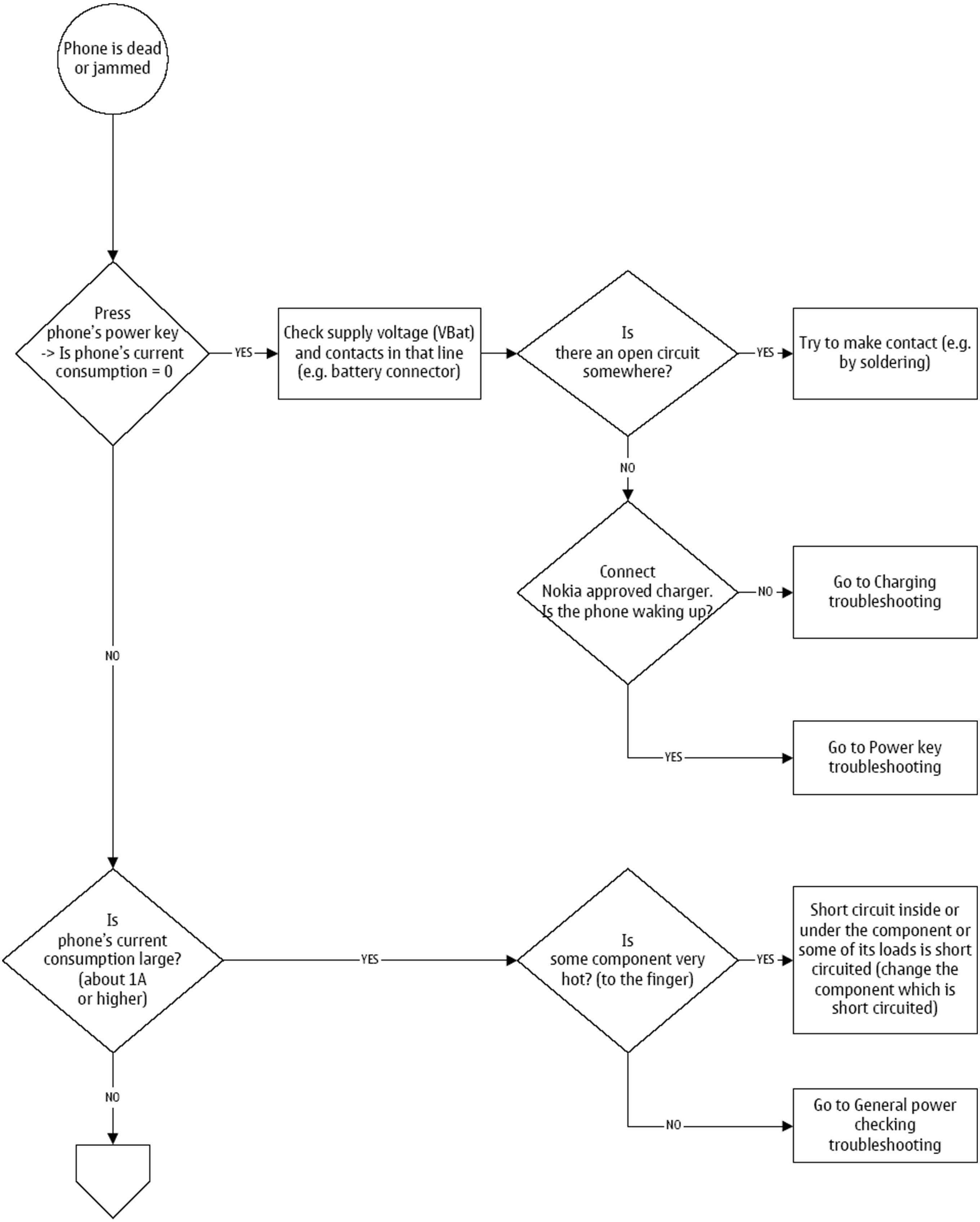
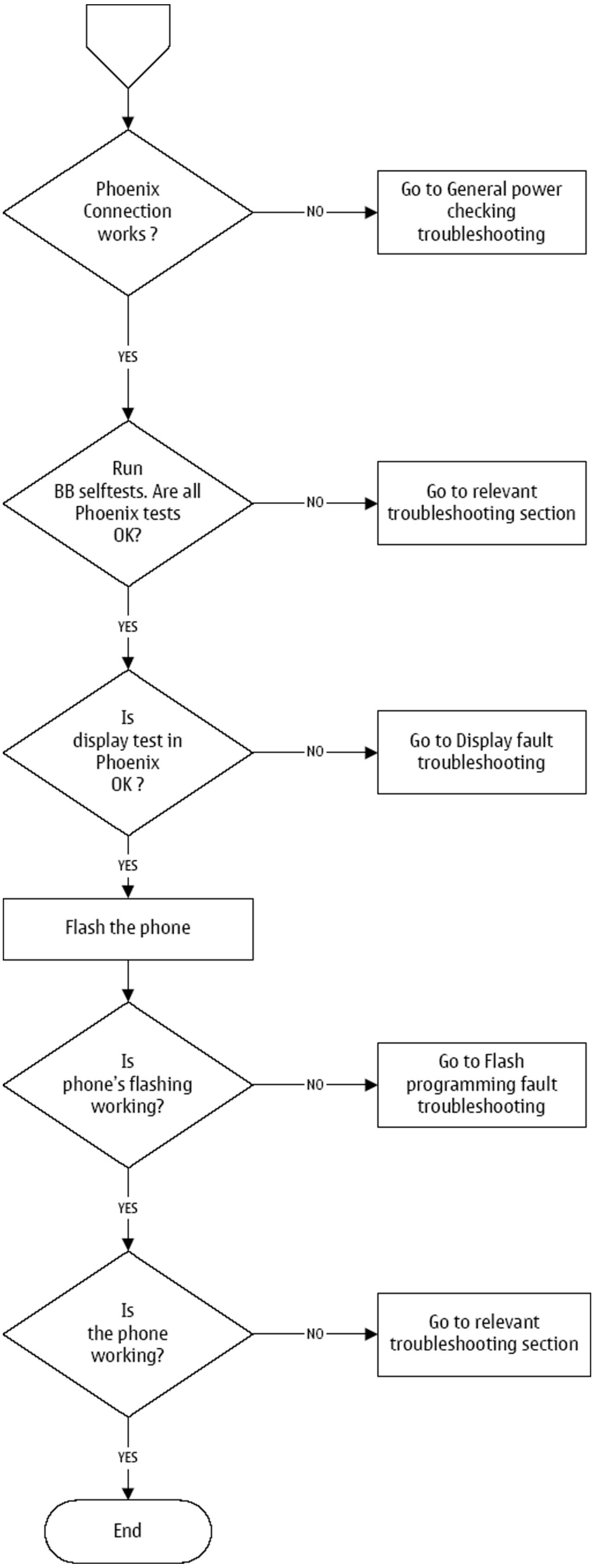


Figure 38 Main troubleshooting tree

Dead or jammed device troubleshooting

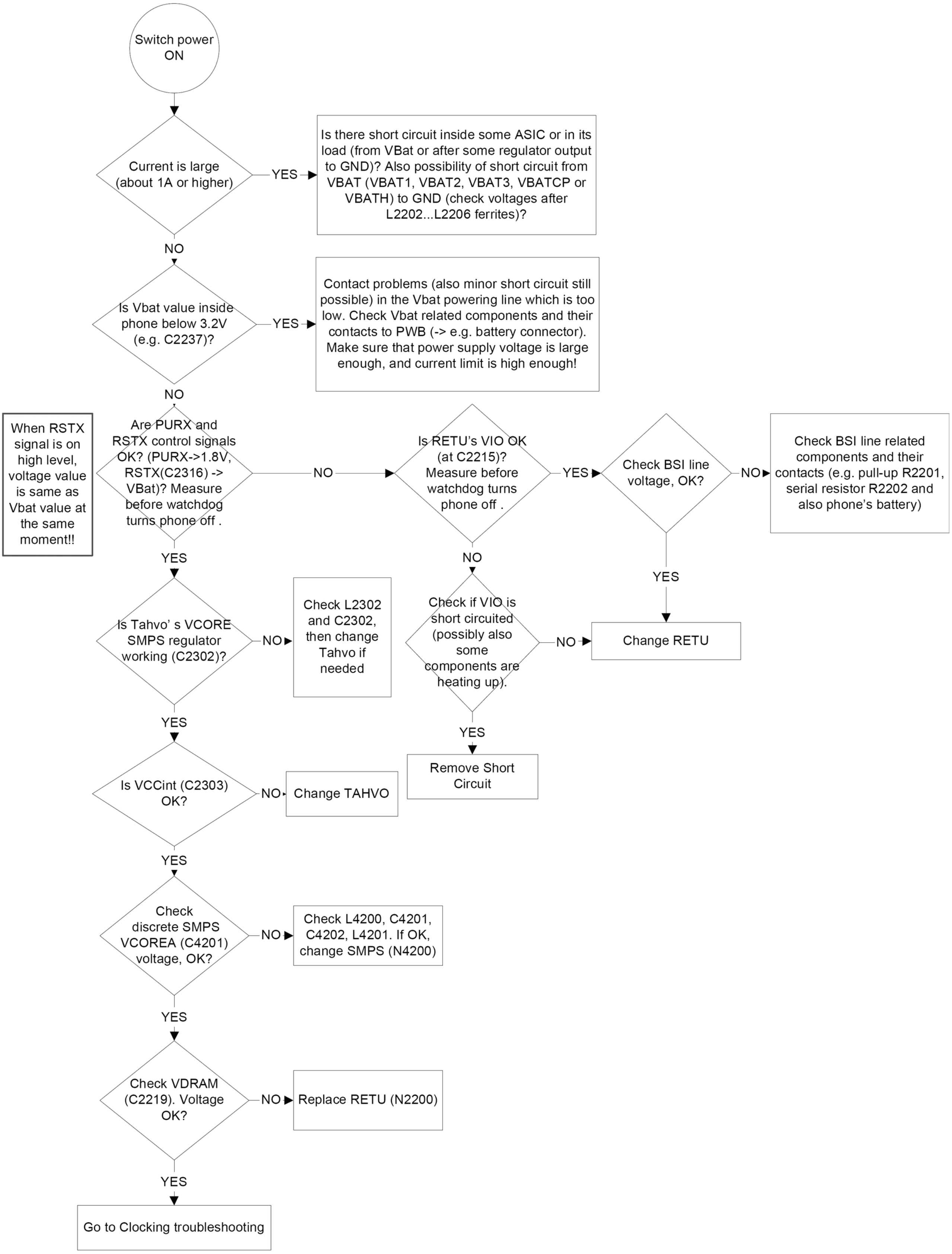
Troubleshooting flow




Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

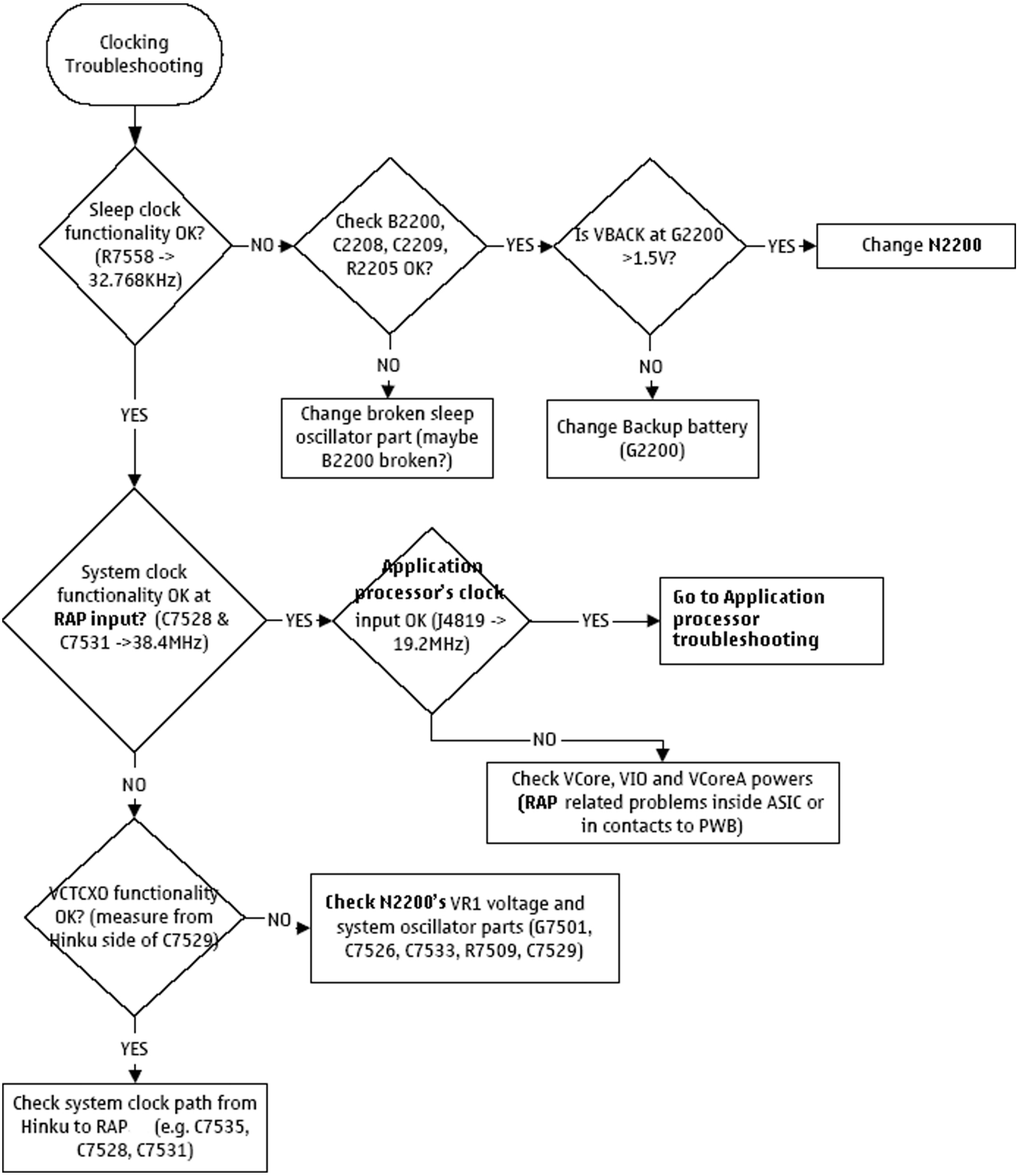
General power checking troubleshooting

Troubleshooting flow



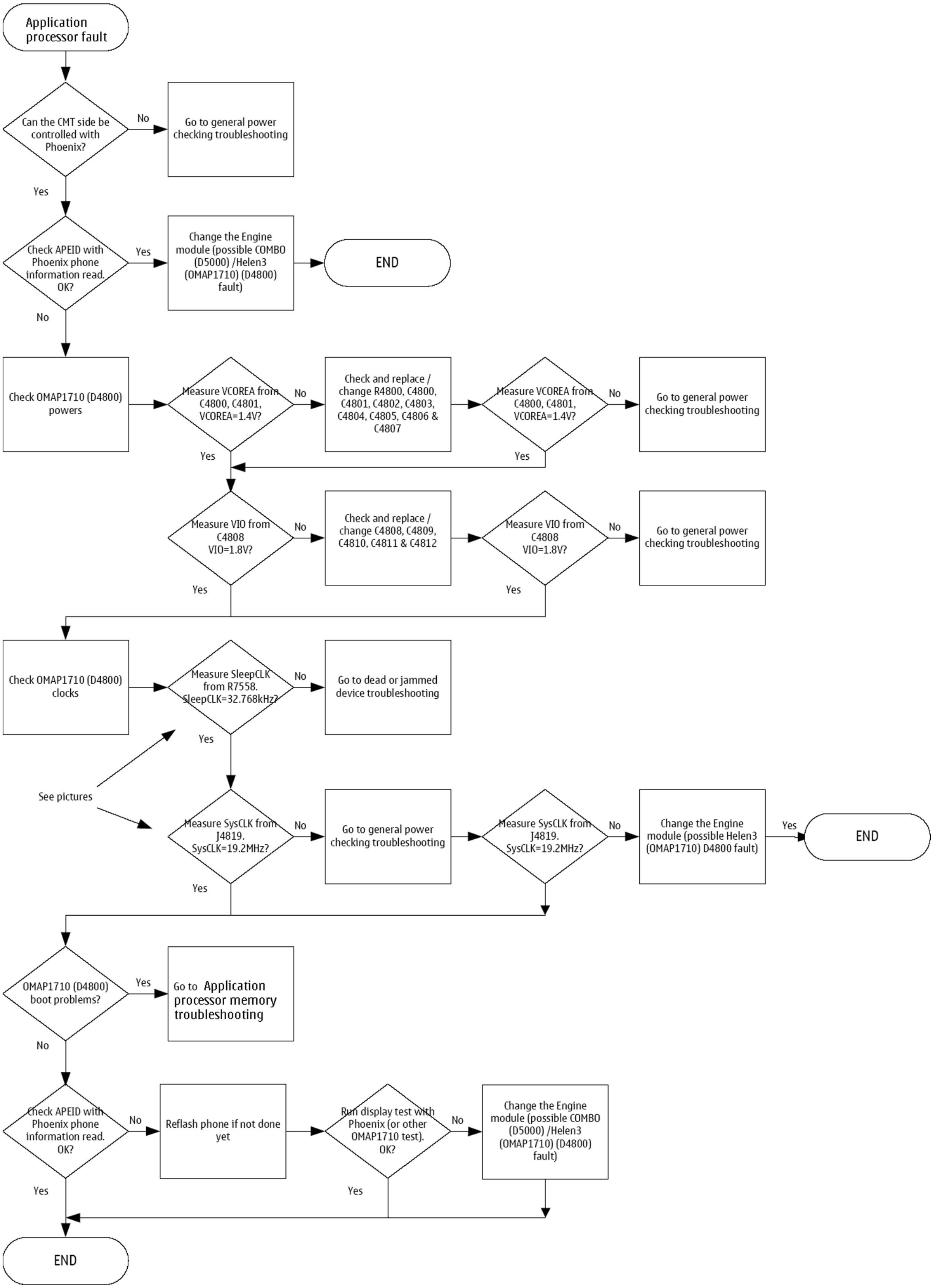
Clocking troubleshooting

Troubleshooting flow

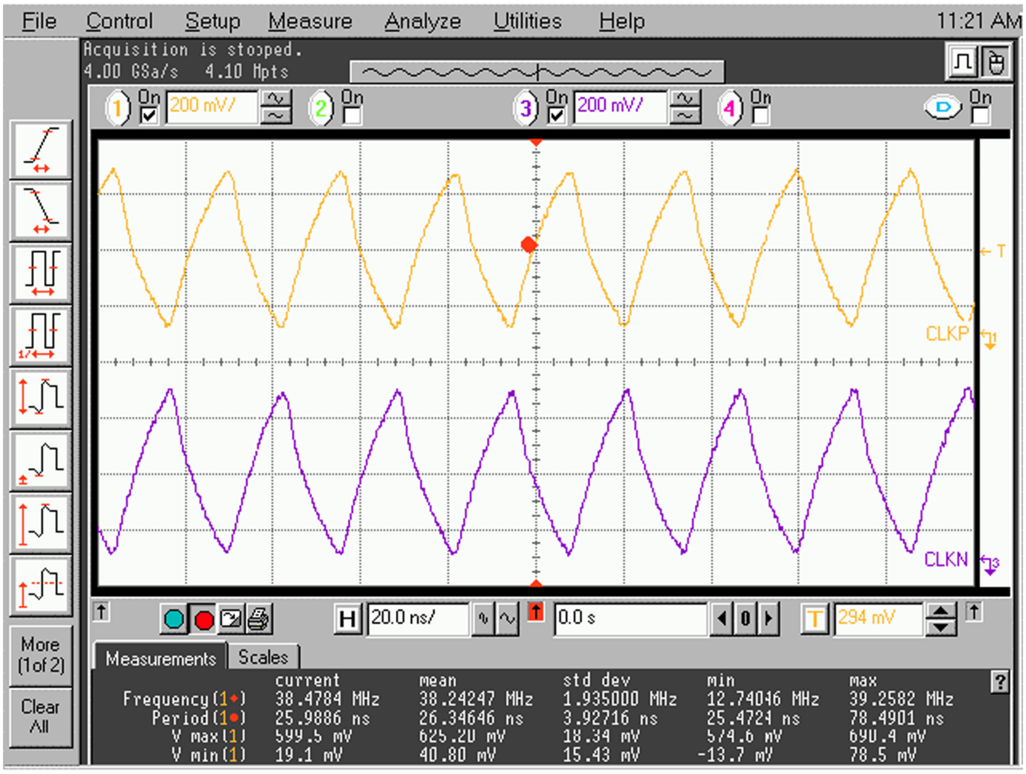


Application processor troubleshooting

Troubleshooting flow



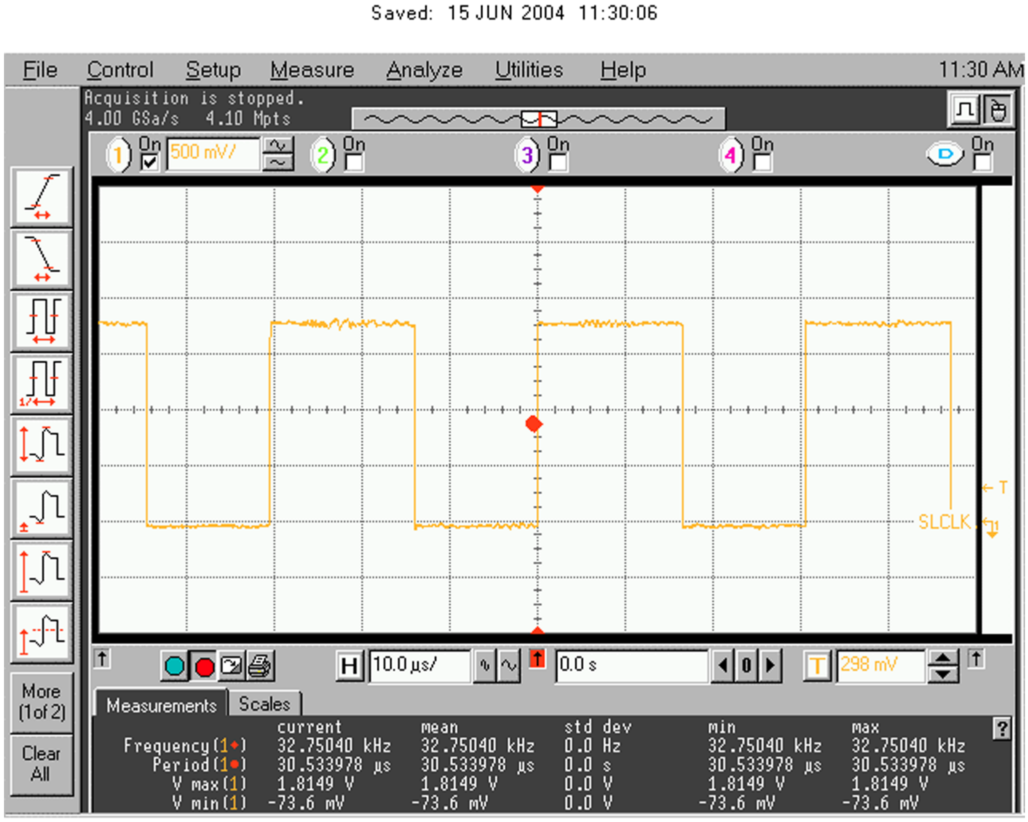
Saved: 15 JUN 2004 11:21:49



```
Acquisition is stopped.
4.00 GSa/s   4.10 Mpts
```

```
                current        mean            std dev         min             max
Frequency(1◆)   38.4784 MHz    38.24247 MHz    1.935000 MHz    12.74046 MHz    39.2582 MHz
   Period(1●)   25.9886 ns     26.34646 ns     3.92716 ns      25.4724 ns      78.4901 ns
     V max(1)   599.5 mV       625.20 mV       18.34 mV        574.6 mV        690.4 mV
     V min(1)   19.1 mV        40.80 mV        15.43 mV       -13.7 mV         78.5 mV
```

Figure 39 SysCLK from C7528 & C7531



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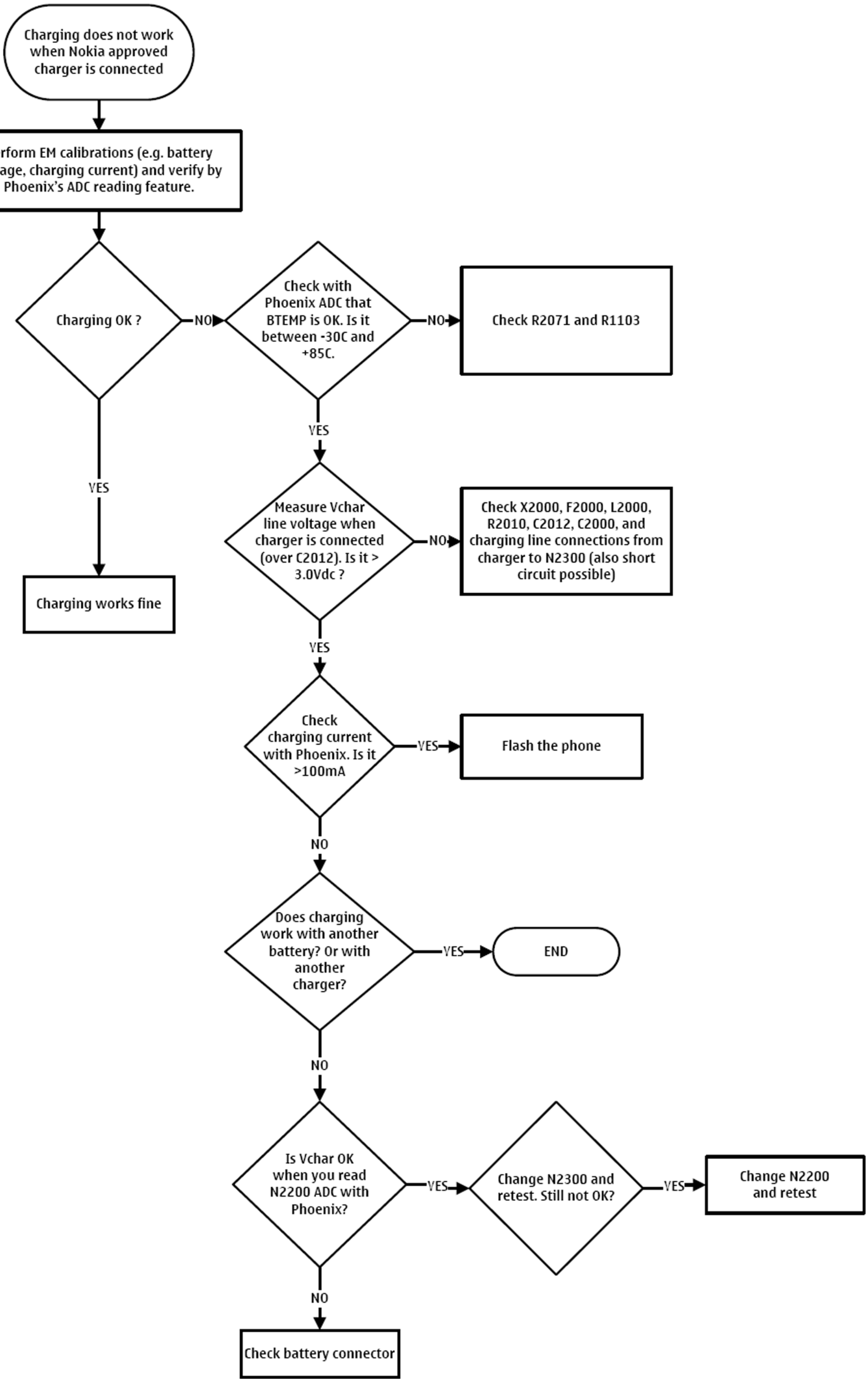
```
Acquisition is stopped.
4.00 GSa/s   4.10 Mpts
```

```
                   current         mean            std dev      min             max
  Frequency(1♦)  32.75040 kHz    32.75040 kHz    0.0 Hz       32.75040 kHz    32.75040 kHz
     Period(1●)  30.533978 µs    30.533978 µs    0.0 s        30.533978 µs    30.533978 µs
      V max(1)   1.8149 V        1.8149 V        0.0 V        1.8149 V        1.8149 V
      V min(1)  -73.6 mV        -73.6 mV         0.0 V       -73.6 mV        -73.6 mV
```

Figure 40 SleepCLK from R7558

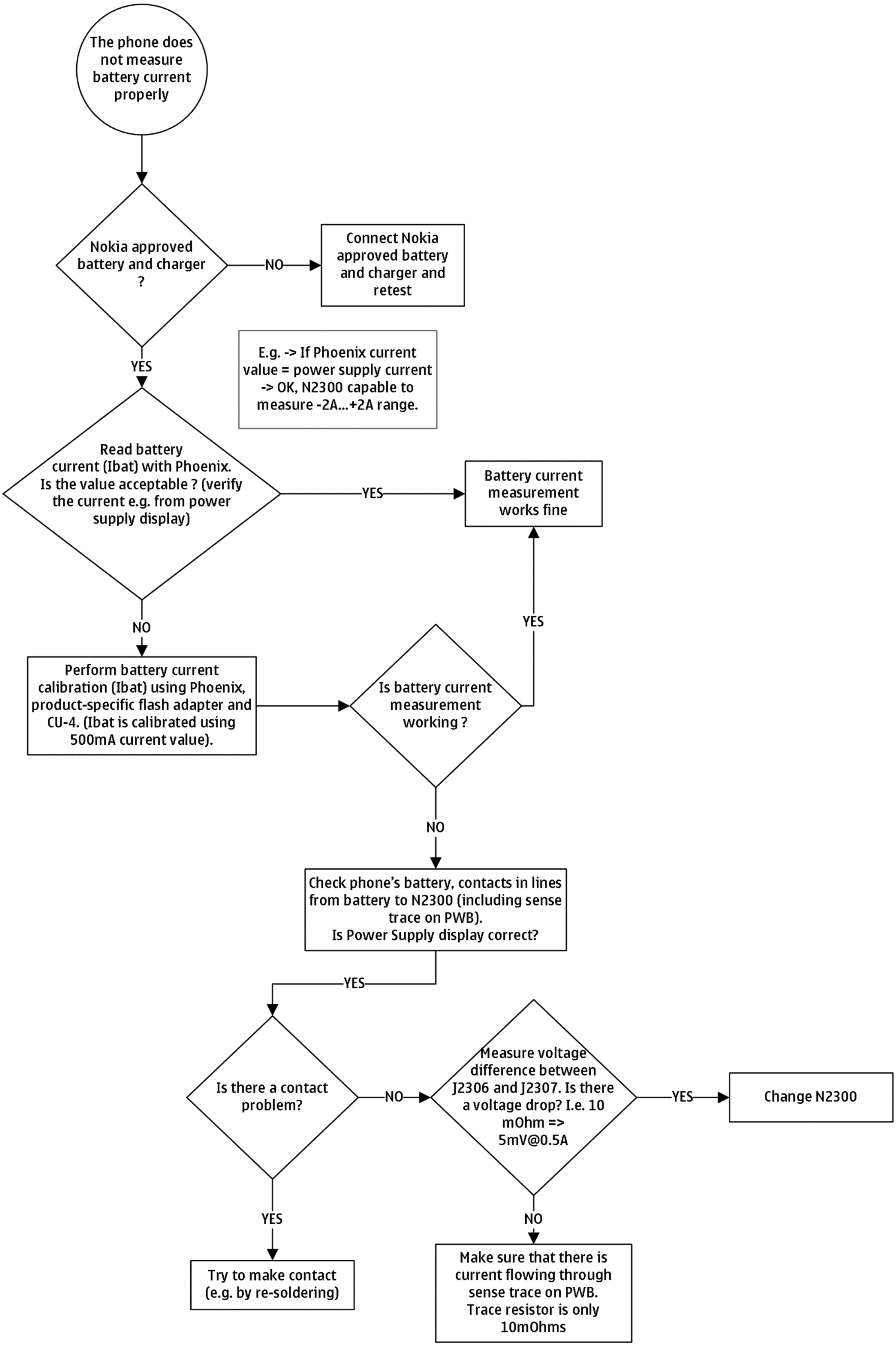
Charging troubleshooting

Troubleshooting flow



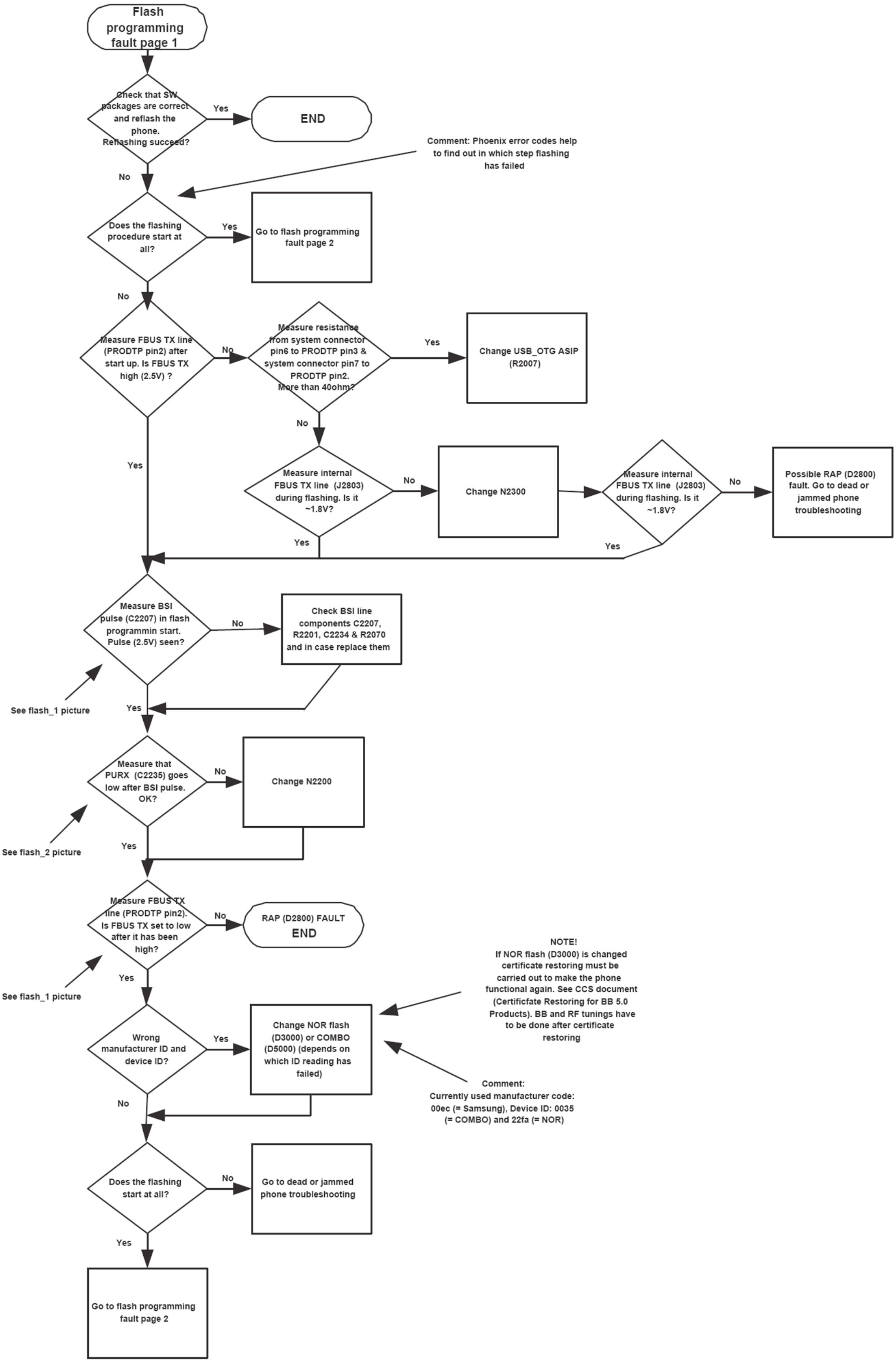
Battery current measuring fault troubleshooting

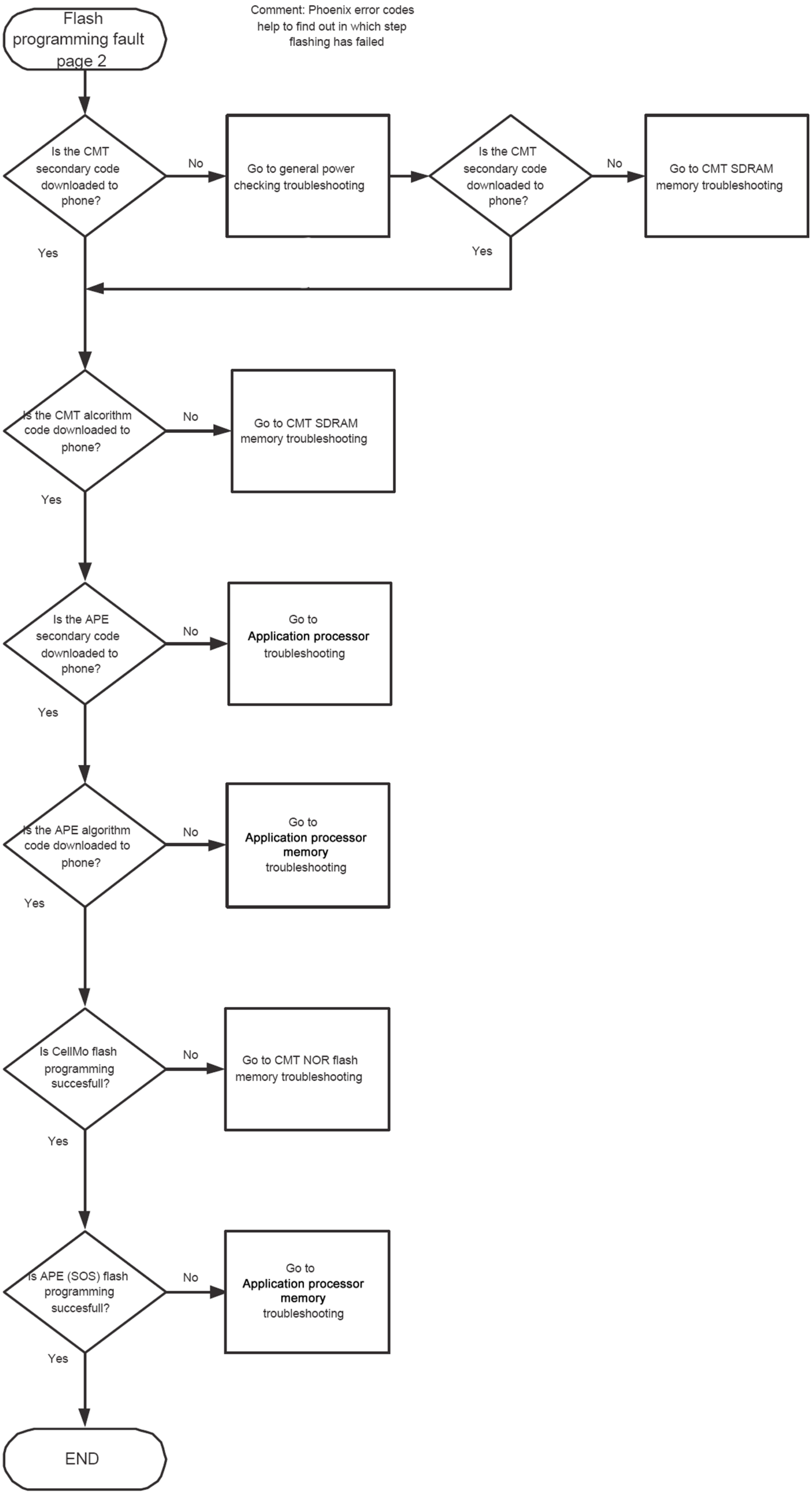
Troubleshooting flow

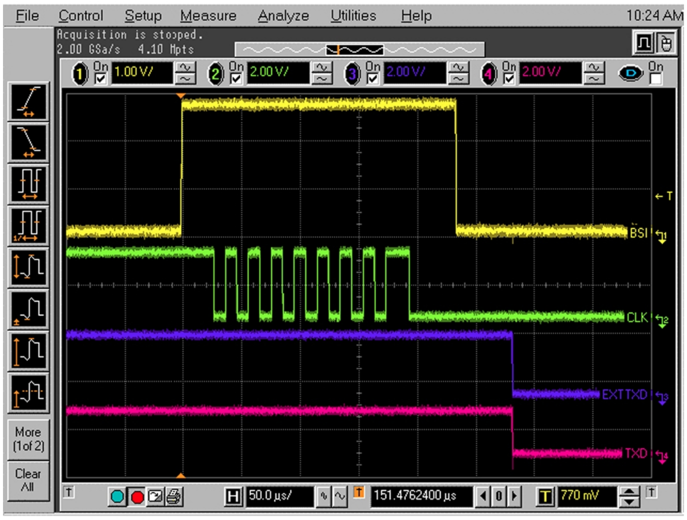


Flash programming fault troubleshooting

Troubleshooting flow



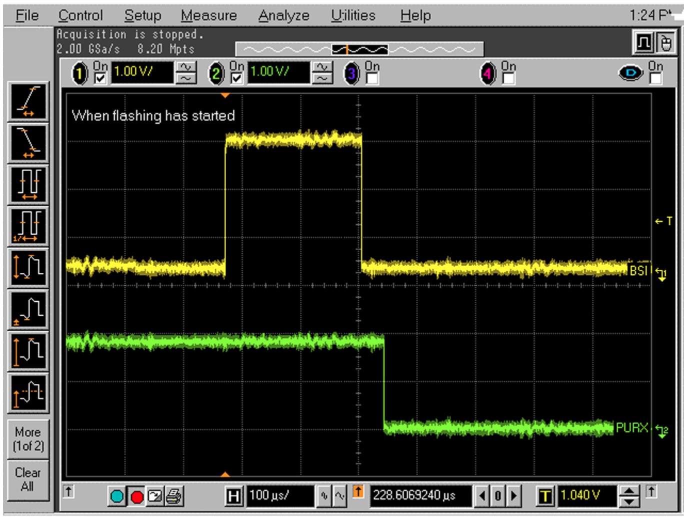

Flash programming fault page 2
Comment: Phoenix error codes help to find out in which step flashing has failed
Is the CMT secondary code downloaded to phone?
No
Go to general power checking troubleshooting
Is the CMT secondary code downloaded to phone?
No
Go to CMT SDRAM memory troubleshooting
Yes
Yes
Is the CMT alcorithm code downloaded to phone?
No
Go to CMT SDRAM memory troubleshooting
Yes
Is the APE secondary code downloaded to phone?
No
Go to Application processor troubleshooting
Yes
Is the APE algorithm code downloaded to phone?
No
Go to Application processor memory troubleshooting
Yes
Is CellMo flash programming succesfull?
No
Go to CMT NOR flash memory troubleshooting
Yes
Is APE (SOS) flash programming succesfull?
No
Go to Application processor memory troubleshooting
Yes
END



Acquisition is stopped.
2.00 GSa/s 4.10 Mpts

Figure 41 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

Saved: 05 JUL 2004 13:24:19



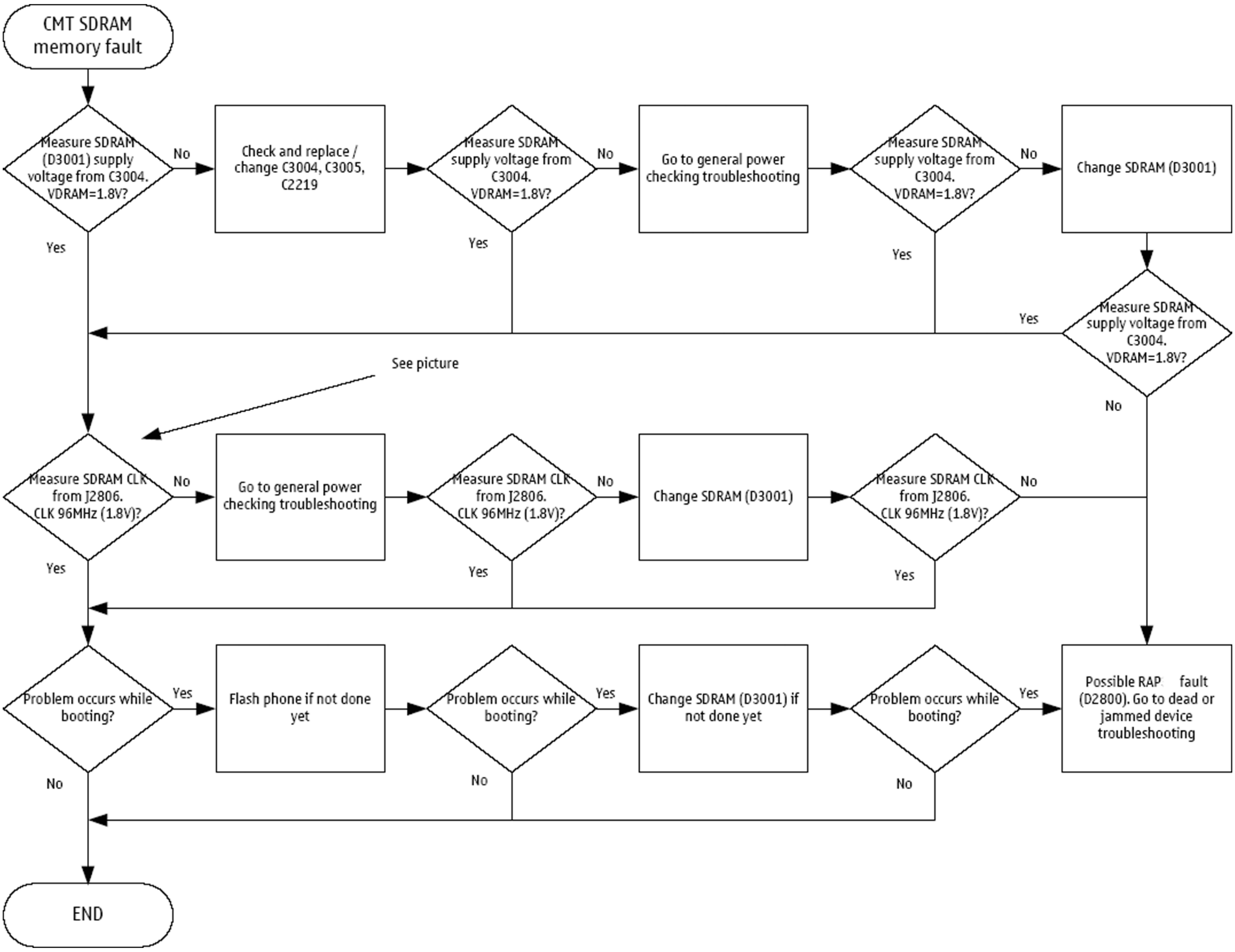
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

When flashing has started

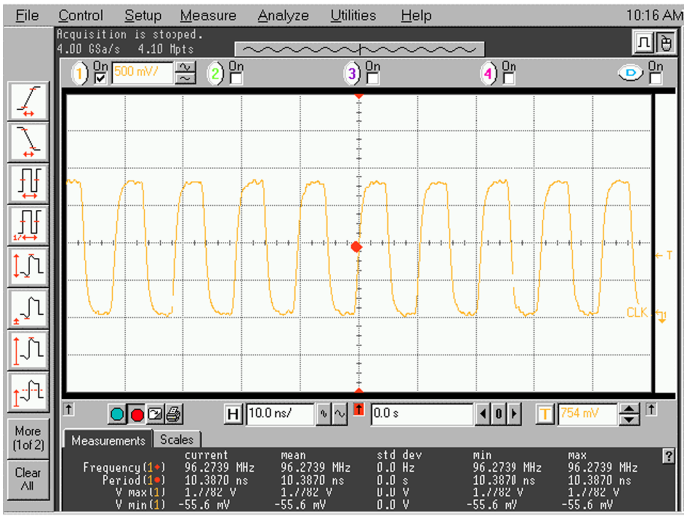
Figure 42 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

CMT SDRAM memory troubleshooting

Troubleshooting flow



Saved: 15 JUN 2004 10:16:02



```
Acquisition is stopped.
4.00 GSa/s   4.10 Mpts
```

1 On ☑ 500 mV/

H 10.0 ns/ 0.0 s

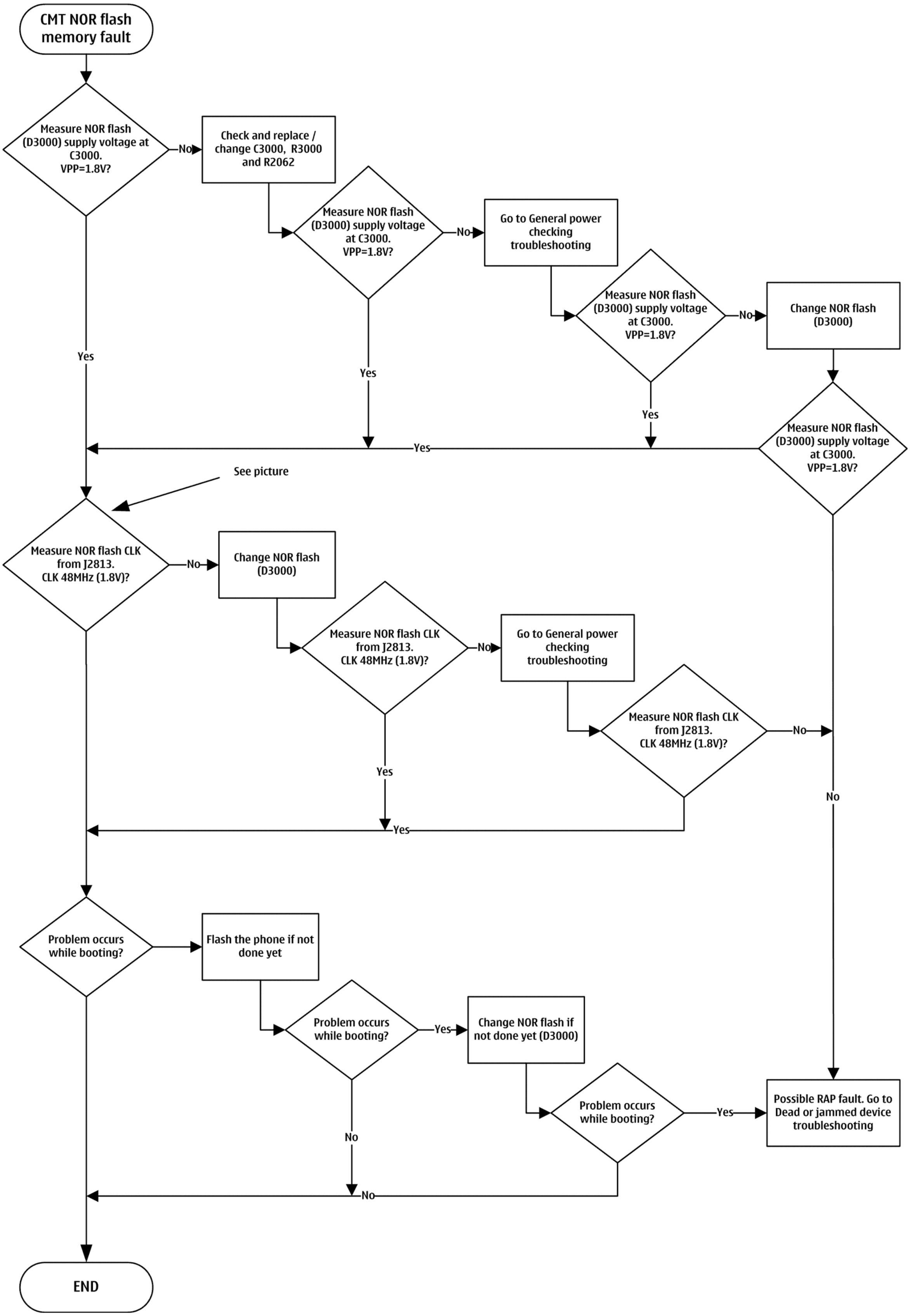
T 754 mV

```
                 current        mean           std dev      min            max
  Frequency(1)   96.2739 MHz    96.2739 MHz    0.0 Hz       96.2739 MHz    96.2739 MHz
     Period(1)   10.3870 ns     10.3870 ns     0.0 s        10.3870 ns     10.3870 ns
      V max(1)   1.7782 V       1.7782 V       0.0 V        1.7782 V       1.7782 V
      V min(1)  -55.6 mV       -55.6 mV        0.0 V       -55.6 mV       -55.6 mV
```

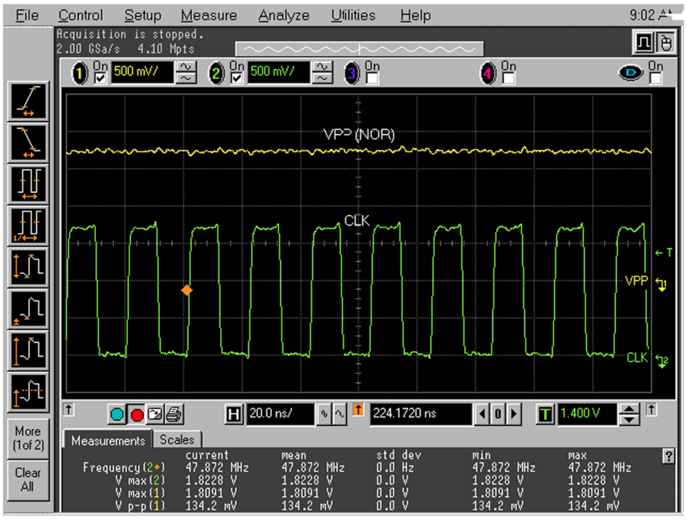
Figure 43 CMT SDRAM CLK from pin J2806

CMT NOR flash fault troubleshooting

Troubleshooting flow



Saved: 05 JUL 2004 09:02:26



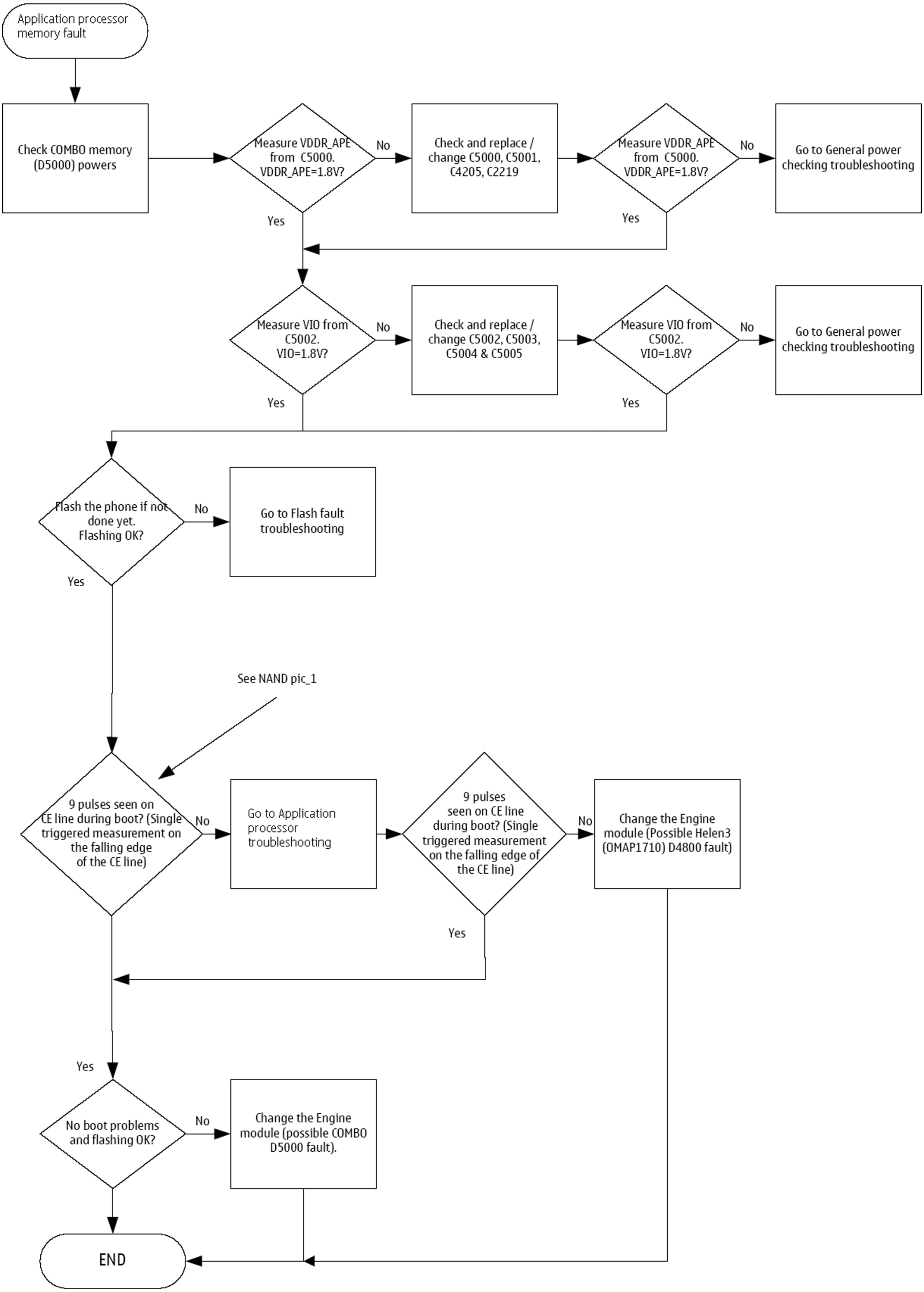
```
Acquisition is stopped.
2.00 GSa/s   4.10 Mpts
```

```
                 current      mean         std dev    min          max
Frequency(2◆)   47.872 MHz   47.872 MHz   0.0 Hz     47.872 MHz   47.872 MHz
     V max(2)   1.8228 V     1.8228 V     0.0 V      1.8228 V     1.8228 V
     V max(1)   1.8091 V     1.8091 V     0.0 V      1.8091 V     1.8091 V
     V p-p(1)   134.2 mV     134.2 mV     0.0 V      134.2 mV     134.2 mV
```

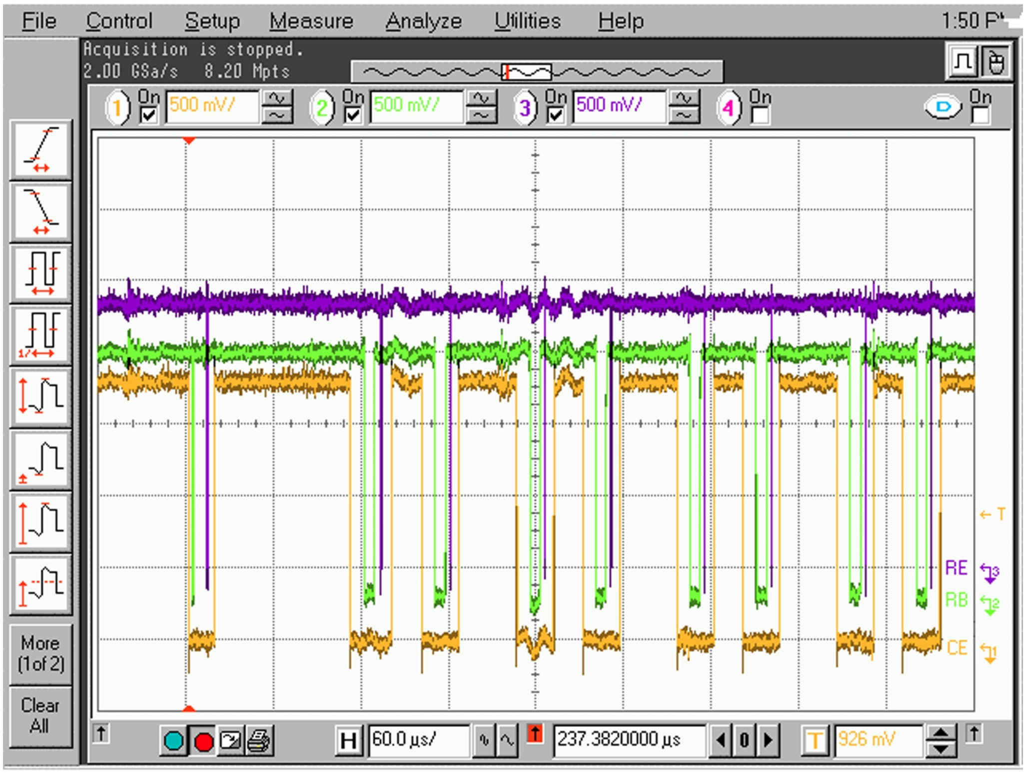
Figure 44 NOR CLK from J2813

Application processor memory troubleshooting

Troubleshooting flow



Saved: 12 JUL 2004 13:50:42



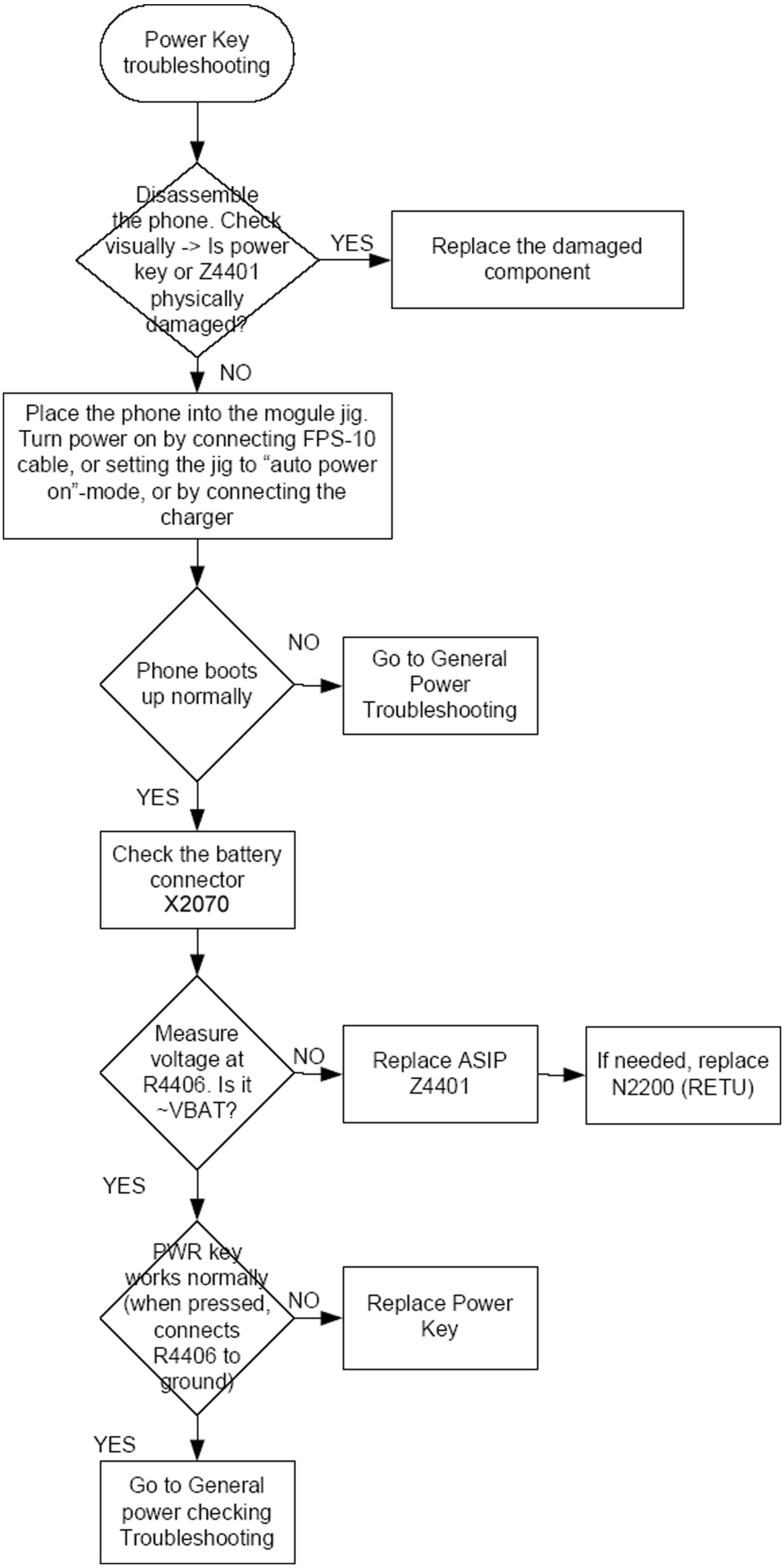
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

Take single trig measurement on the falling edge of the CE signal (=J5001).

Figure 45 COMBO NAND in boot pic 1.

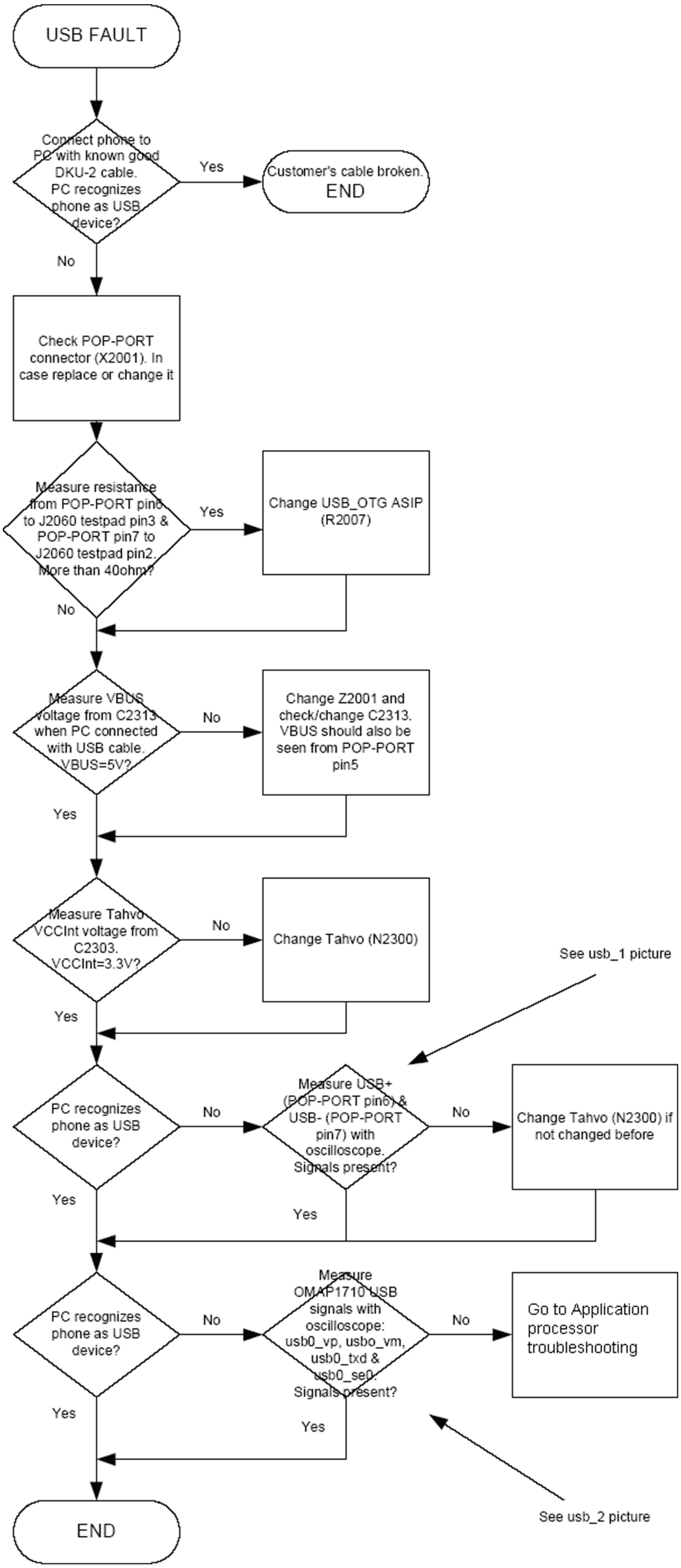
Power key troubleshooting

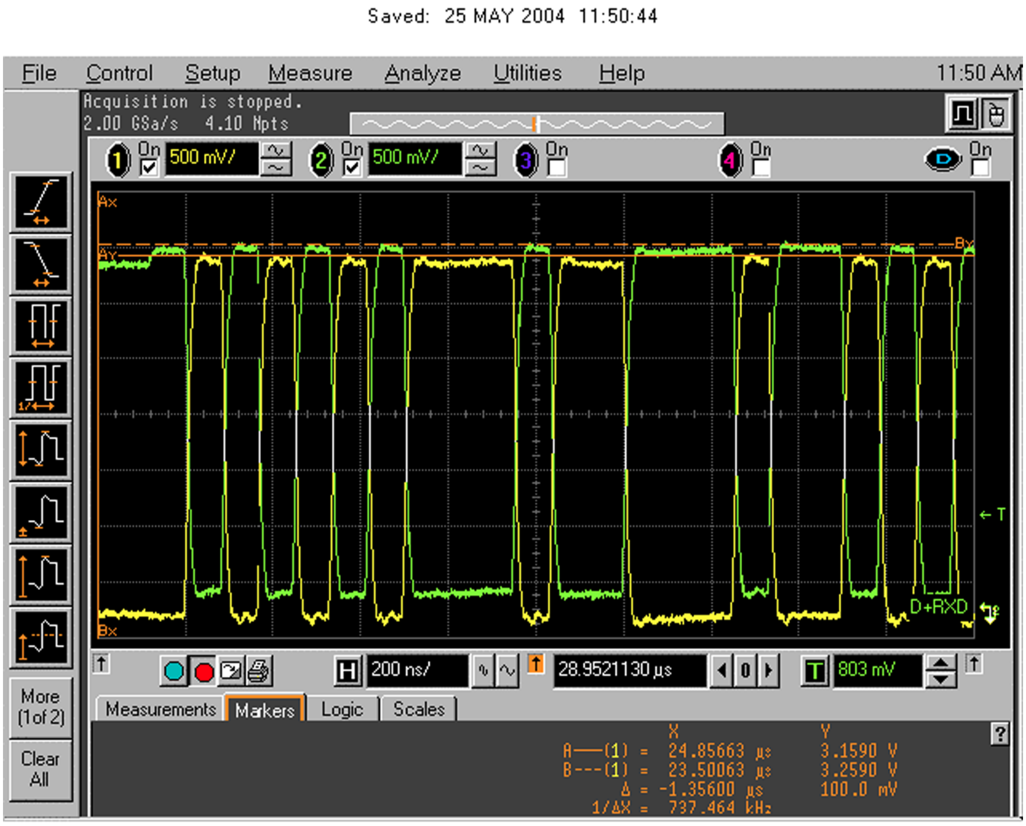
Troubleshooting flow



USB interface troubleshooting

Troubleshooting flow





Saved: 25 MAY 2004 11:50:44

```
Acquisition is stopped.
2.00 GSa/s    4.10 Mpts
```

1 On ☑ 500 mV/
2 On ☑ 500 mV/
3 On ☐
4 On ☐
D On ☐

H 200 ns/
28.9521130 µs
T 803 mV

```
              X                   Y
A——(1) =  24.85663 µs        3.1590 V
B---(1) =  23.50063 µs       3.2590 V
      Δ = -1.35600 µs        100.0 mV
   1/ΔX =  737.464 kHz
```

Figure 46 USB 1: D-TXD (POP-PORT pin6) and D+RXD (POP-PORT pin7) voltage levels when USB connected.

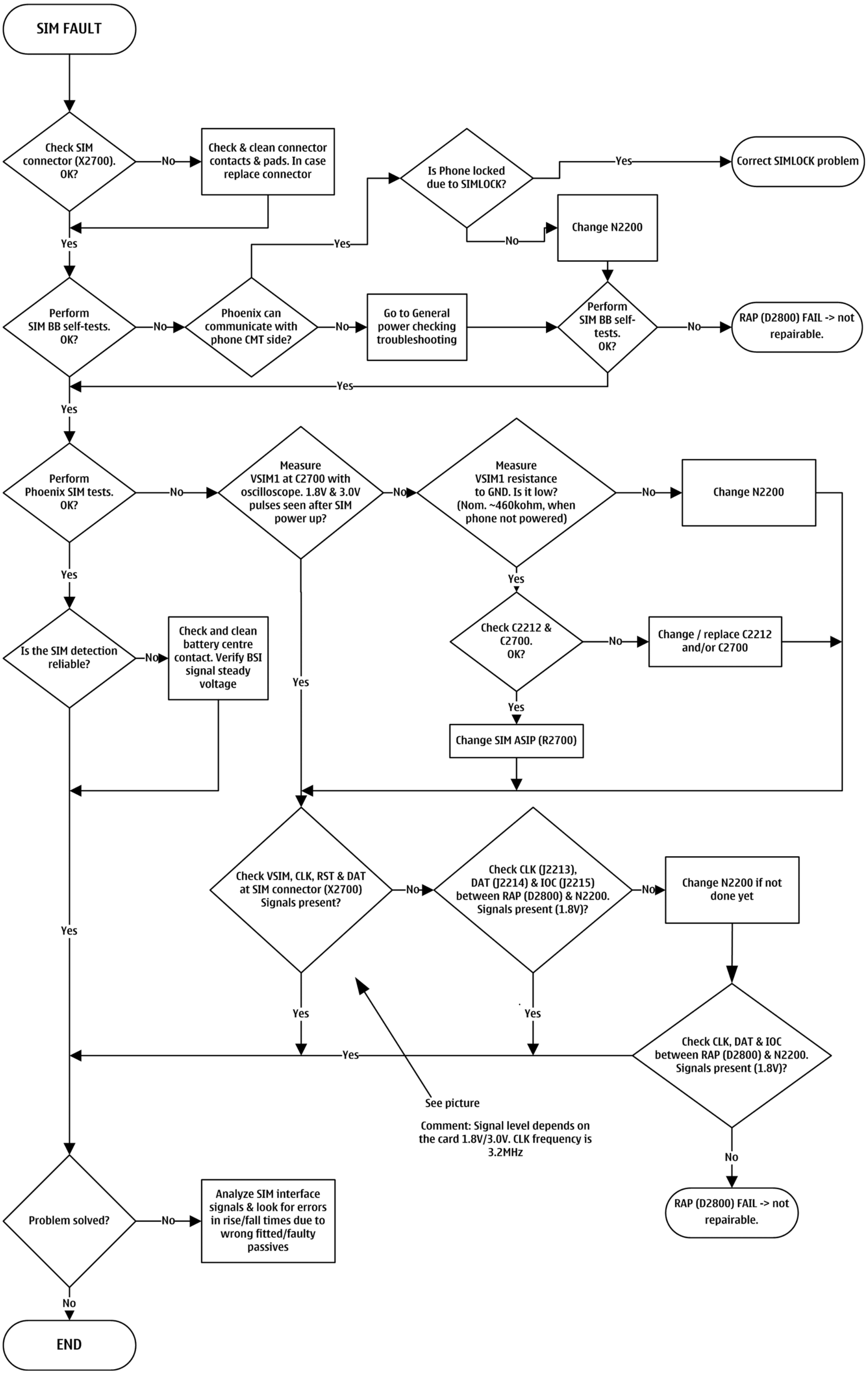
Saved: 06 JUL 2004 09:16:02

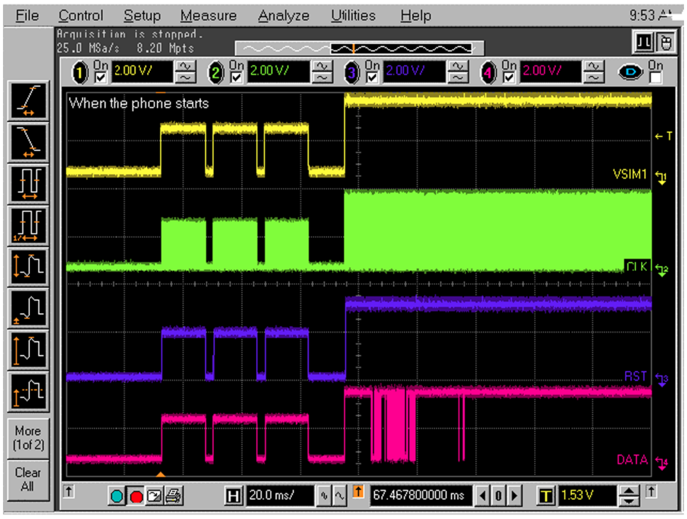
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts

Figure 47 USB 2: Take single triggered measurement on the rising edge of the Helen usb0_txen (J4813) line.

SIM card troubleshooting

Troubleshooting flow



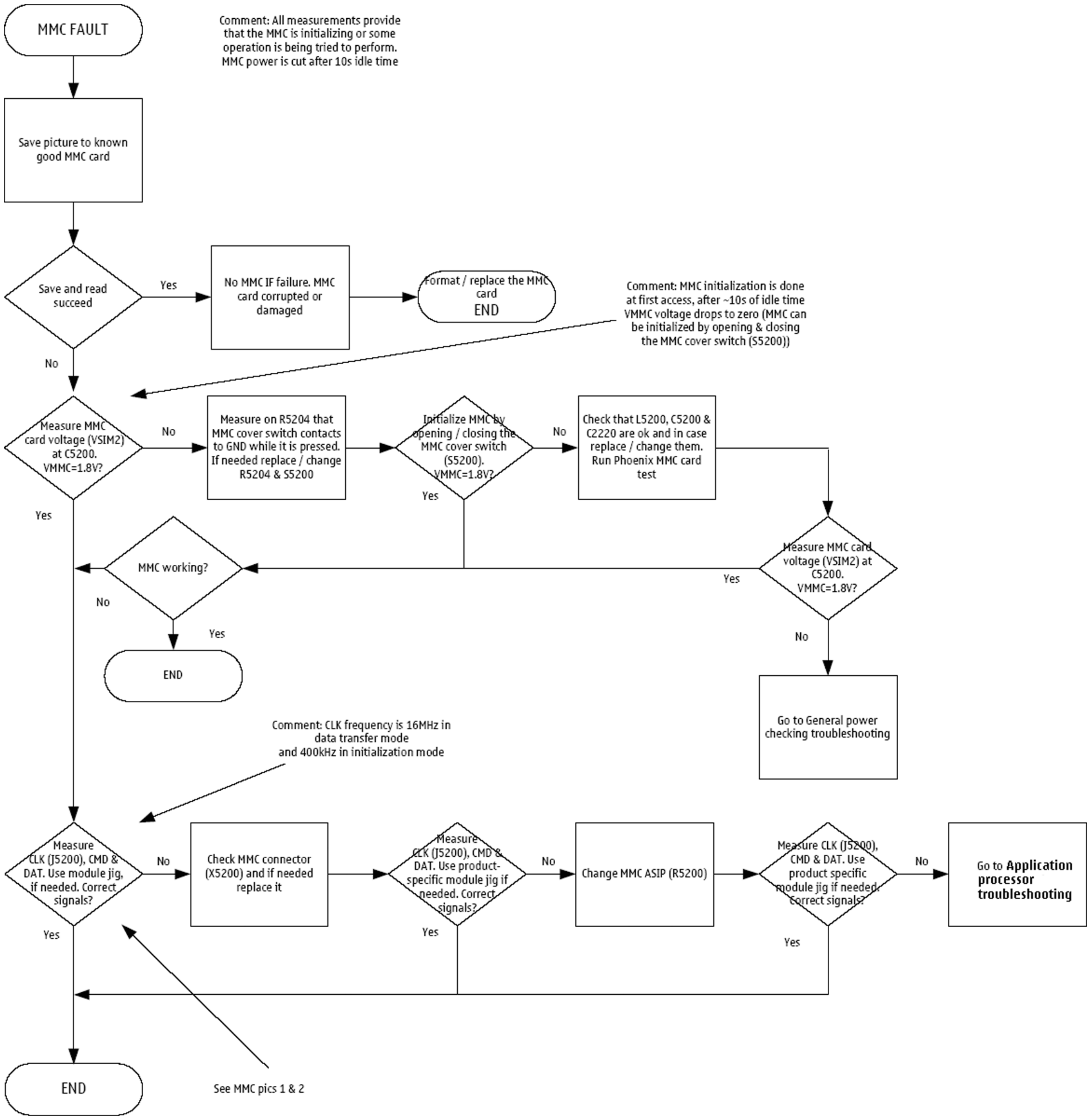


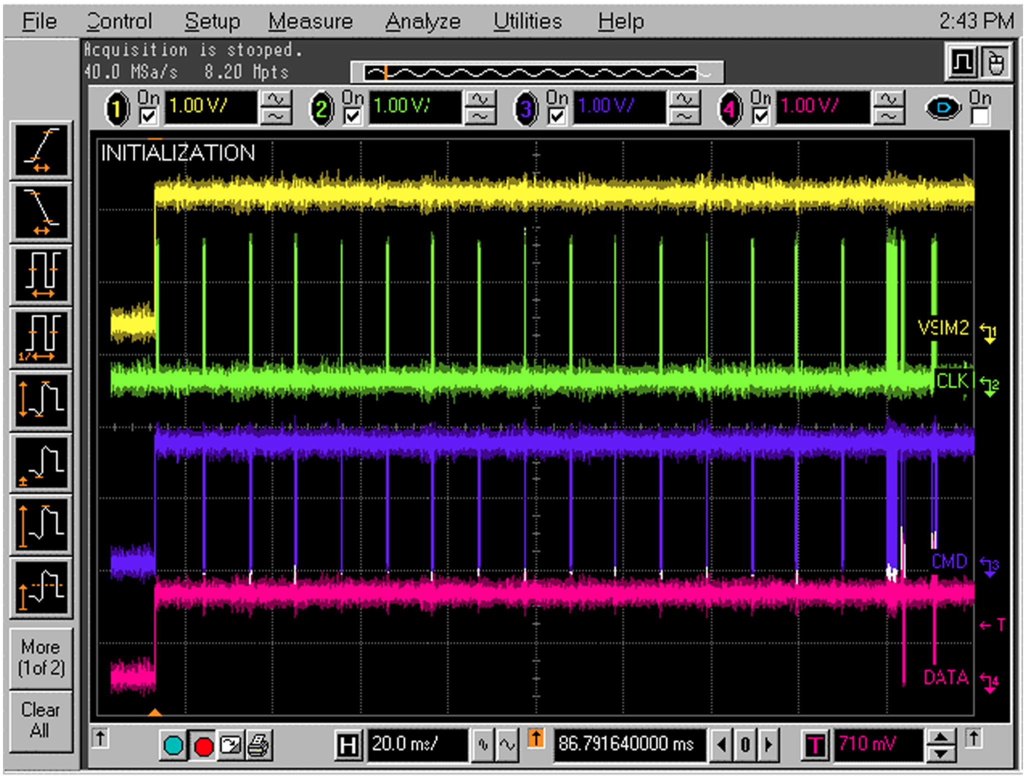
SIM CLK frequency = 3.2MHz (Take single triggered measurement in boot on the VSIM1 line).

Figure 48 SIM interface signals

MMC troubleshooting

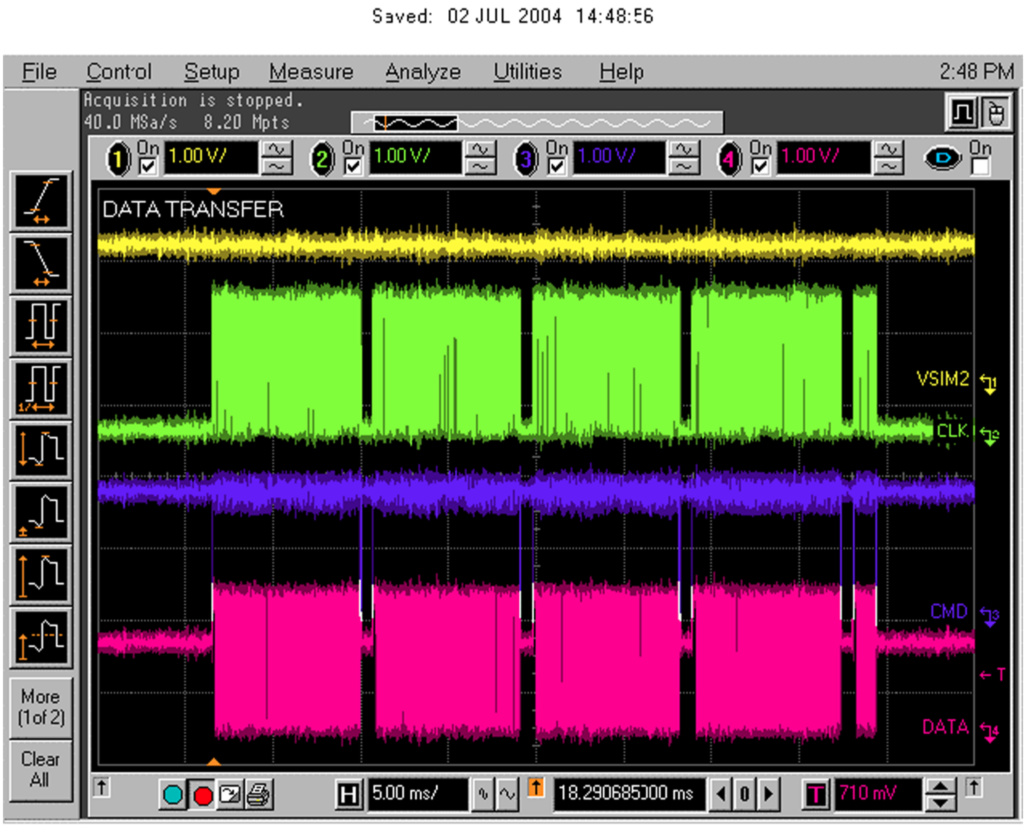
Troubleshooting flow





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

Figure 49 MMC card initialization



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

Figure 50 Data transfer

Keyboard troubleshooting

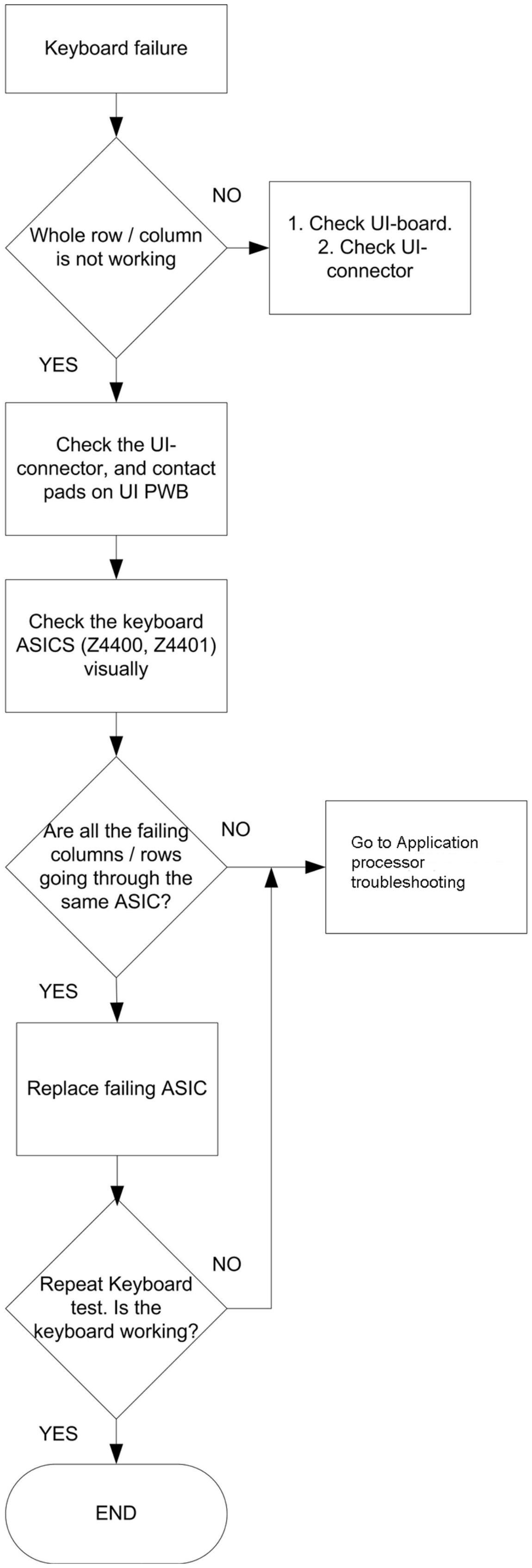
Context

There are two possible failure modes in the keyboard module:

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

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

Troubleshooting flow



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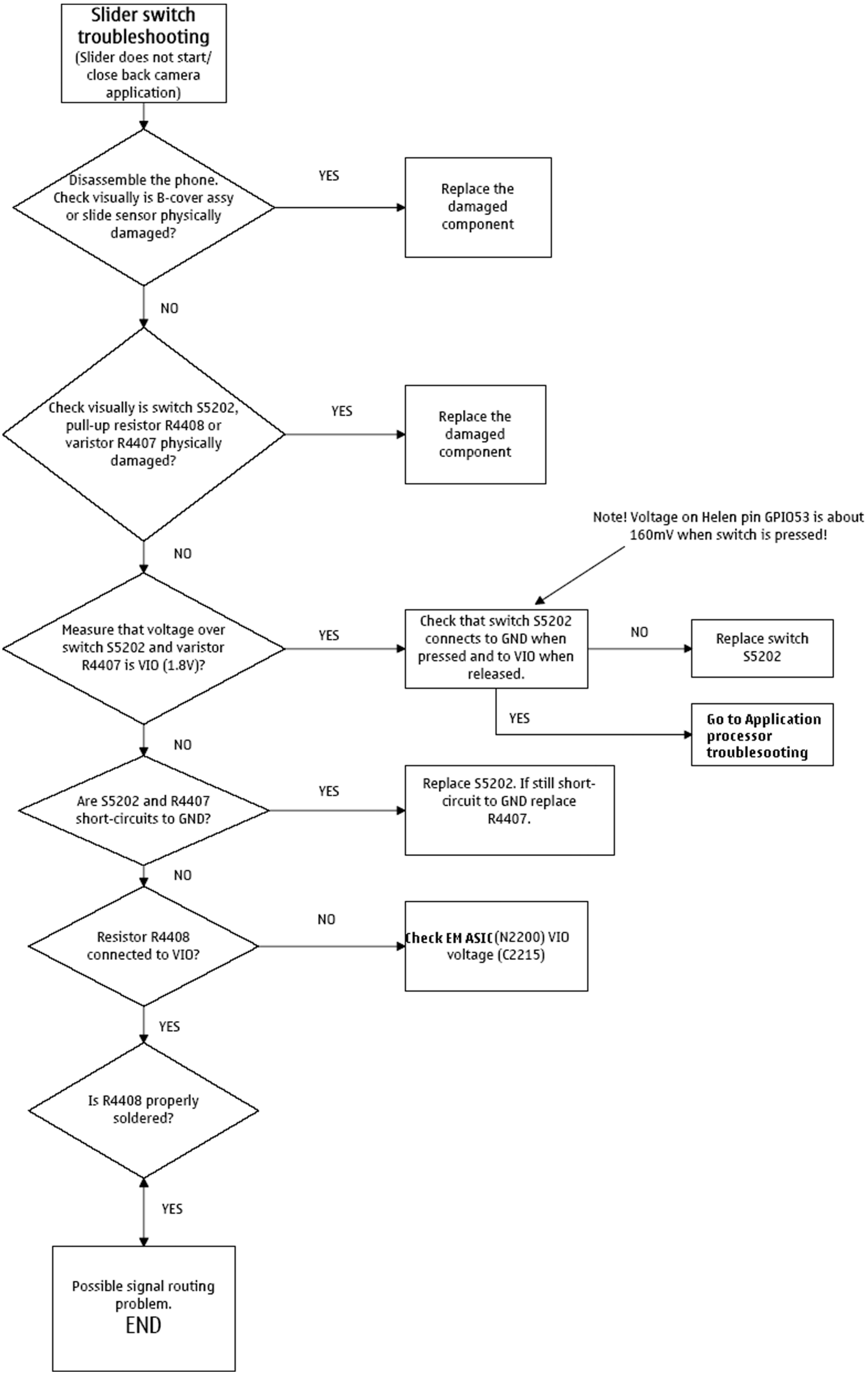
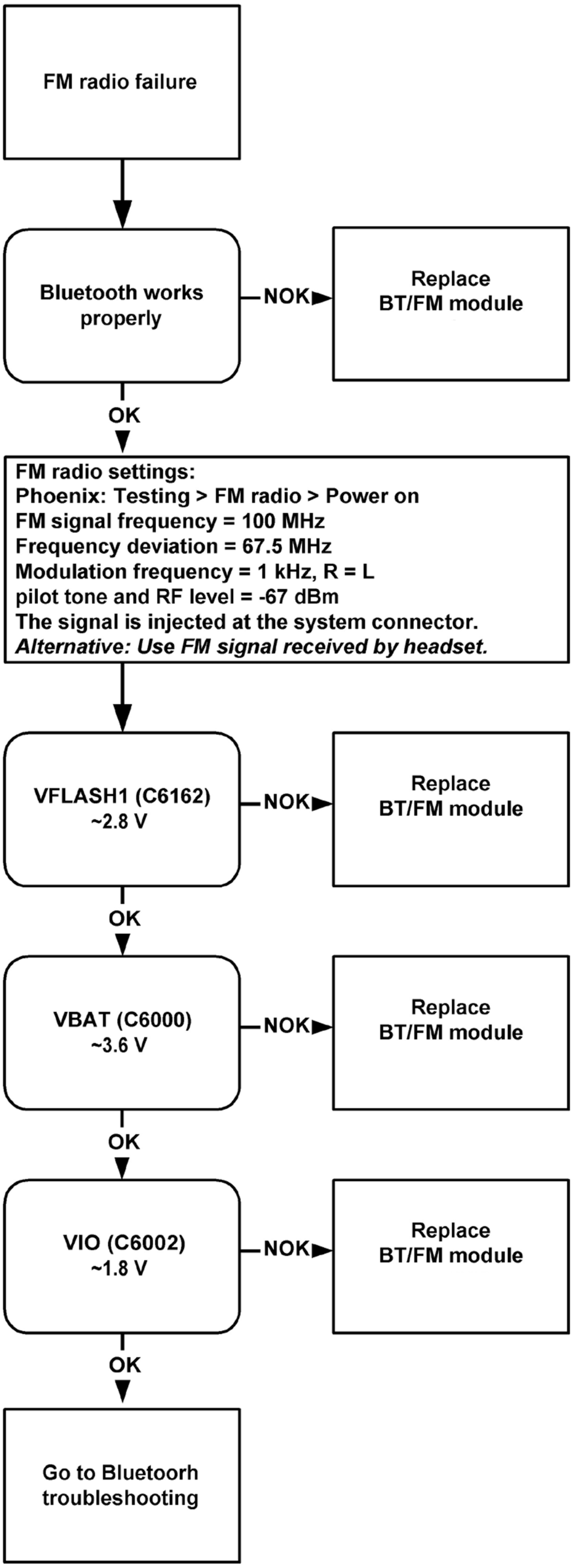
Slider switch troubleshooting

Troubleshooting flow



FM radio troubleshooting

Troubleshooting flow



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.

  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.

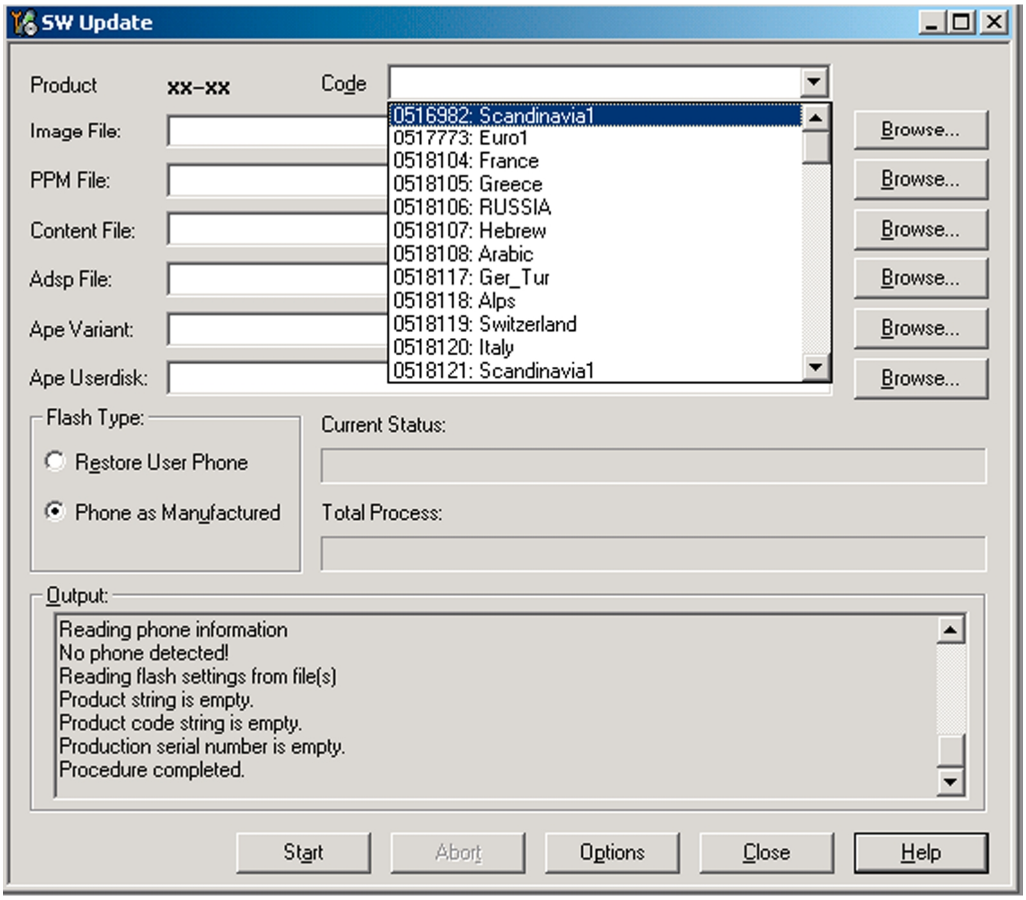
   ii Update the phone MCU software to the latest available version.

   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.



Product xx-xx

Code

Flash Type:
○ Restore User Phone
● Phone as Manufactured

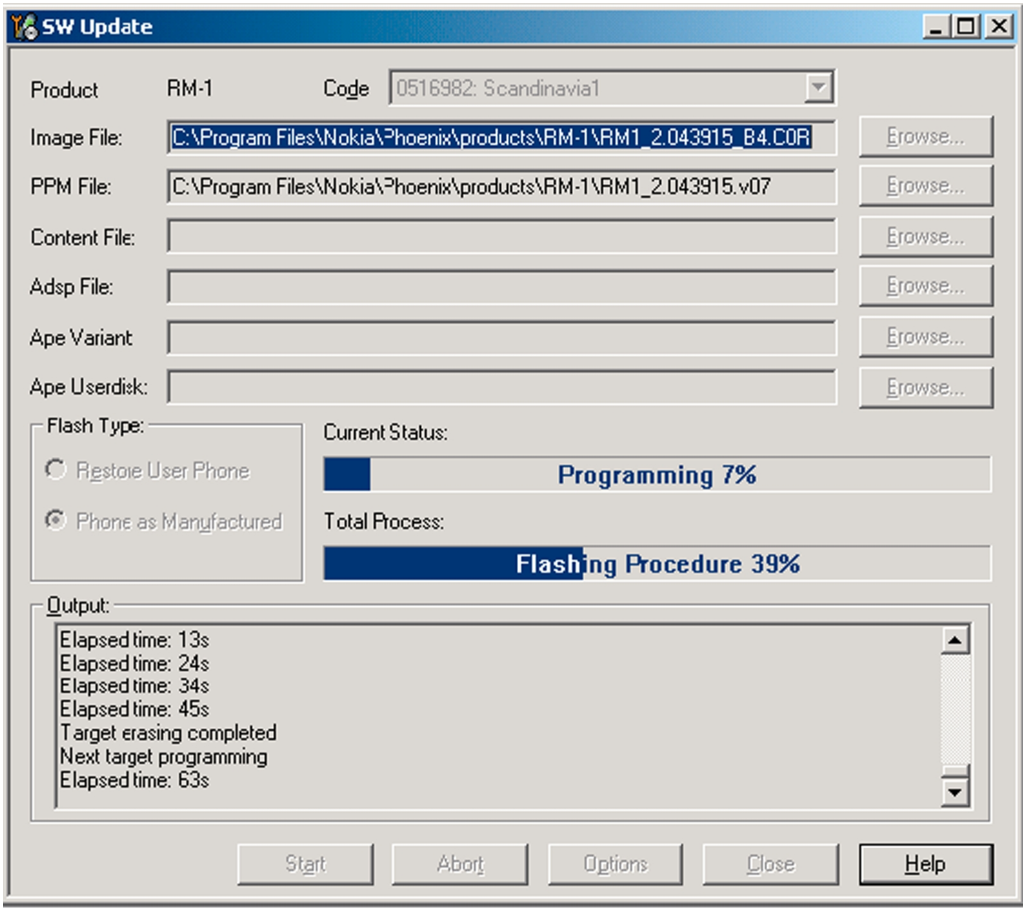
Output:

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

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.



Product: RM-1
Code: 0516982: Scandinavia1
Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R
PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07
Flash Type: ○ Restore User Phone ● Phone as Manufactured
Current Status: Programming 7%
Total Process: Flashing Procedure 39%

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

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** .

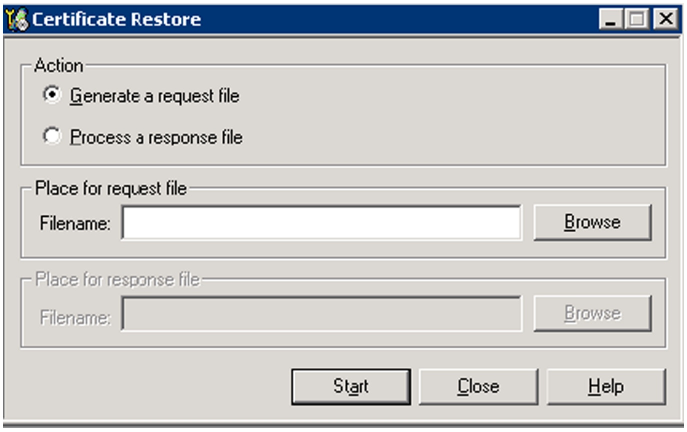
2. Create a *Request* file.

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

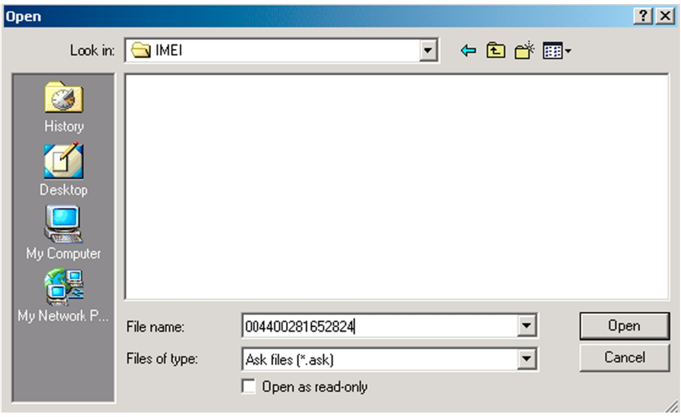
i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

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



Action: ● Generate a request file ○ Process a response file iv Name the file so that you can easily identify it, and click **Open**.



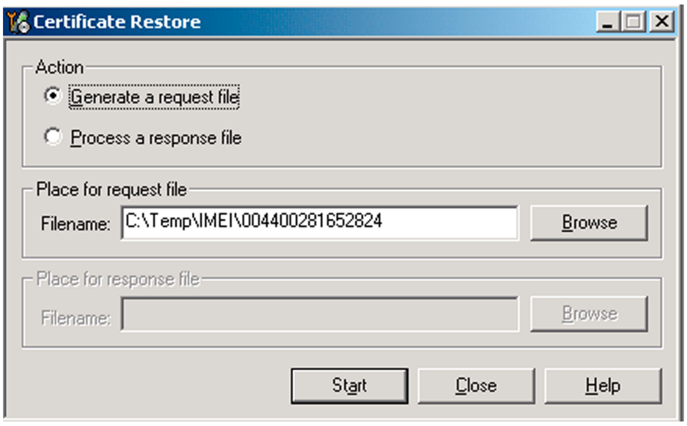
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.



Action

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

Place for response file

Filename:

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

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

3. Restore certificate.

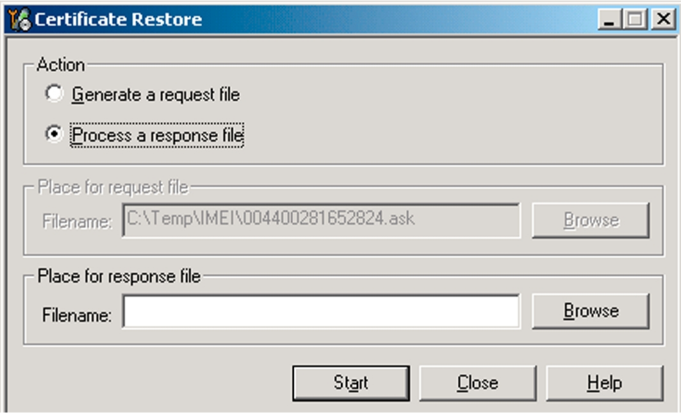
For this procedure, you must supply +12 V to CU-4 from an external power supply.

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

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

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



Certificate Restore

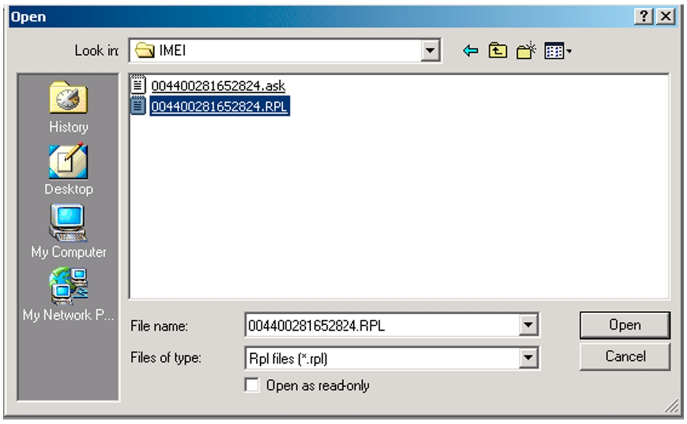
Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename:

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

vi Click **Open**.



Open

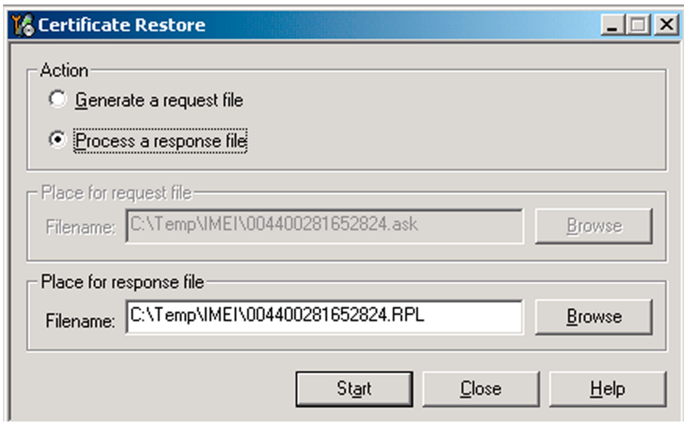
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

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

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



Certificate Restore

Action
○ Generate a request file
● Process a response file

Place for request file
Filename: C:\Temp\IMEI\004400281652824.ask

Place for response file
Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

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

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

Display module troubleshooting

General instructions for display troubleshooting

Context

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

Table 8 Display module troubleshooting cases

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

Table 9 Pixel defects

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

Steps

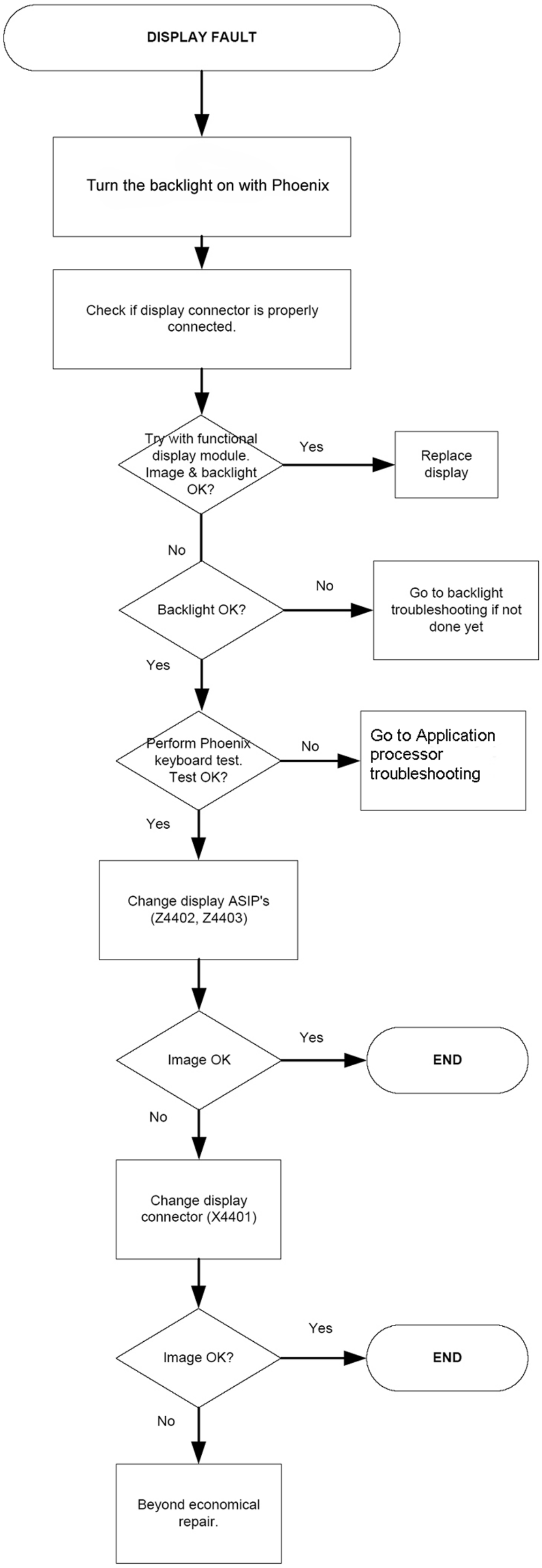
1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   i To check the functionality, connect the phone to a docking station.
   ii Start *Phoenix* service software.
   iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.

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

Display fault troubleshooting

Troubleshooting flow



Display and keyboard backlight troubleshooting

Context

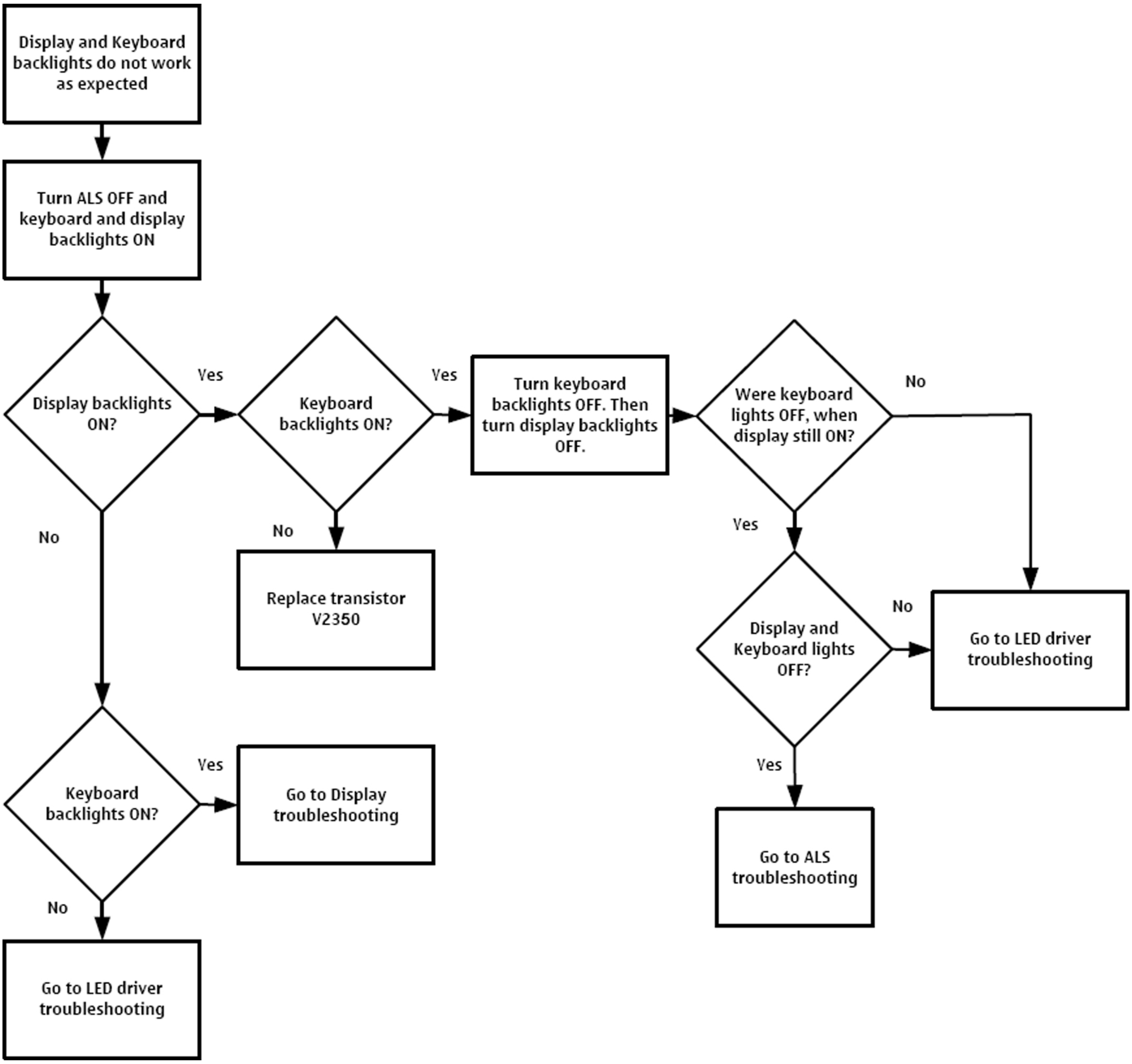
The device has one LED driver that provides current for both display and keyboard backlights.

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

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

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

Troubleshooting flow



ALS troubleshooting

Context

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

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

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

Steps

1. Cover the light guide (upper part of the A-Cover).
2. Start *Phoenix*.
3. Choose **File→Scan Product.**

4. Choose **Tuning→Ambient Light Sensor Calibration.**

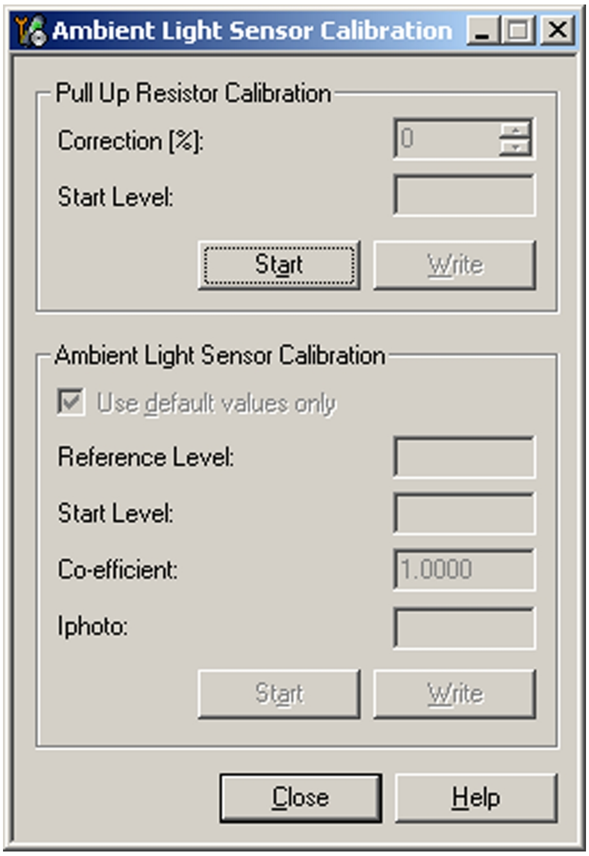
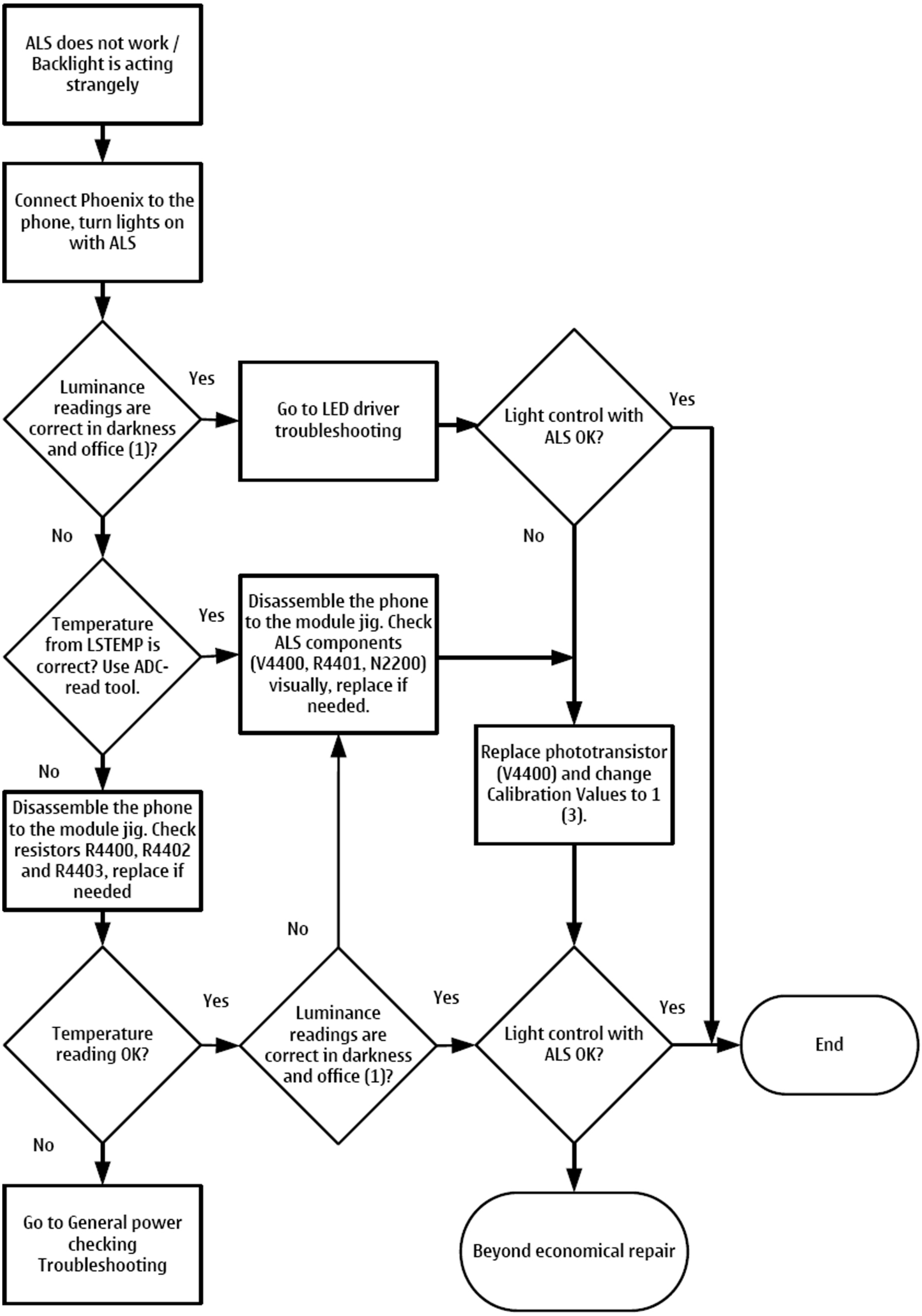


Figure 51 ***Ambient Light Sensor Calibration*** **window**

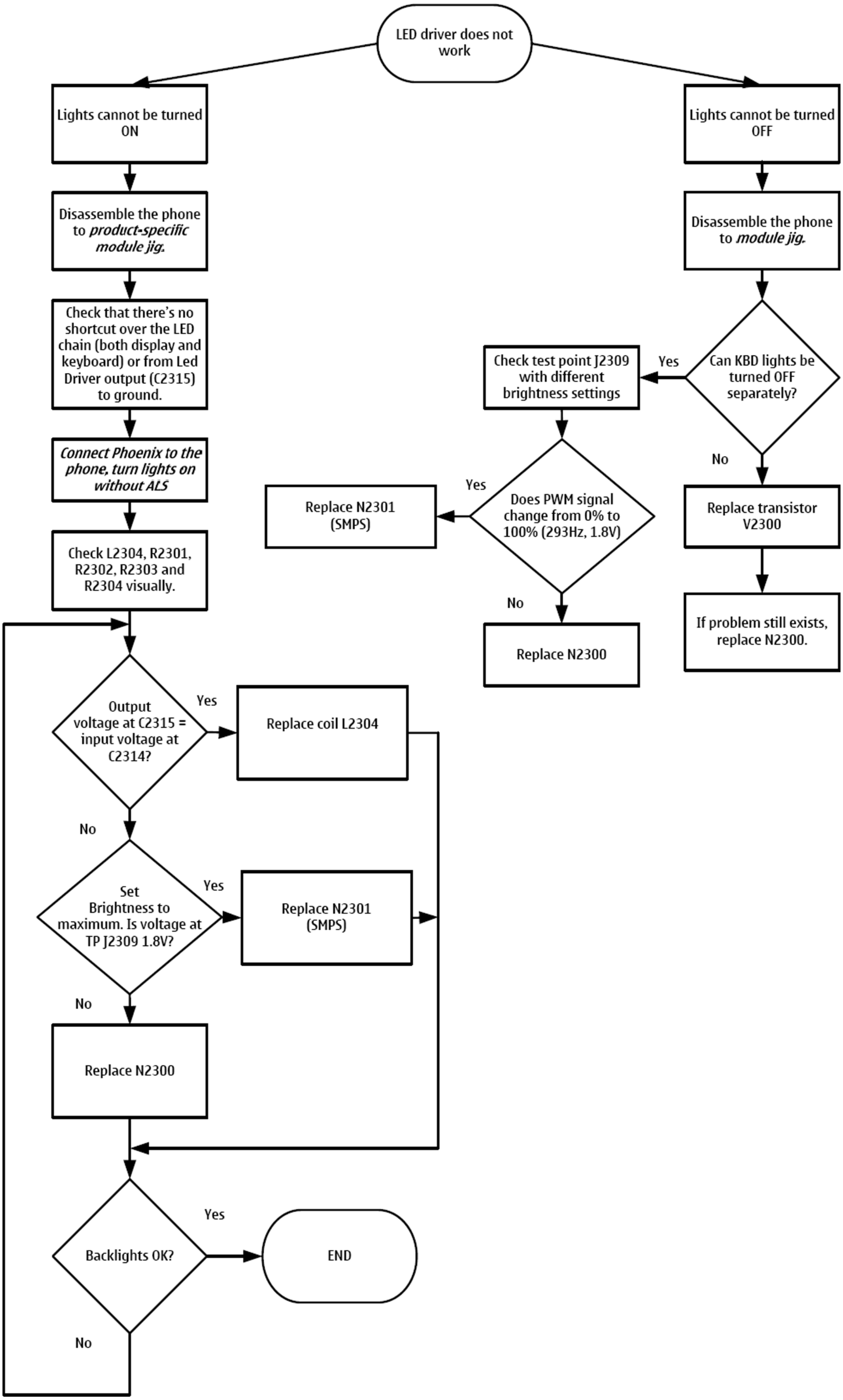
5. In the *Pull Up Resistor Calibration* pane, click **Start**, and **Write**.
6. In the *Ambient Light Sensor Calibration* pane, check the **Use default values only** check box, and click **Write**.
7. To end the calibration, click **Close**.

Troubleshooting flow



LED driver troubleshooting

Troubleshooting flow



Bluetooth troubleshooting

Introduction to Bluetooth troubleshooting

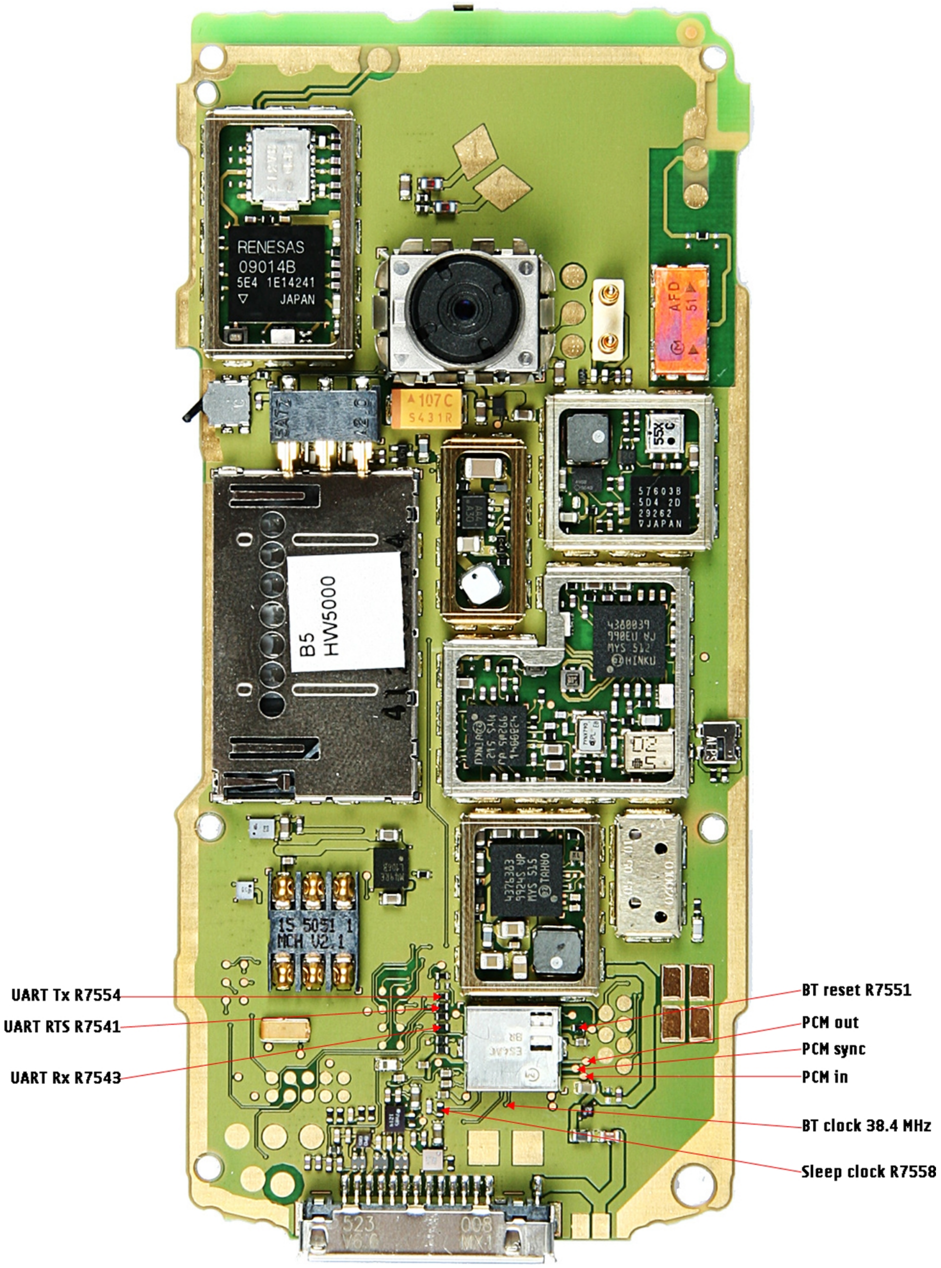
There are two main Bluetooth problems that can occur:

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

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

Location of the BT antenna

Bluetooth test points



Bluetooth settings for Phoenix

Steps

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

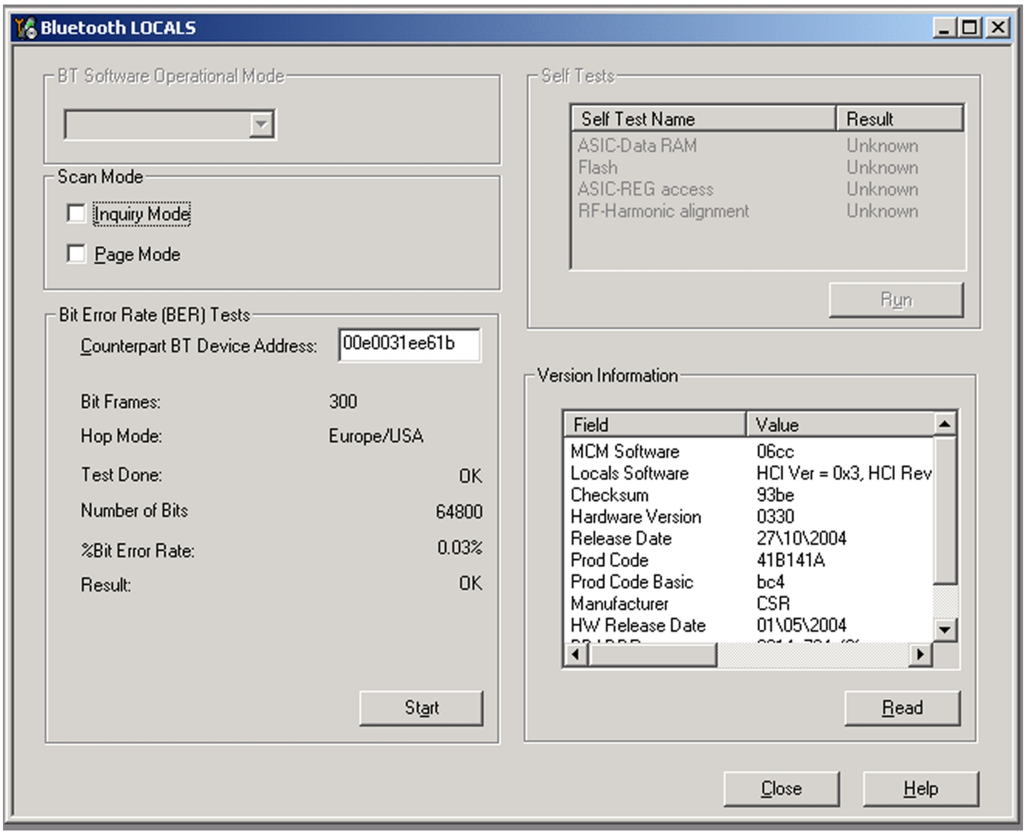
   In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.

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

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

Results

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



Counterpart BT Device Address: 00e0031ee61b
Bit Frames: 300
Hop Mode: Europe/USA
Test Done: OK
Number of Bits 64800
%Bit Error Rate: 0.03%
Result: OK

Self Test Name	Result
ASIC-Data RAM	Unknown
Flash	Unknown
ASIC-REG access	Unknown
RF-Harmonic alignment	Unknown

Field	Value
MCM Software	06cc
Locals Software	HCI Ver = 0x3, HCI Rev
Checksum	93be
Hardware Version	0330
Release Date	27\10\2004
Prod Code	41B141A
Prod Code Basic	bc4
Manufacturer	CSR
HW Release Date	01\05\2004

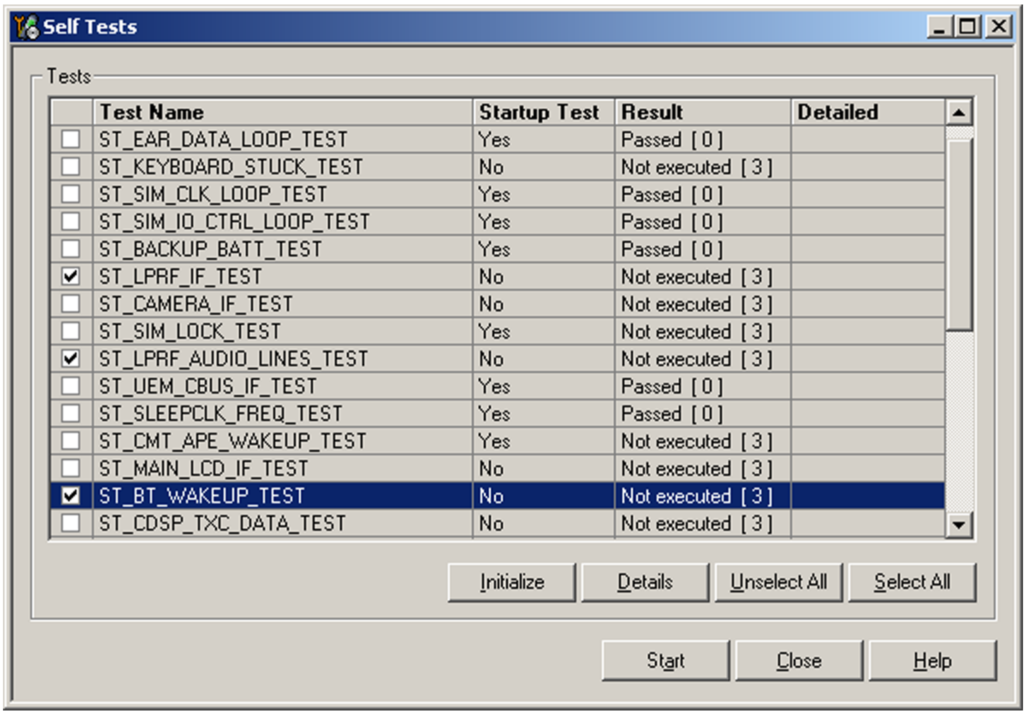
Figure 52 BER test result

Bluetooth self tests in Phoenix

Steps

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

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

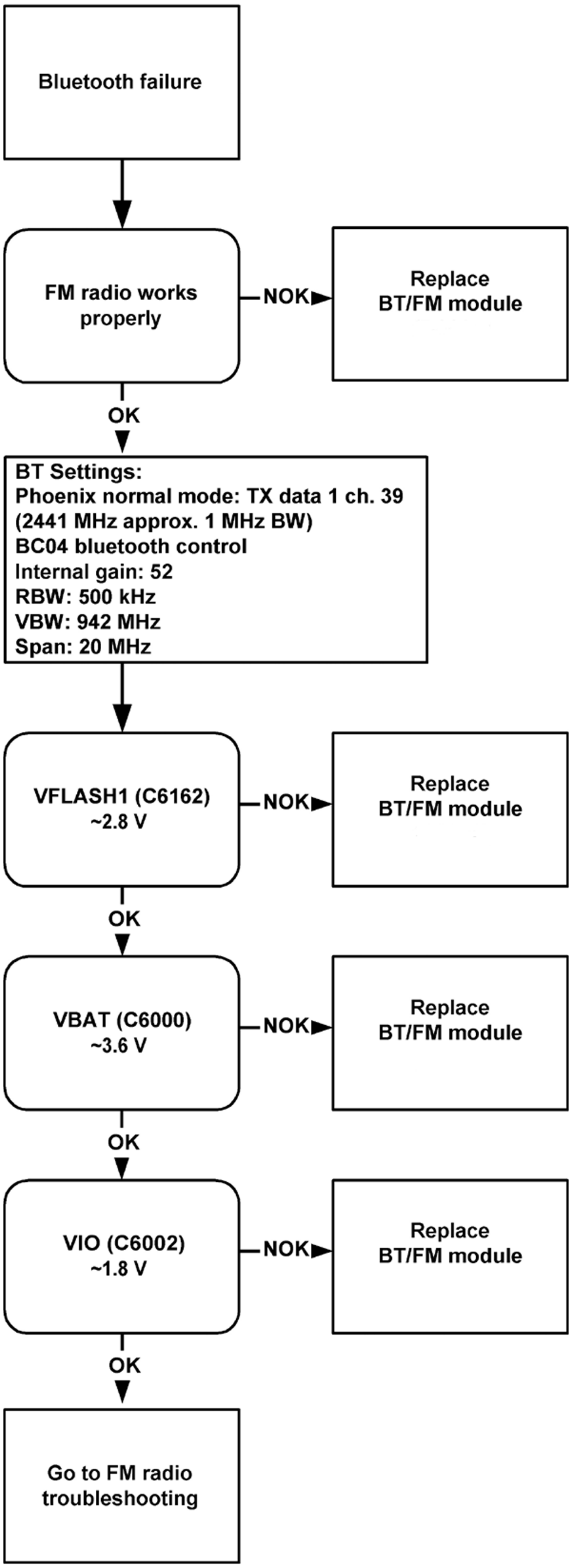


	Test Name	Startup Test	Result	Detailed
☐	ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
☐	ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
☐	ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
☐	ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
☐	ST_BACKUP_BATT_TEST	Yes	Passed [0]	
☑	ST_LPRF_IF_TEST	No	Not executed [3]	
☐	ST_CAMERA_IF_TEST	No	Not executed [3]	
☐	ST_SIM_LOCK_TEST	Yes	Not executed [3]	
☑	ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
☐	ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
☐	ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
☐	ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
☐	ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
☑	ST_BT_WAKEUP_TEST	No	Not executed [3]	
☐	ST_CDSP_TXC_DATA_TEST	No	Not executed [3]	

Figure 53 Bluetooth self tests in *Phoenix*

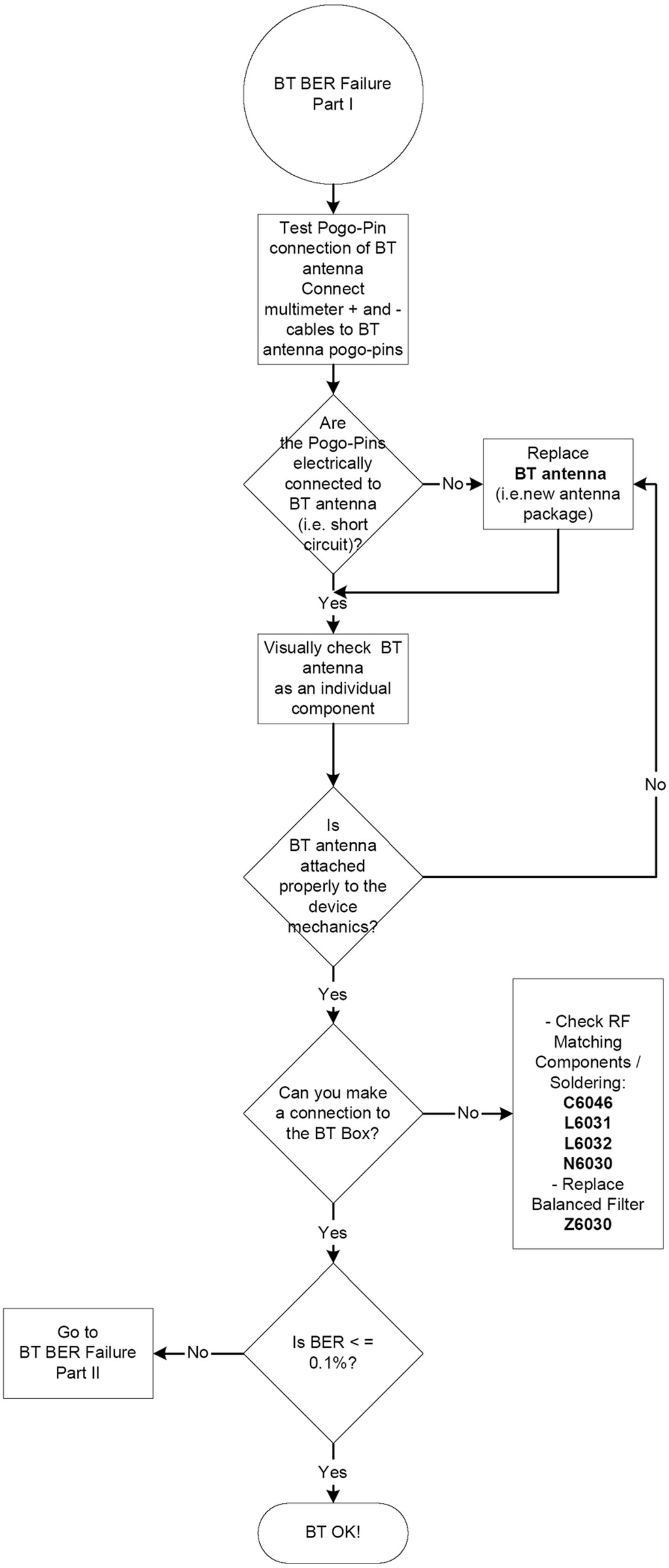
Bluetooth troubleshooting

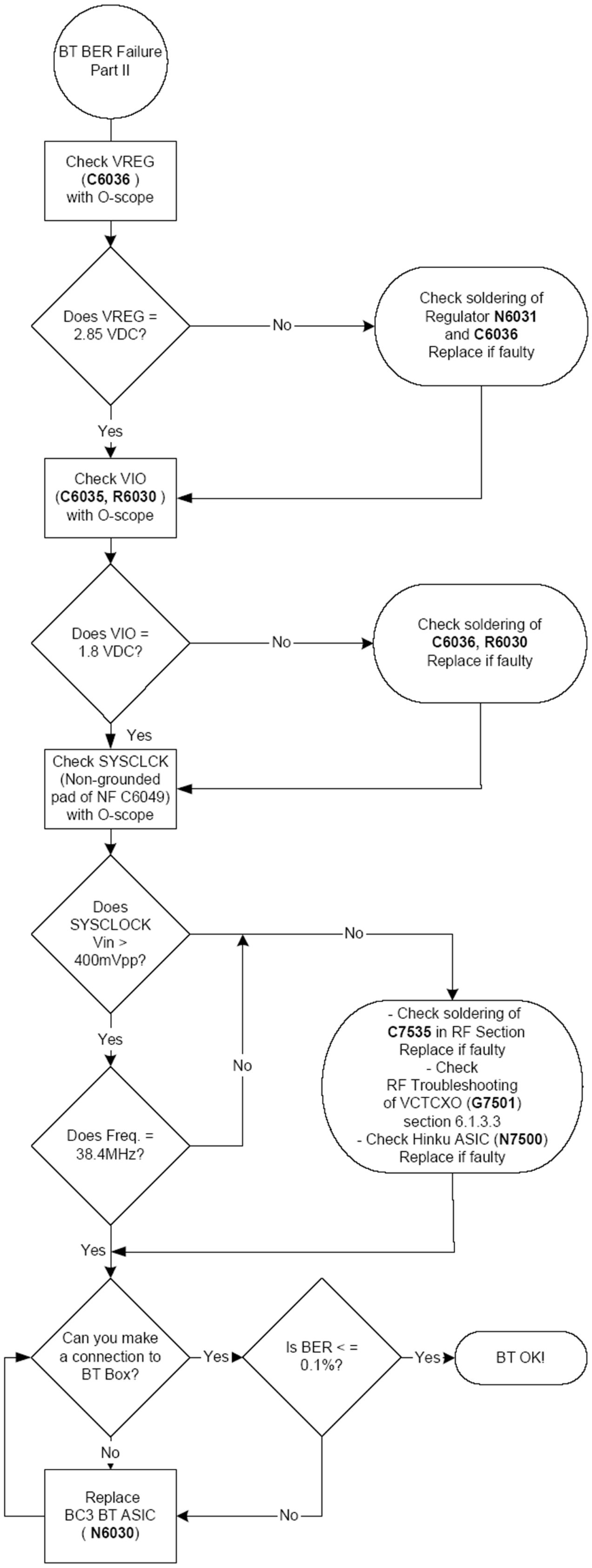
Bluetooth troubleshooting



Bluetooth BER failure troubleshooting

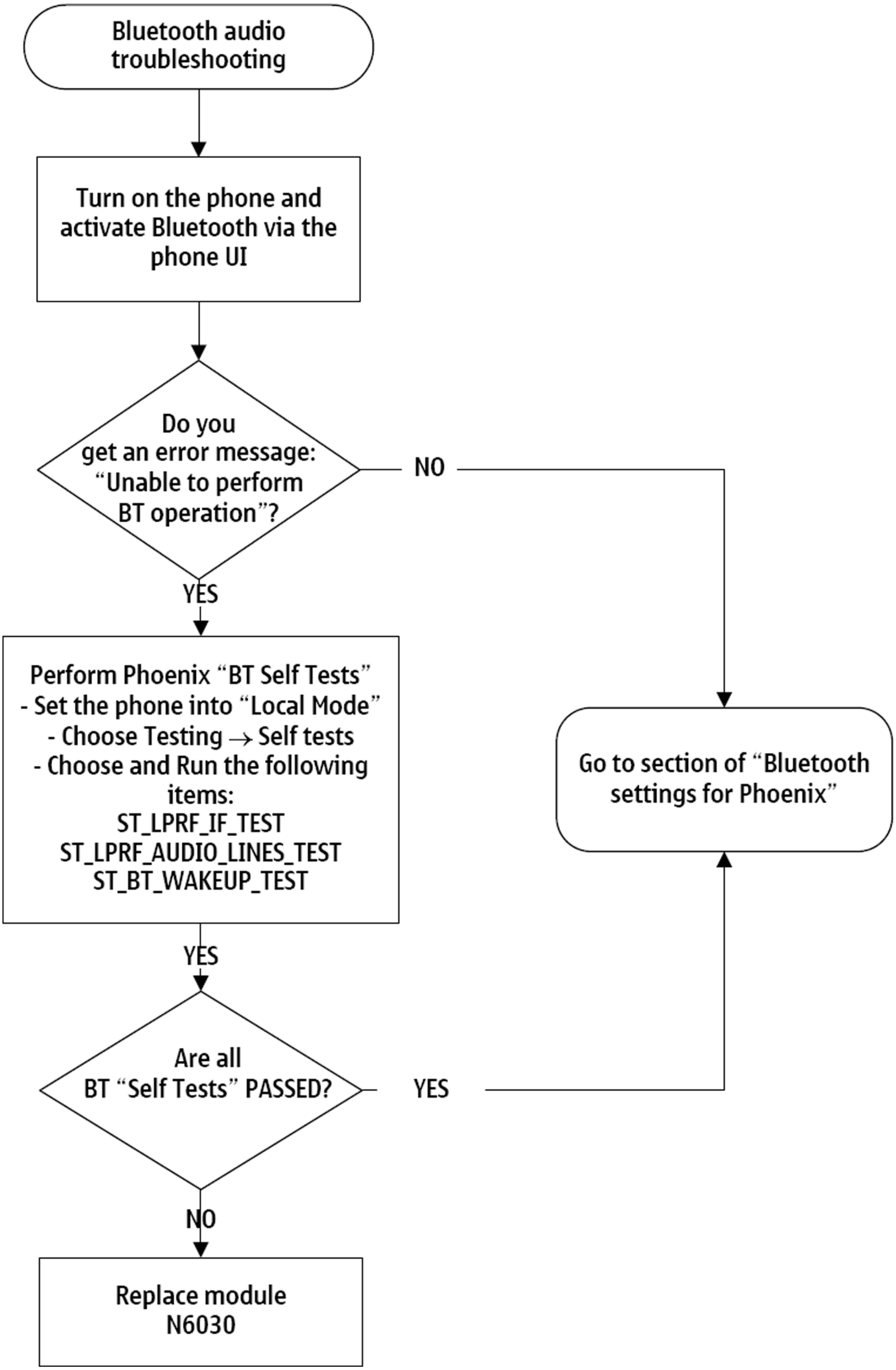
Troubleshooting flow




BT BER Failure Part II
Check VREG (**C6036**) with O-scope
Does VREG = 2.85 VDC?
No
Check soldering of Regulator **N6031** and **C6036** Replace if faulty
Yes
Check VIO (**C6035, R6030**) with O-scope
Does VIO = 1.8 VDC?
No
Check soldering of **C6036**, **R6030** Replace if faulty
Yes
Check SYSCLCK (Non-grounded pad of NF C6049) with O-scope
Does SYSCLOCK Vin > 400mVpp?
No
Yes
No
- Check soldering of **C7535** in RF Section Replace if faulty - Check RF Troubleshooting of VCTCXO (**G7501**) section 6.1.3.3 - Check Hinku ASIC (**N7500**) Replace if faulty
Does Freq. = 38.4MHz?
Yes
Can you make a connection to BT Box?
Yes
Is BER < = 0.1%?
Yes
BT OK!
No
Replace BC3 BT ASIC (**N6030**)
No

BT audio failure troubleshooting

Troubleshooting flow



Audio troubleshooting

Audio troubleshooting test instructions

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

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

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

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					

Measurement data

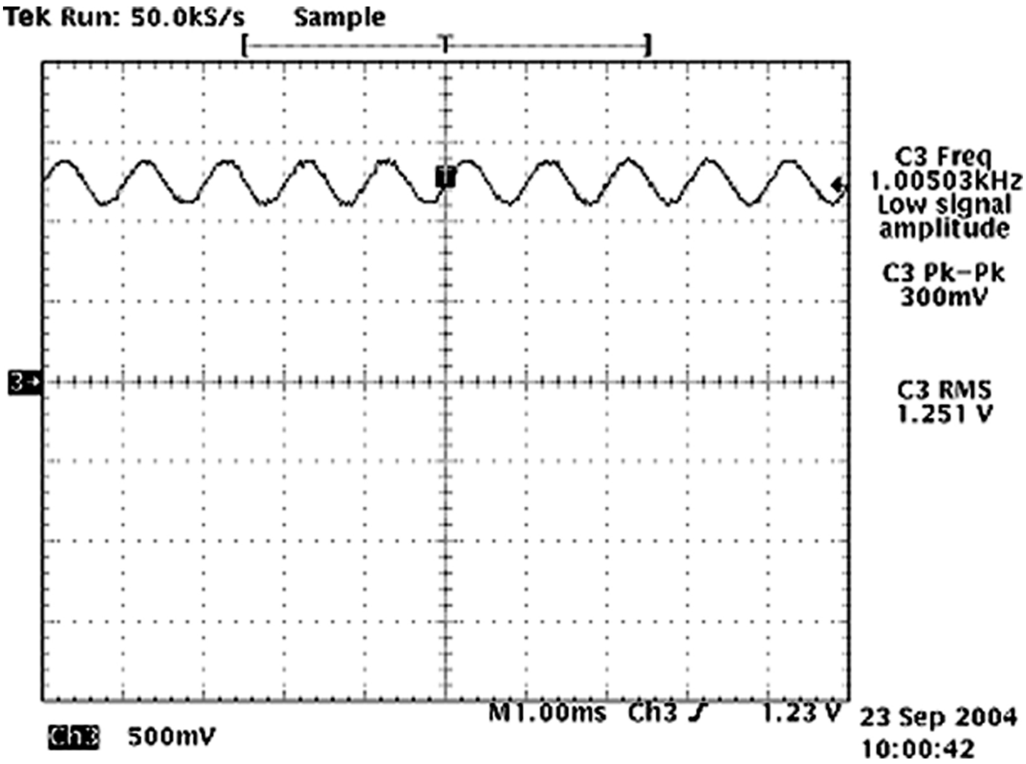
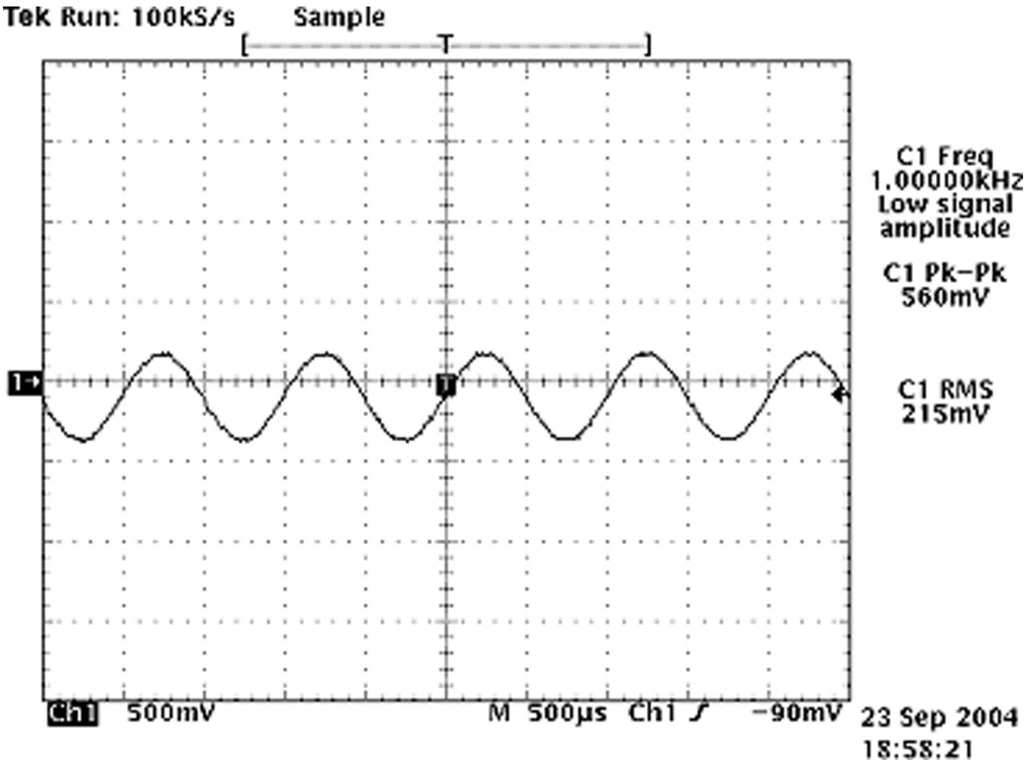


Figure 54 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



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

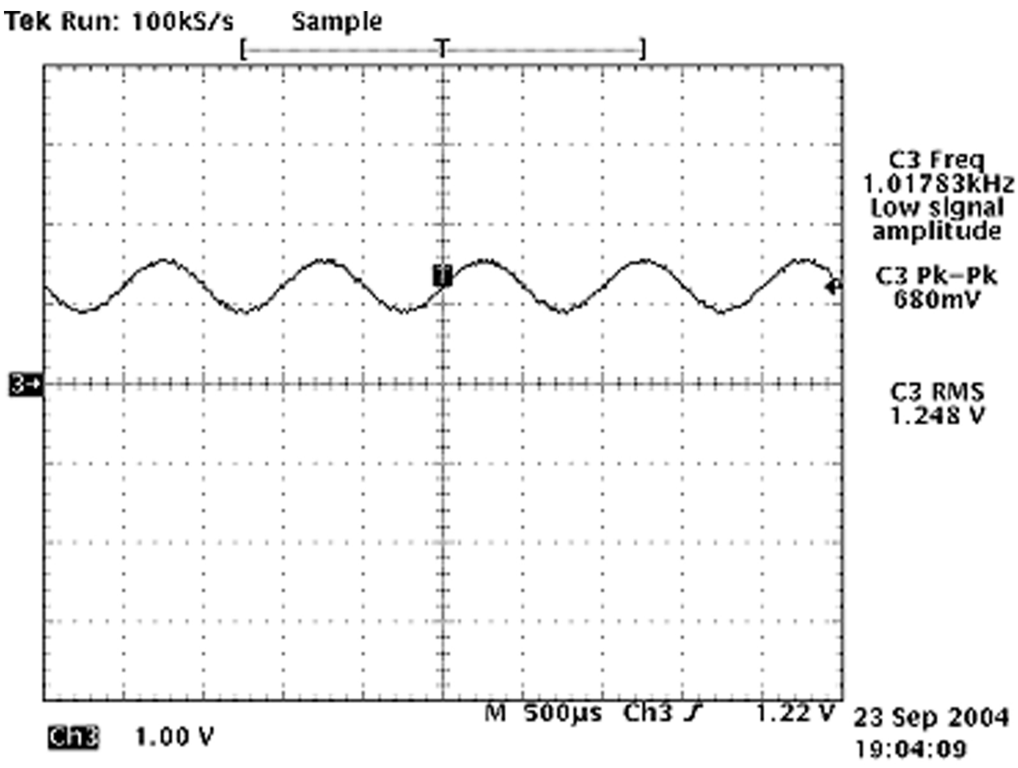
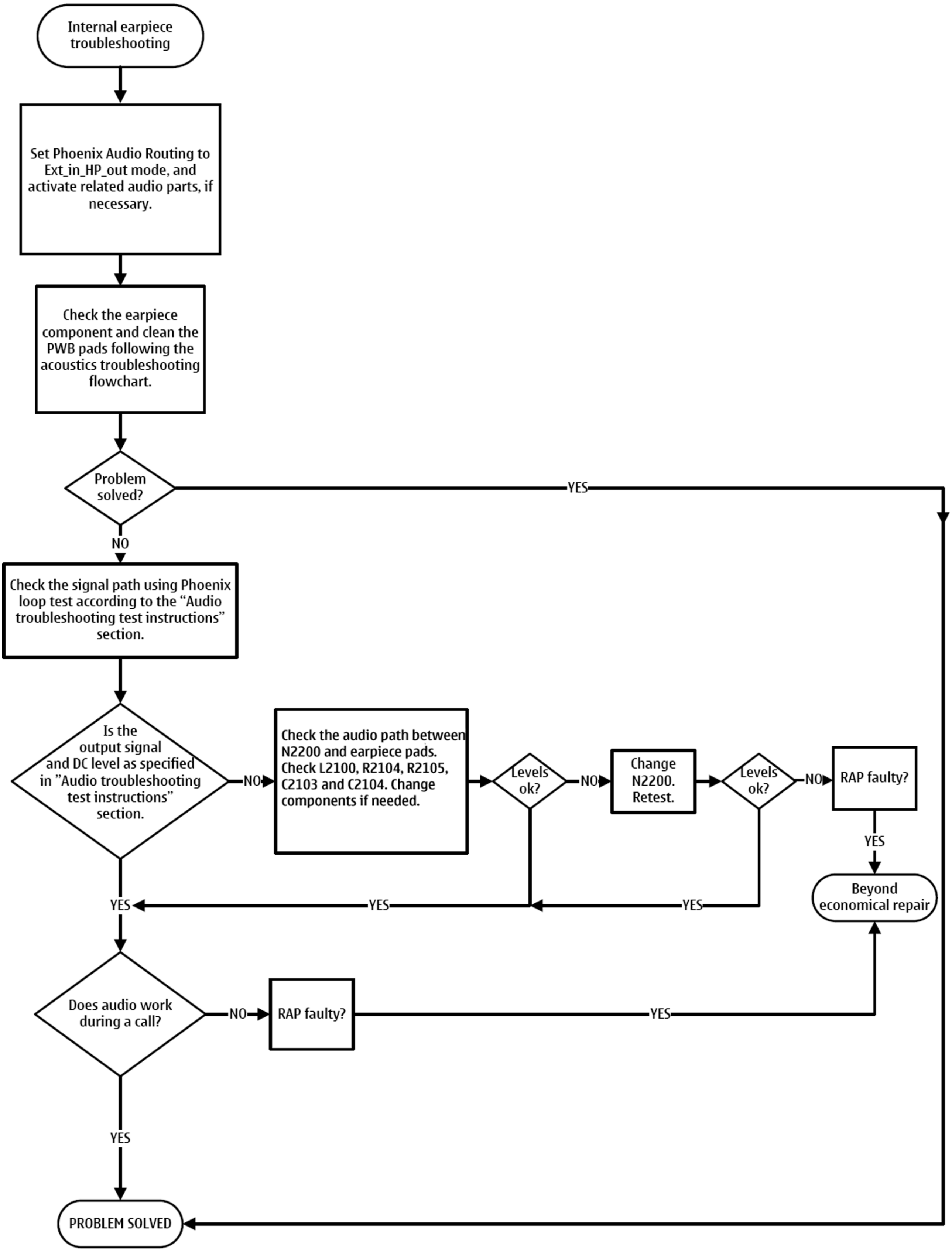


Figure 56 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

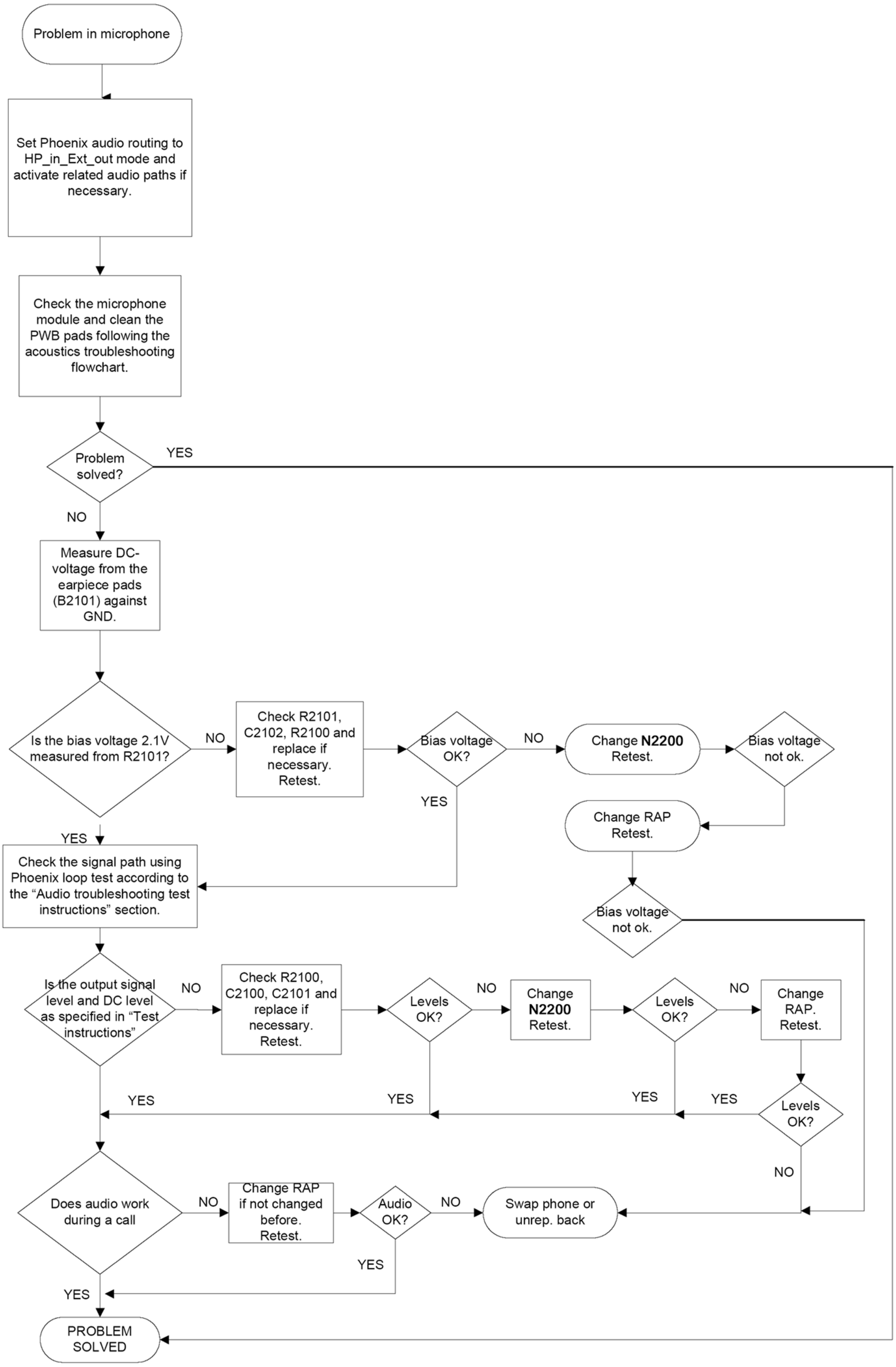
Internal earpiece troubleshooting

Troubleshooting flow



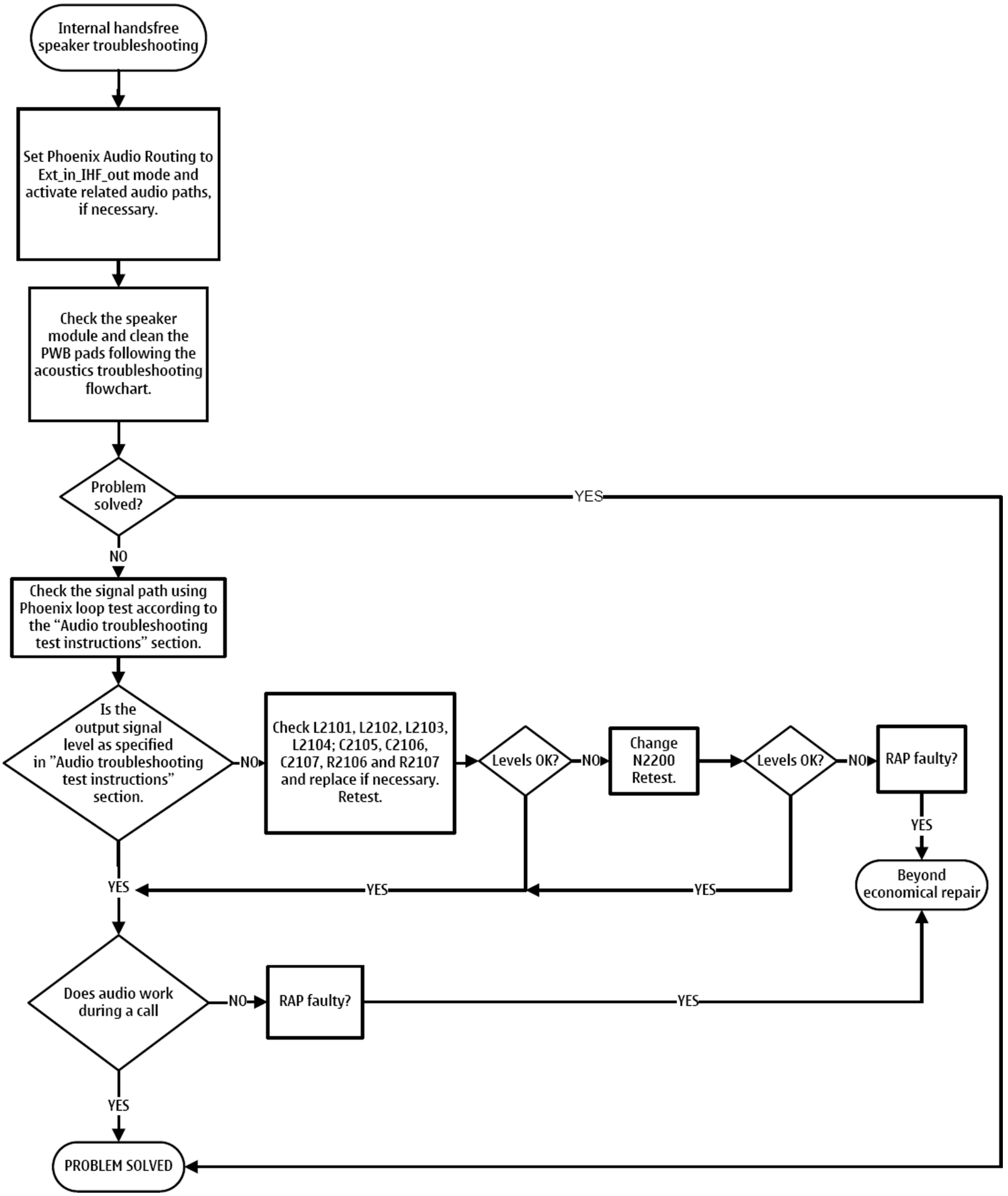
Internal microphone troubleshooting

Troubleshooting flow



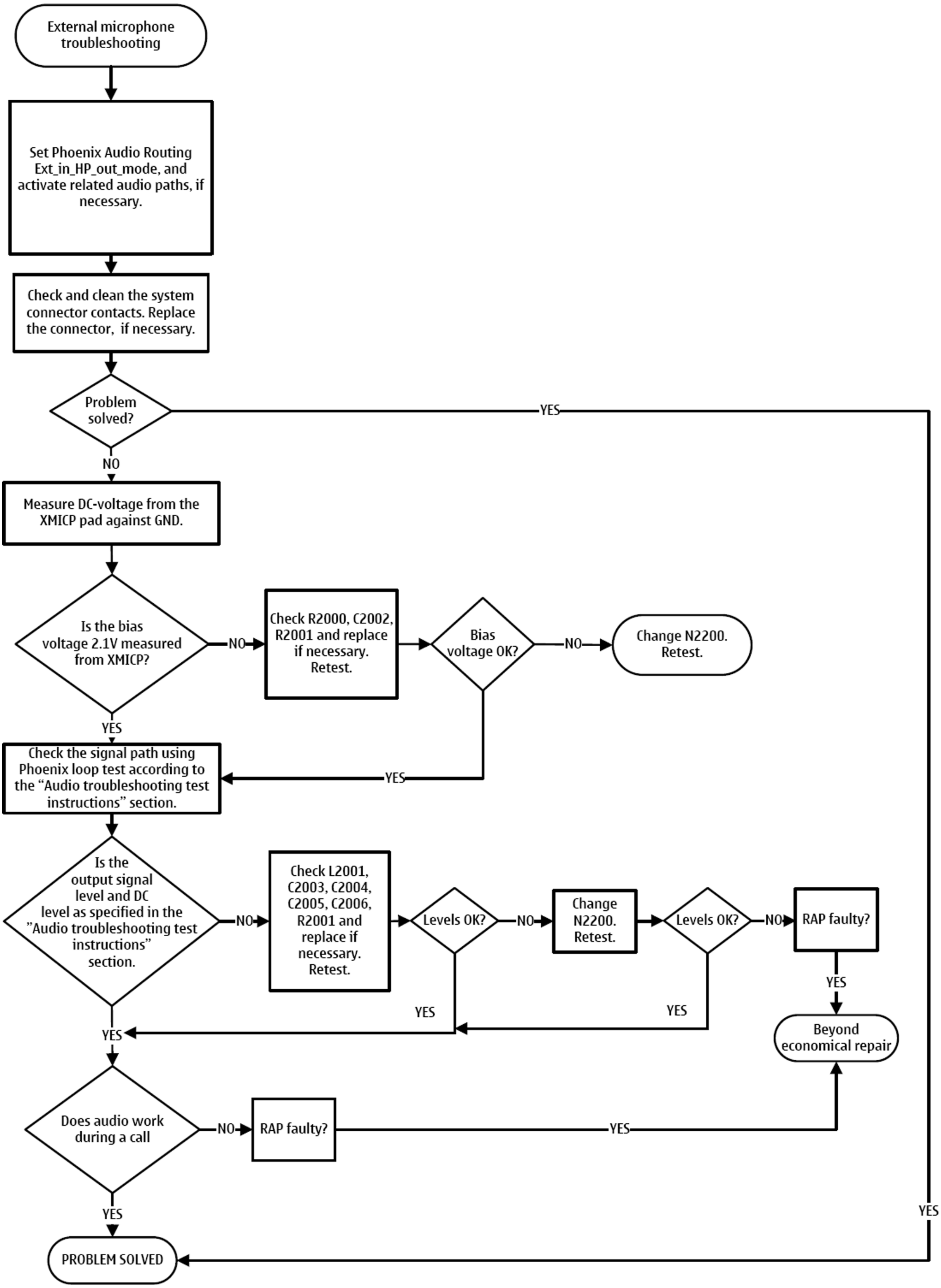
IHF troubleshooting

Troubleshooting flow



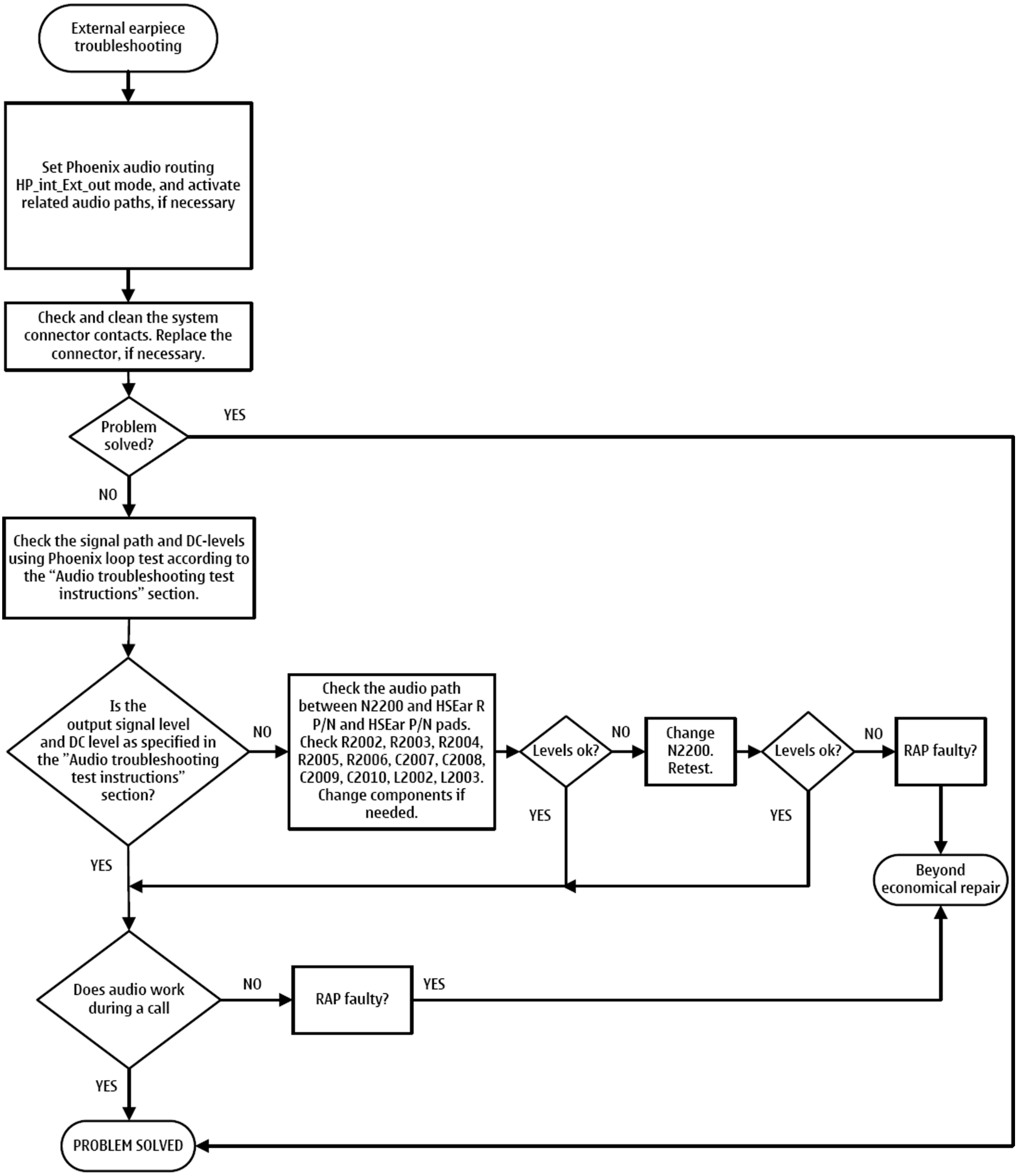
External microphone troubleshooting

Troubleshooting flow



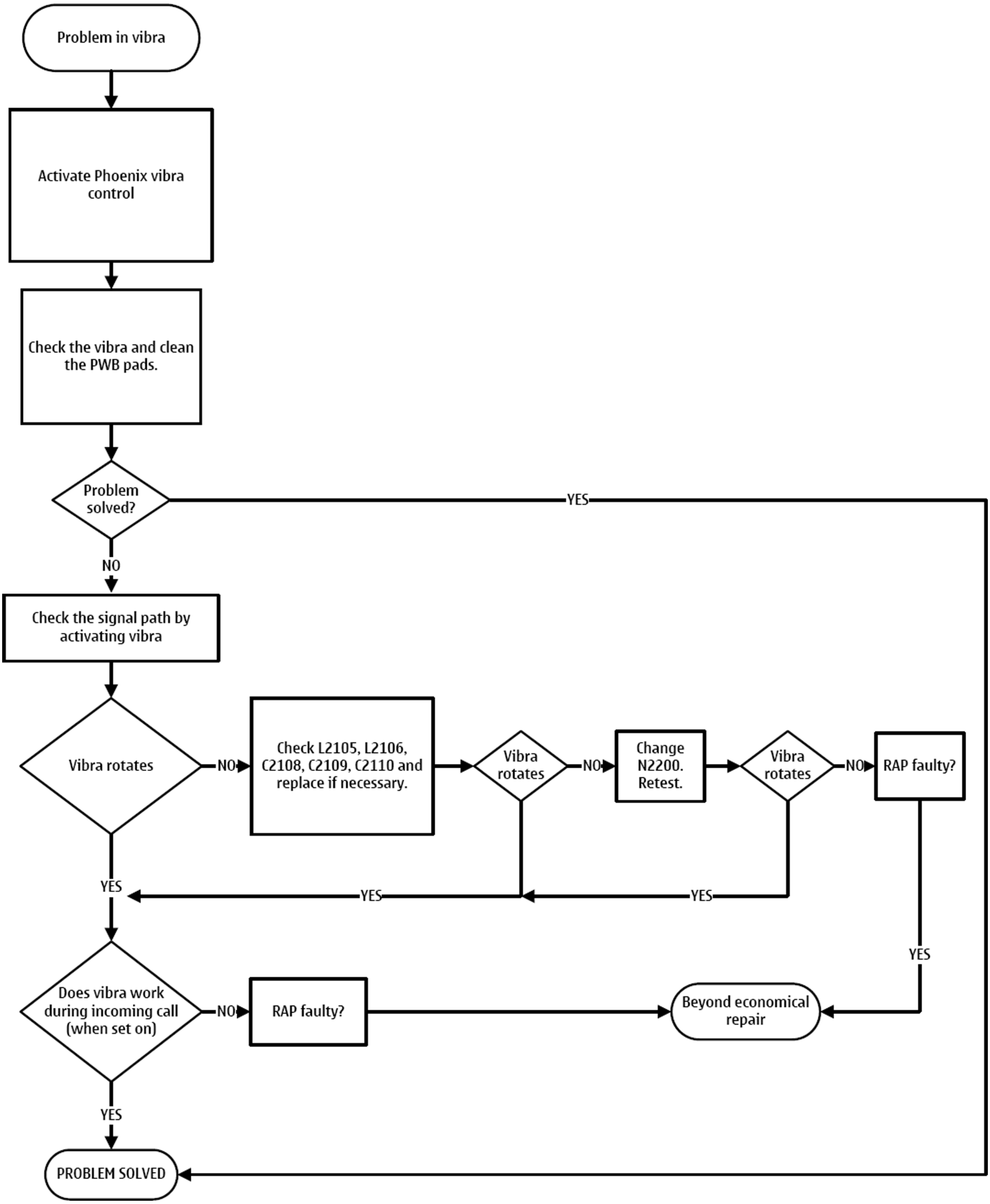
External earpiece troubleshooting

Troubleshooting flow



Vibra troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Energy management calibration

Prerequisites

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

Hardware setup:

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

Steps

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

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

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

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

Table 10 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.

7 — RF Troubleshooting and Tuning Guide

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Table of Contents

List of Tables

List of Figures

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Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Caution:** All measurements with an RF coupler should be performed in RF shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, it should be checked that there are no transmissions on the same frequencies as used in the tests.

The RF section of the phone is build around two RF ASICS: Rx ASIC and Tx ASIC. There is also one GSM PA (Power Amplifier) on board.

Most RF semiconductors are static discharge sensitive. ESD protection must be taken care of during repair (ground straps and ESD soldering irons). The RF ASICs, PA and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

A capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware, in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used. All spectrum analyser measurements in this manual are made with a Fluke PM9639/011 10:1 (500 ohm) probe. It is recommended that a similar kind of probe is used for all troubleshooting measurements.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

For additional RF troubleshooting instructions, see Appendix A. These instructions include descriptions/ instructions for RF self-tests as well as troubleshooting instructions for various fault cases.

RF key component placement

The RF section of the phone is build around two RF ASICs: Rx ASIC N7500 and Tx ASIC N7501.

There is one PA (Power Amplifier) on the board for GSM (N7502).

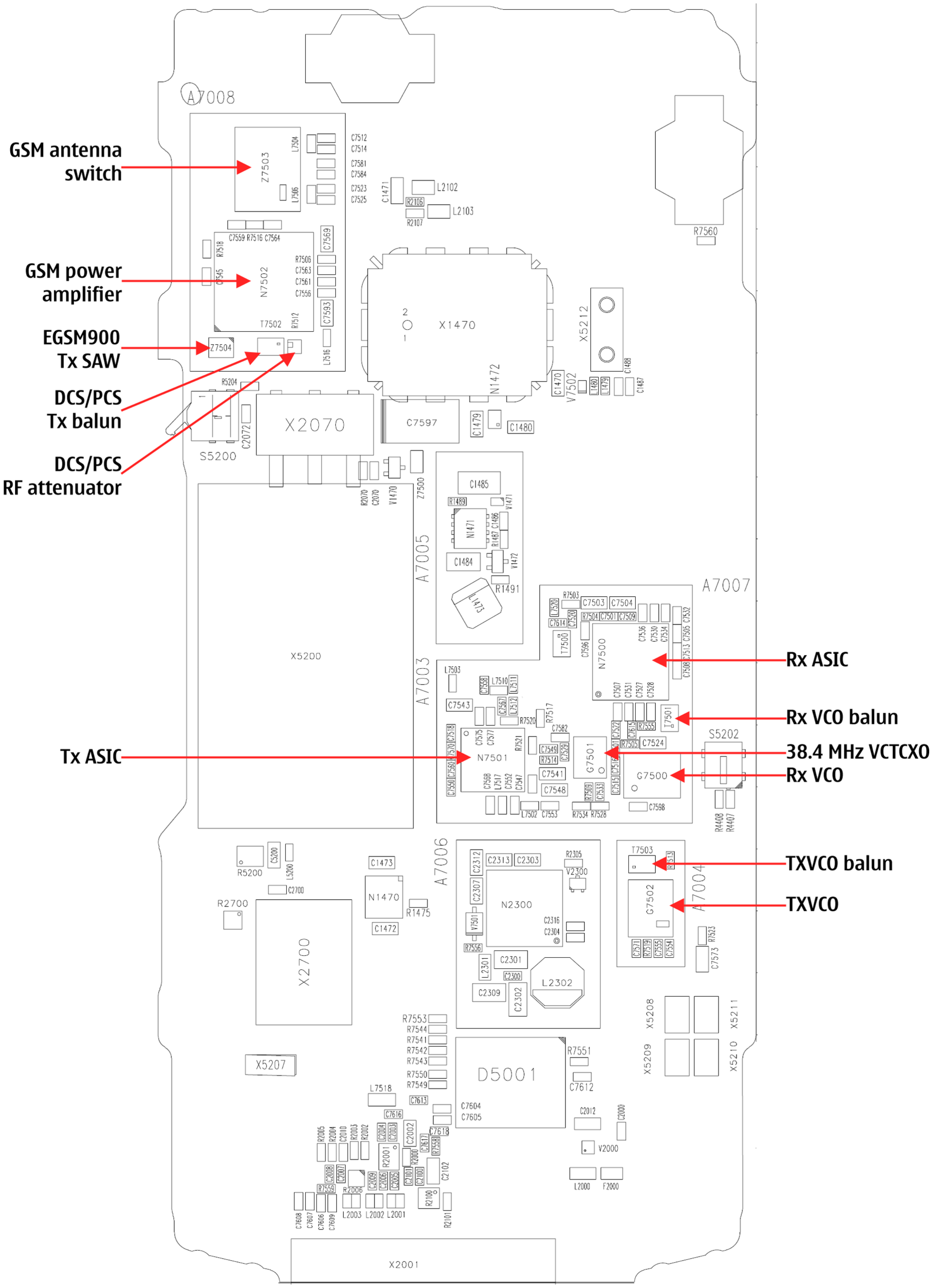


Figure 57 RF key component placement

Troubleshooting test point locations

Test points for spectrum analyzer

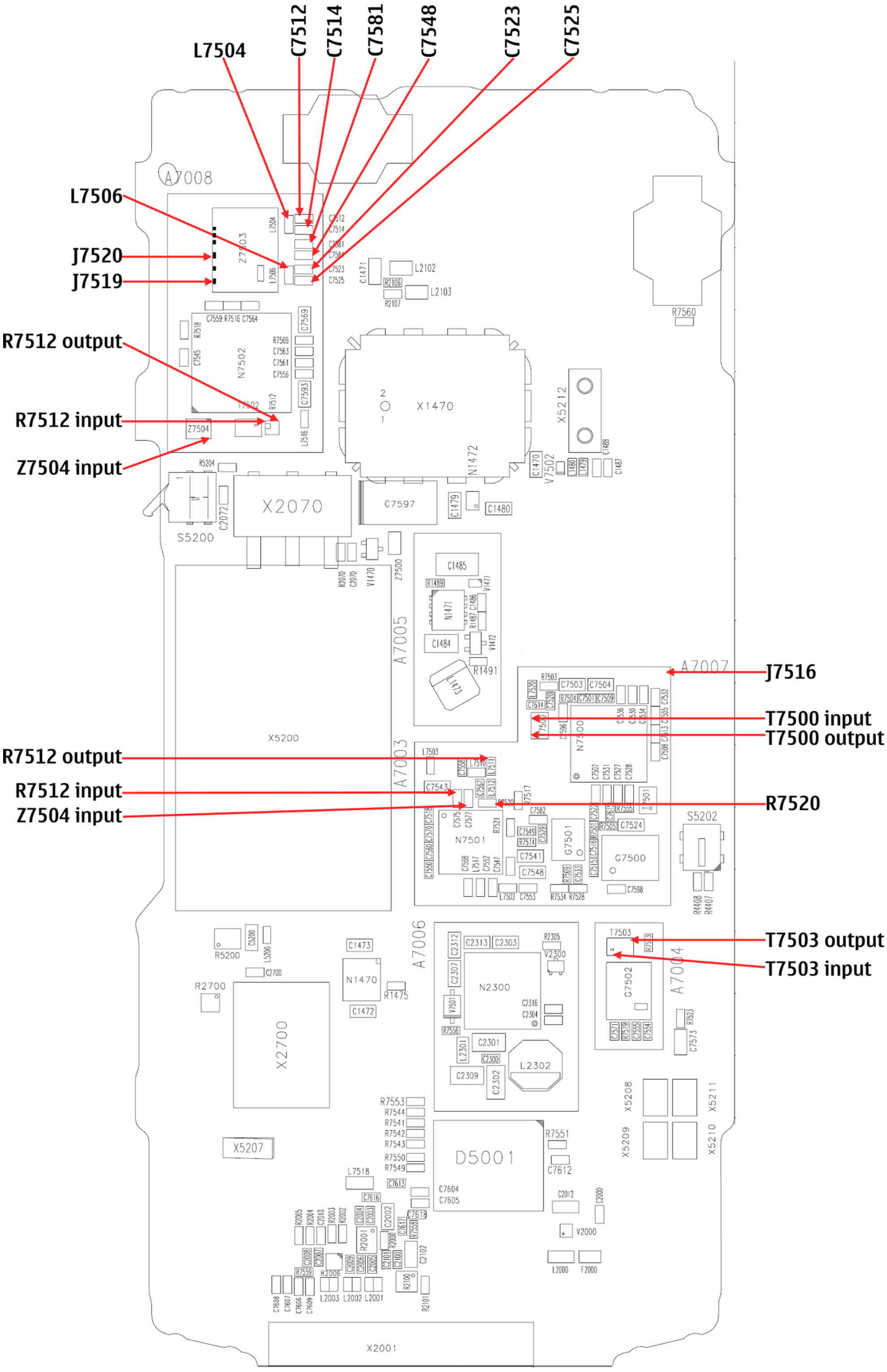


Figure 58 Test point locations for spectrum analyzer

Test points for oscilloscope

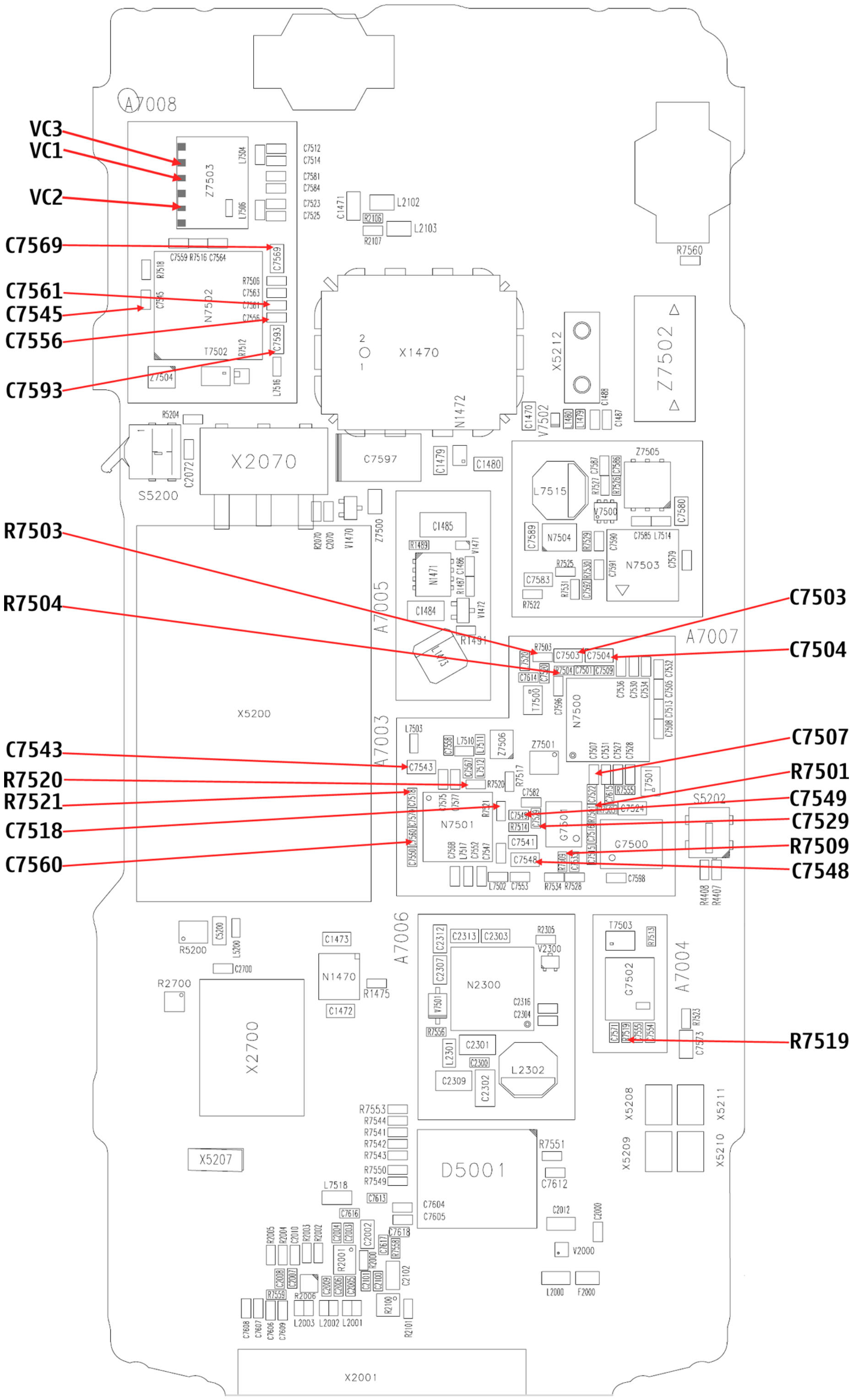


Figure 59 Test points for oscilloscope - bottom

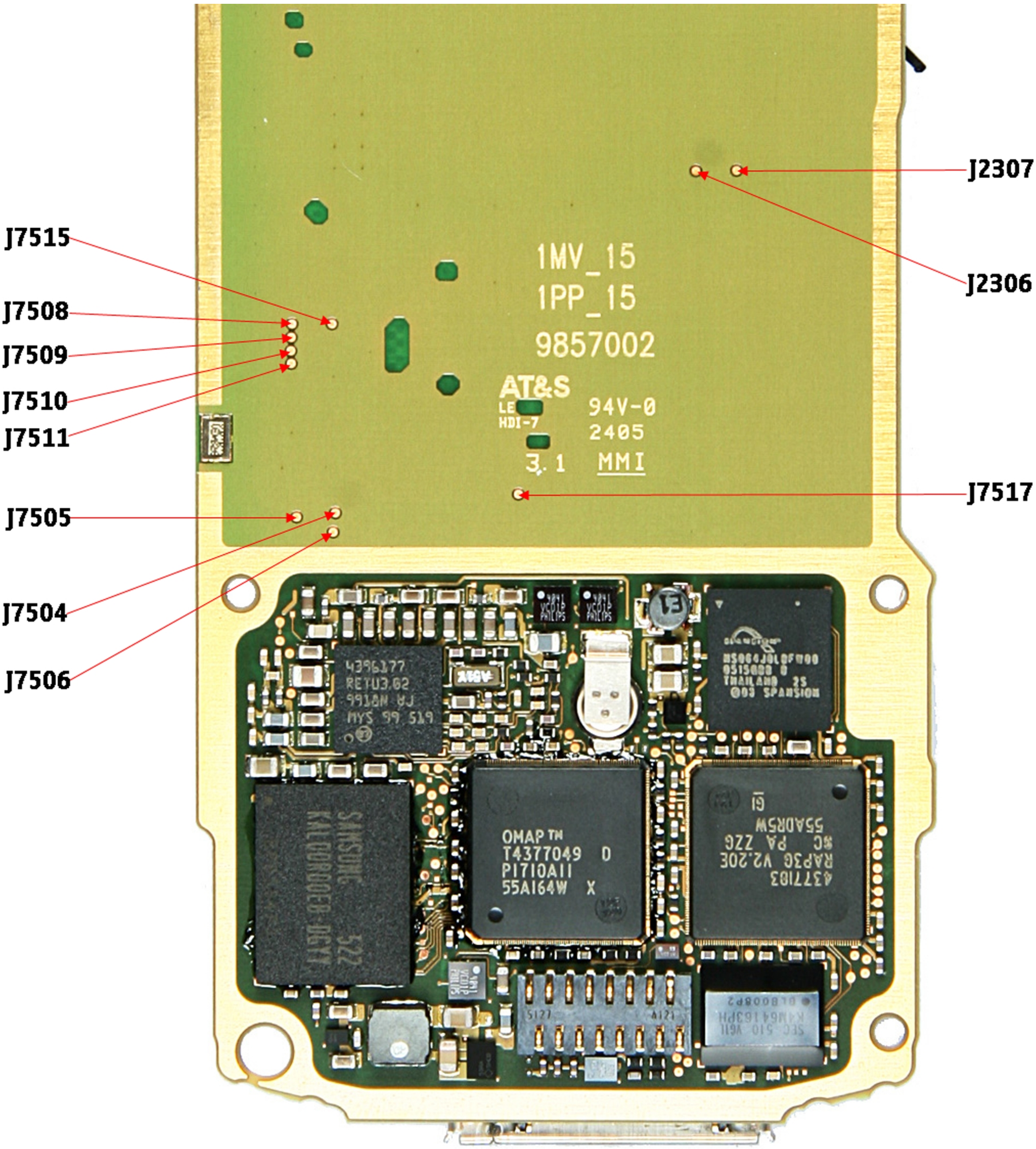


Figure 60 Test points for oscilloscope - top

Receiver troubleshooting

Introduction to Rx troubleshooting

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

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately. For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (page 7–10).

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771 kHz above the carrier frequency.

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

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

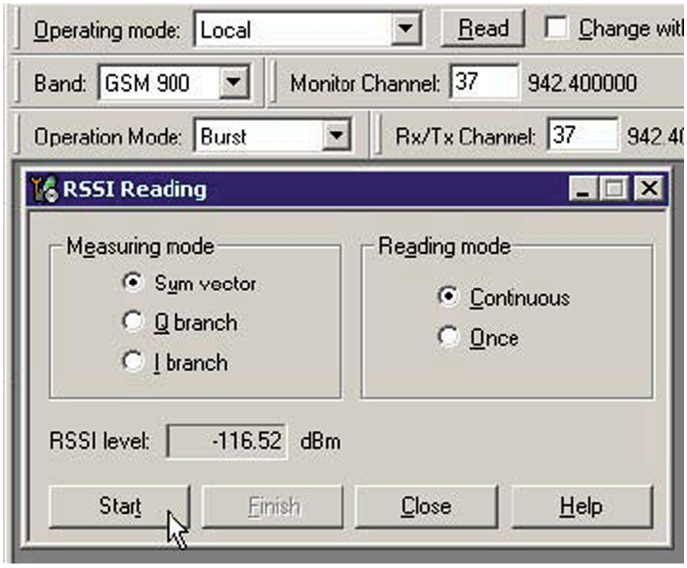
RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

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

Steps

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

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



Operating mode: Local

Band: GSM 900

Monitor Channel: 37 942.400000

Operation Mode: Burst

Rx/Tx Channel: 37 942.4

Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -116.52 dBm

Figure 61 *RSSI Reading* window

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

Results

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

Transmitter troubleshooting

General instructions for Tx troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use.
- Transmitter can be controlled in the local mode for diagnostic purposes.

- The most useful *Phoenix* tool for GSM transmitter testing is **RF Controls**.
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a repair procedure.

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

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

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

Steps

1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-8 flash prommer with a modular cable.

   Make sure that you have a PKD-1 dongle connected to the computer parallel port.

2. Connect a DC power supply to the module jig.

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.
   >
   > Set the DC supply voltage to 3.9 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.

3. Connect an RF cable between the RF connector of the module test jig and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise the GSM PA may be damaged.

   > **Note:** There are two antenna connectors in the module jig:
   >
   > - one for GSM
   > - one for Bluetooth
   >
   > Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

   > **Note:** The maximum input power of a spectrum analyser is +30 dBm.
   >
   > To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set **Tx** on.

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

   ii Initialize connection to the phone. (With FPS-8 use FBUS driver when using DAU-9S and COMBOX driver).

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

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

Alternative steps

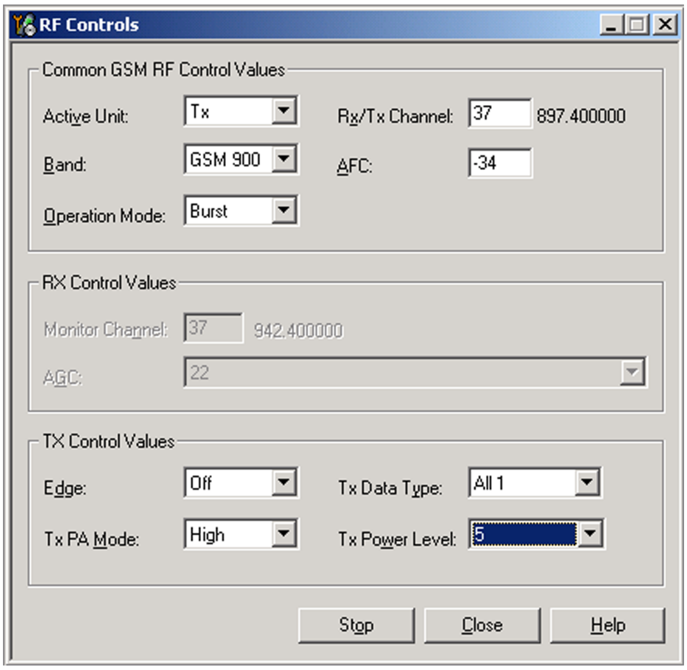
- (GSM850)/EGSM900/GSM1800/GSM1900 troubleshooting

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

  ii In the *RF Controls* window:

    - Select **Band**.
    - Set **Active unit** to **Tx** (Default = **Rx**).
    - Set **Operation mode** to **Burst** (Default = **Burst**).
    - Set **Edge** to **Off** (Default).
    - Set **Tx Data Type** to **All 1** (Default = **All 1**).

- Set **Tx PA Mode** to **Free** (Default).
- Set **Tx Power Level** in the following way:.
    - (GSM850 *if applicable: **37**)
    - GSM900: **5** (Default = **19**)
    - GSM1800: **0** (Default = **15**)
    - GSM1900: **0** (Default = **15**)
- Set power level to 5 (Default = 19) on GSM850/GSM900 or to 0 (Default = 15) on GSM1800/GSM1900.



Common GSM RF Control Values
Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: -34
Operation Mode: Burst

RX Control Values
Monitor Channel: 37 942.400000
AGC: 22

TX Control Values
Edge: Off
Tx Data Type: All 1
Tx PA Mode: High
Tx Power Level: 5

Figure 62 RF Controls window

Checking antenna functionality

The main antenna has one main antenna element: GSM.

In the GSM antenna, there is one Feed and two GND contacts.

The contacts of the GSM antenna are separated in the (RDC = 0 ohm) short-circuit.

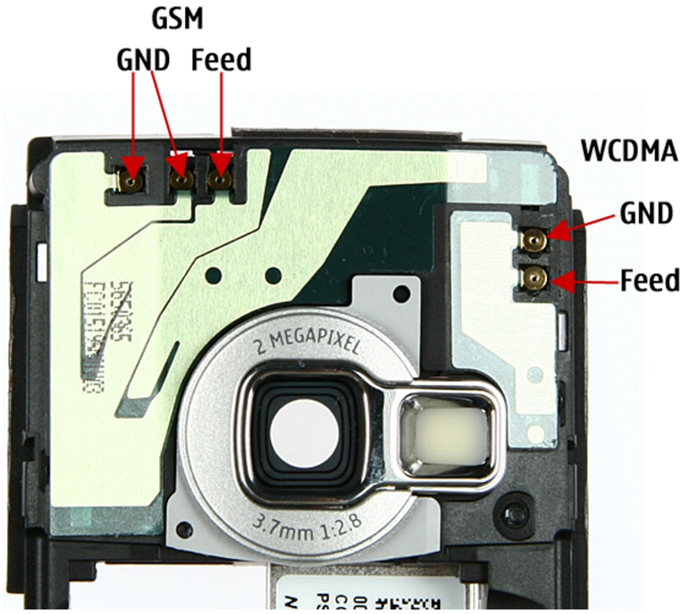


Figure 63 Feed and GND spots of the main antenna

The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

BT antenna

BT antenna has one Feed and two GND contacts. The antenna is functioning normally when the contacts function (RDC = 0 ohm) and the antenna is visually intact.

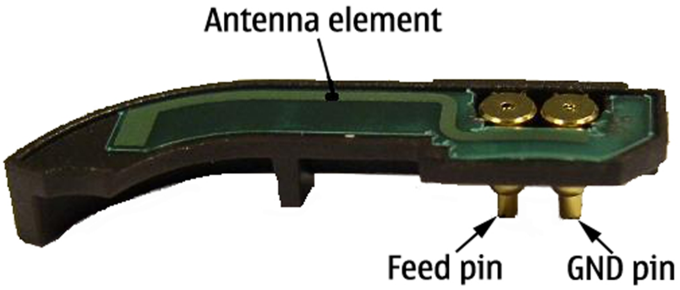
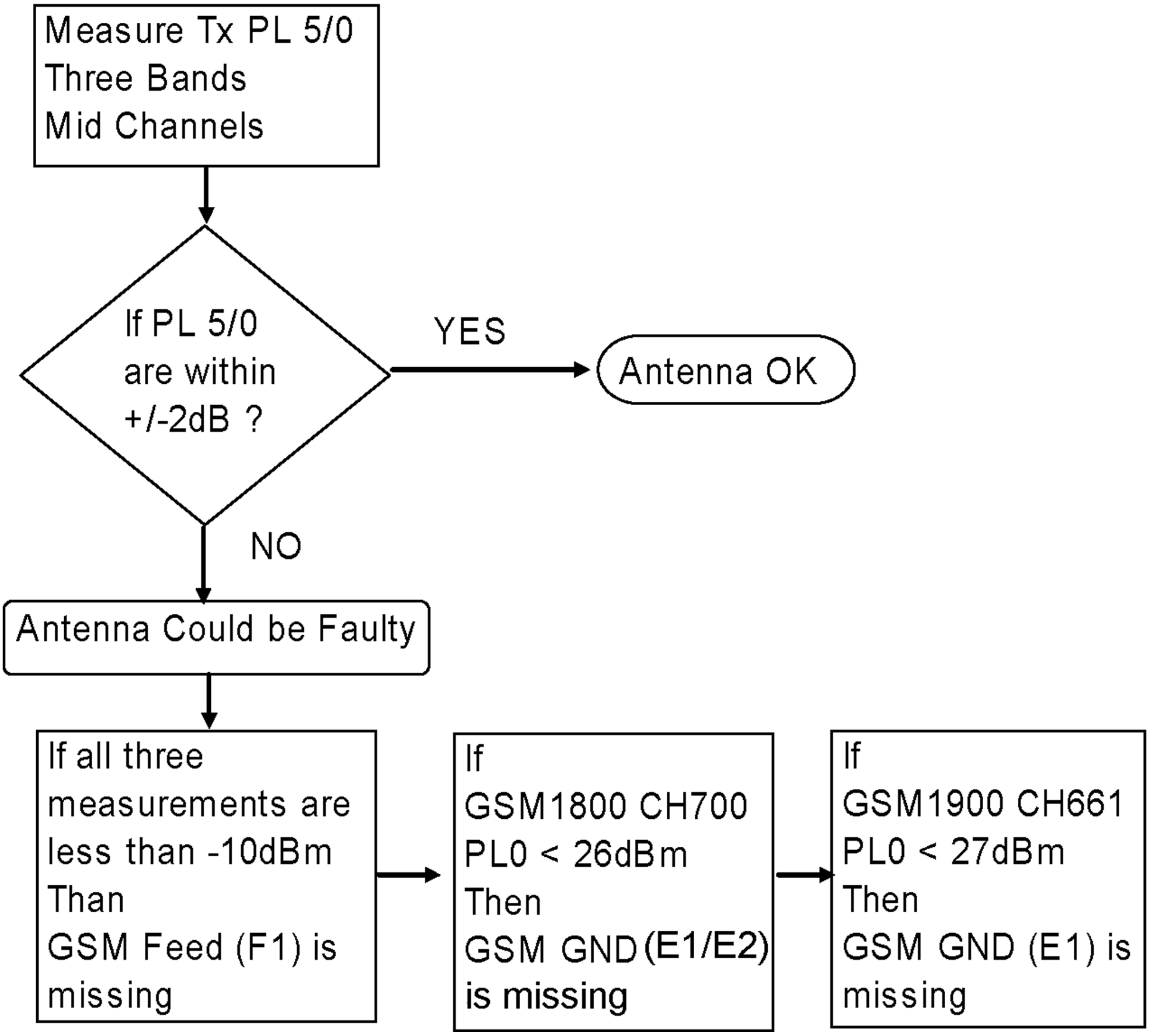


Figure 64 BT antenna

Antenna troubleshooting

Troubleshooting flow



RF tunings

Introduction to RF tunings

Phone RF is tuned in production. There is no reason to do the re-calibration unless:

- one or more of the RF components is changed
- flash memory chip is changed or otherwise corrupted.

Caution: RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase results in a complete mistuning of the RF side.

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

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. For more detailed information, see section Service Tools and Service Concepts.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. In the following table there are RF attenuations of the module jig:

Band	Attenuation
GSM850/GSM900	0.2 dB
GSM1800	0.3 dB
GSM1900	0.3 dB

RF autotuning

Prerequisites

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

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

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

Context

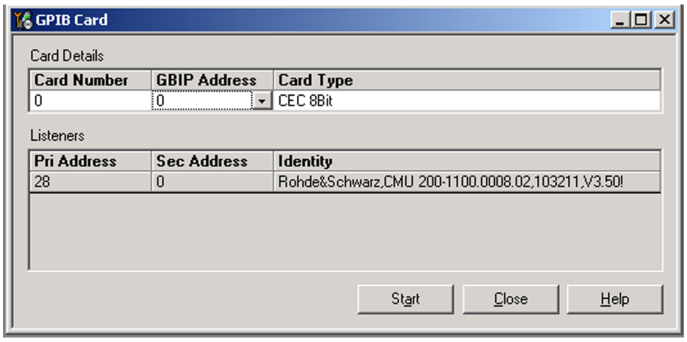
RF autotuning is performed with the aid of a digital radio communication tester (CMU200). Autotuning covers all RF tunings that are needed to perform after RF component repairs.

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

Steps

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

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



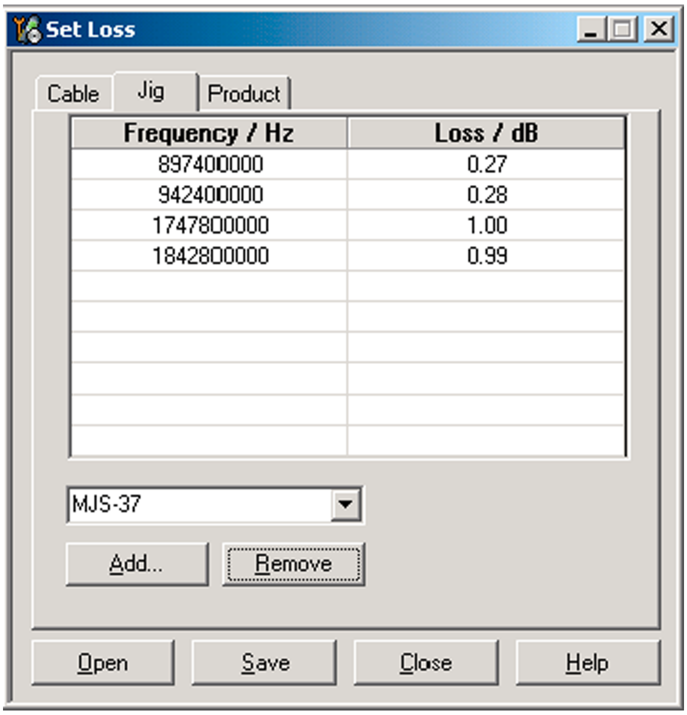
Card Details

Card Number	GBIP Address	Card Type
0	0	CEC 8Bit

Listeners

Pri Address	Sec Address	Identity
28	0	Rohde&Schwarz,CMU 200-1100.0008.02,103211,V3.50!

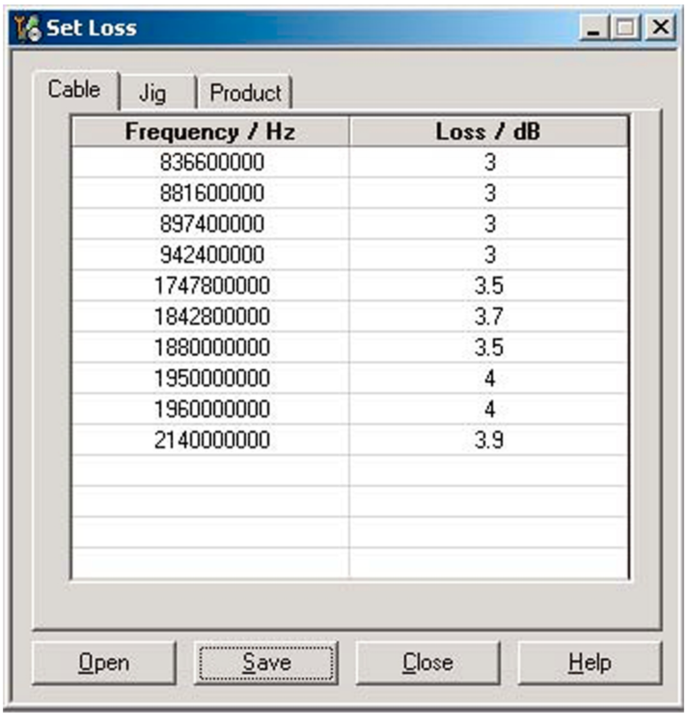
5. To specify the cable loss from module jig to the communication tester, choose **Set Loss** from the **Tuning** menu.
6. In the *Set Loss* window, click the **Jig** tab, and select the right jig for the phone.



Frequency / Hz	Loss / dB
897400000	0.27
942400000	0.28
1747800000	1.00
1842800000	0.99

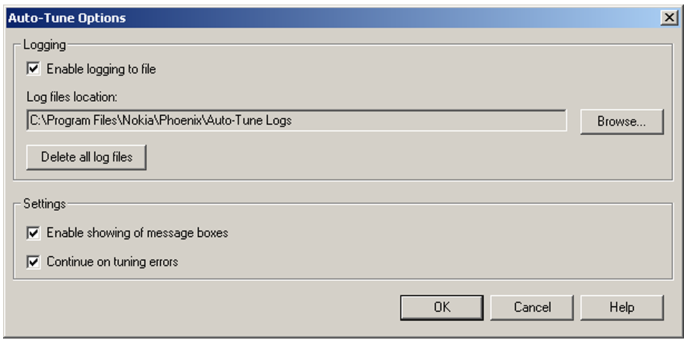
MJS-37

7. Click the **Cable** tab and add the extra cable attenuation.



Frequency / Hz	Loss / dB
836600000	3
881600000	3
897400000	3
942400000	3
1747800000	3.5
1842800000	3.7
1880000000	3.5
1950000000	4
1960000000	4
2140000000	3.9

8. To start autotuning, choose **Auto-Tune** from the **Tuning** menu.
9. In the *Auto-Tune* window, click **Options**.
10. In the *Auto-Tune options* window, see that the **Enable showing of message boxes** check box is checked, and click **OK**.



☑ Enable logging to file

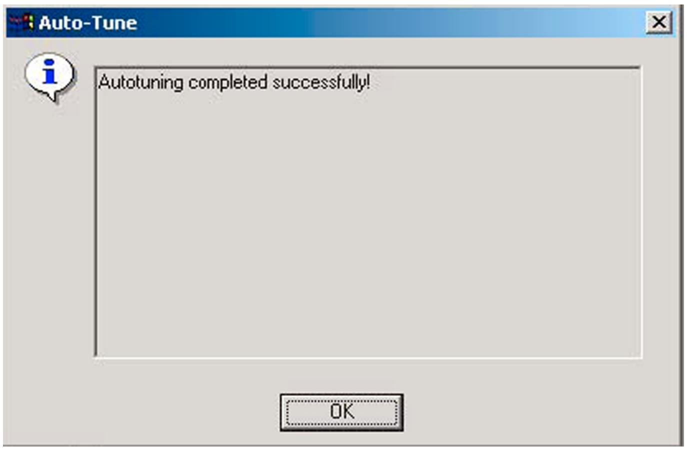
Log files location: C:\Program Files\Nokia\Phoenix\Auto-Tune Logs

☑ Enable showing of message boxes

☑ Continue on tuning errors

Results

Autotuning completed successfully! message appears.



Autotuning completed successfully!

RF manual tuning guide

Required manual tunings after component changes

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

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

Changed component	Perform following tunings
Tx RF ASIC	RF Channel Filter Calibration, Tx IQ Tuning, Tx Power Level Tuning, Temperature Sensor Calibration
RX RF ASIC	RF Channel Filter Calibration, Rx Calibration, Rx Band Filter Response Compensation, Rx AM Suppression
Any component in the GSM TX RF chain before the PA	Tx IQ Tuning, Tx Power Level Tuning
Any component in the GSM TX RF chain after the PA or PA	Tx Power Level Tuning
Any component in the GSM RX chain	Rx Calibration, RX Band Filter Response Compensation, RX AM Suppression
VCTCXO	Rx Calibration

System mode independent manual tunings

RF channel filter calibration

Context

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

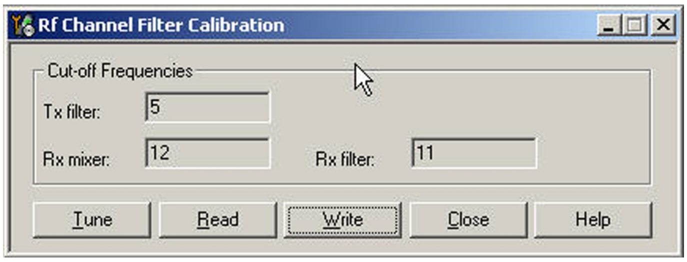
Table 11 RF channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	5	31
Rx filter	0	11	31

Steps

1. From the **System mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**RF Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results



Tx filter: 5
Rx mixer: 12
Rx filter: 11

Figure 65 RF channel filter calibration typical values

PA (power amplifier) detection

Context

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

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

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

Temperature sensor calibration

Context

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

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

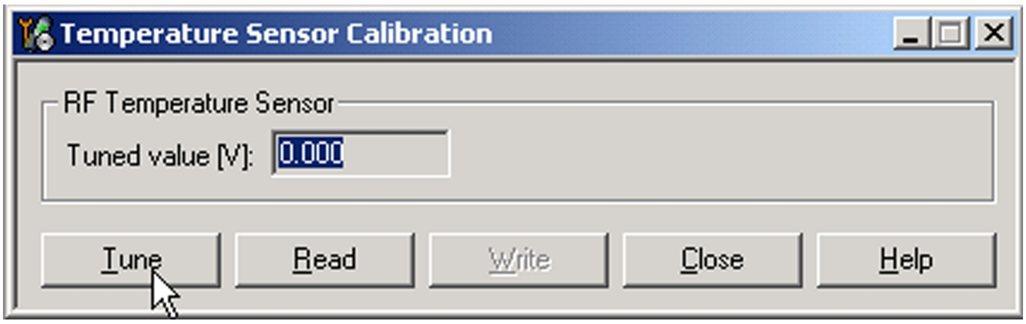
The module is able to do this calibration by itself, no external equipment is needed.

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

Steps

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

3. Click **Tune**.



Tuned value [V]: 0.000

Table 12 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	V

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

GSM receiver tunings

Rx calibration (GSM)

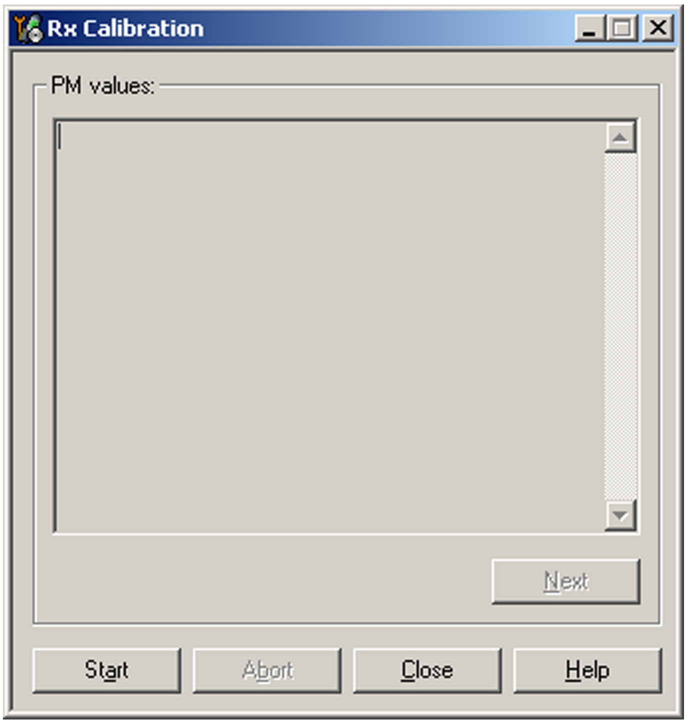
Context

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

Steps

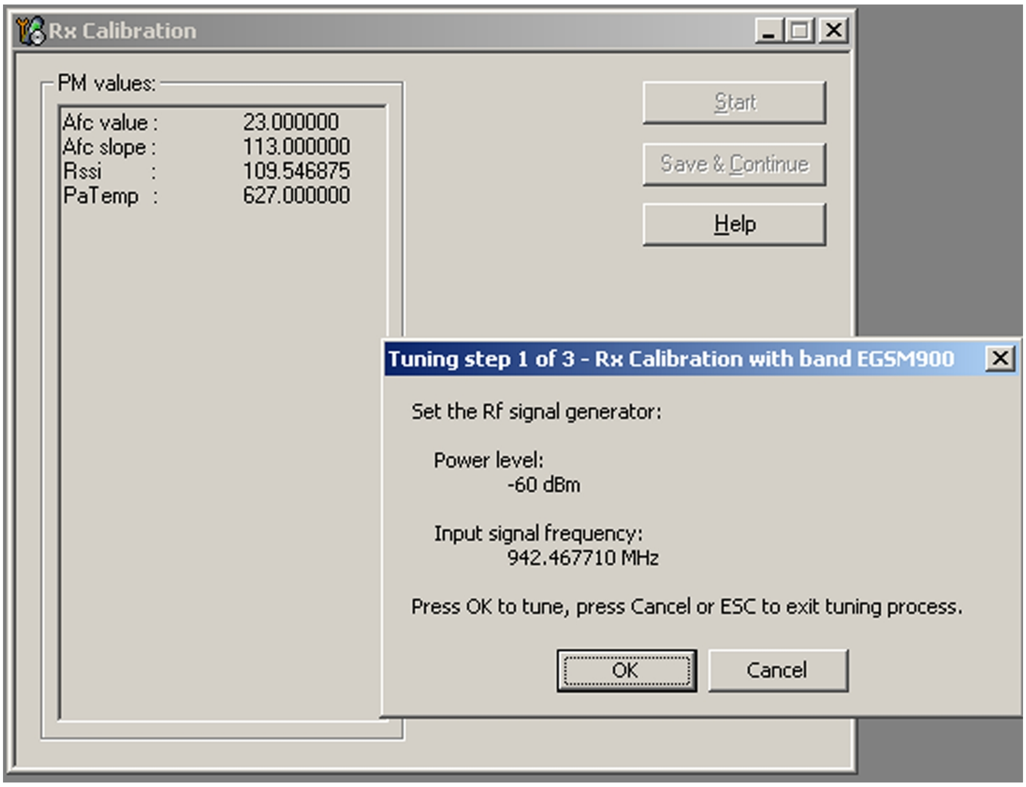
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. Choose **File→Scan Product.**
4. From the **Operating mode** drop-down menu, set mode to **Local**.
5. Choose **Tuning→GSM→Rx Calibration.**

6. Click **Start**.



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

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



Afc value : 23.000000
Afc slope : 113.000000
Rssi : 109.546875
PaTemp : 627.000000

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

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

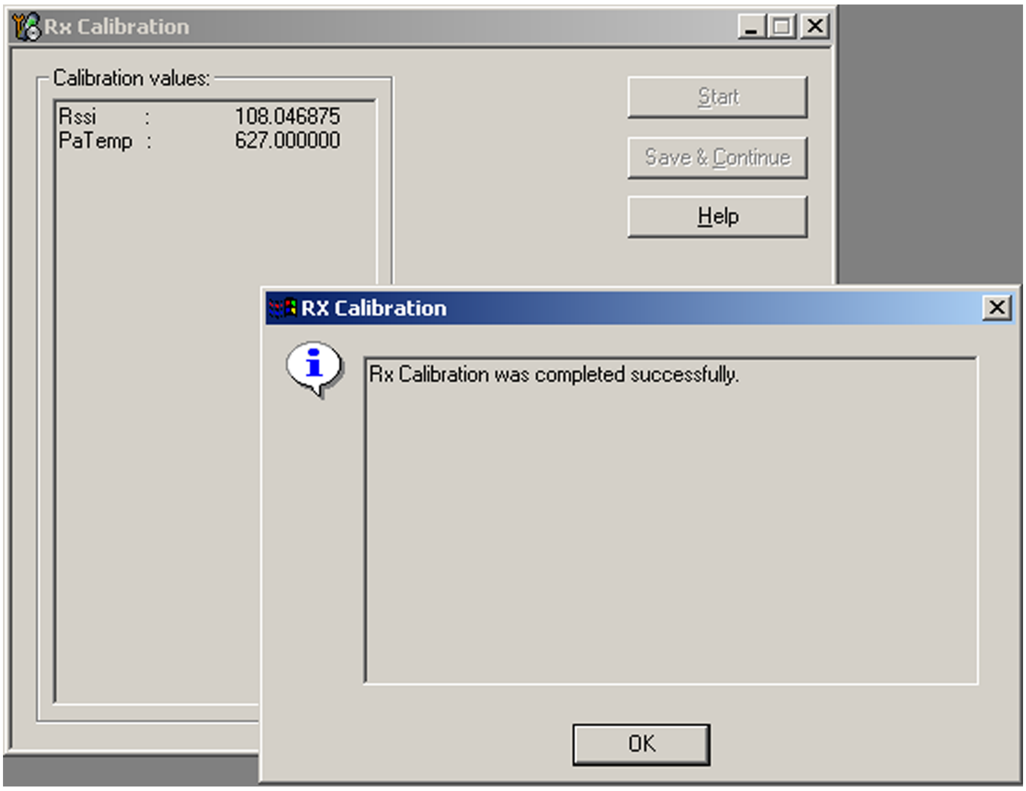
9. Check that the tuning values are within the limits specified in the following table:

Table 13 RF tuning limits in Rx calibration

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

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

Results



Calibration values:
Rssi : 108.046875
PaTemp : 627.000000

Rx Calibration was completed successfully.

Rx band filter response compensation (GSM)

Prerequisites

Rx Calibration must be performed before the Rx Band Filter Response Compensation.

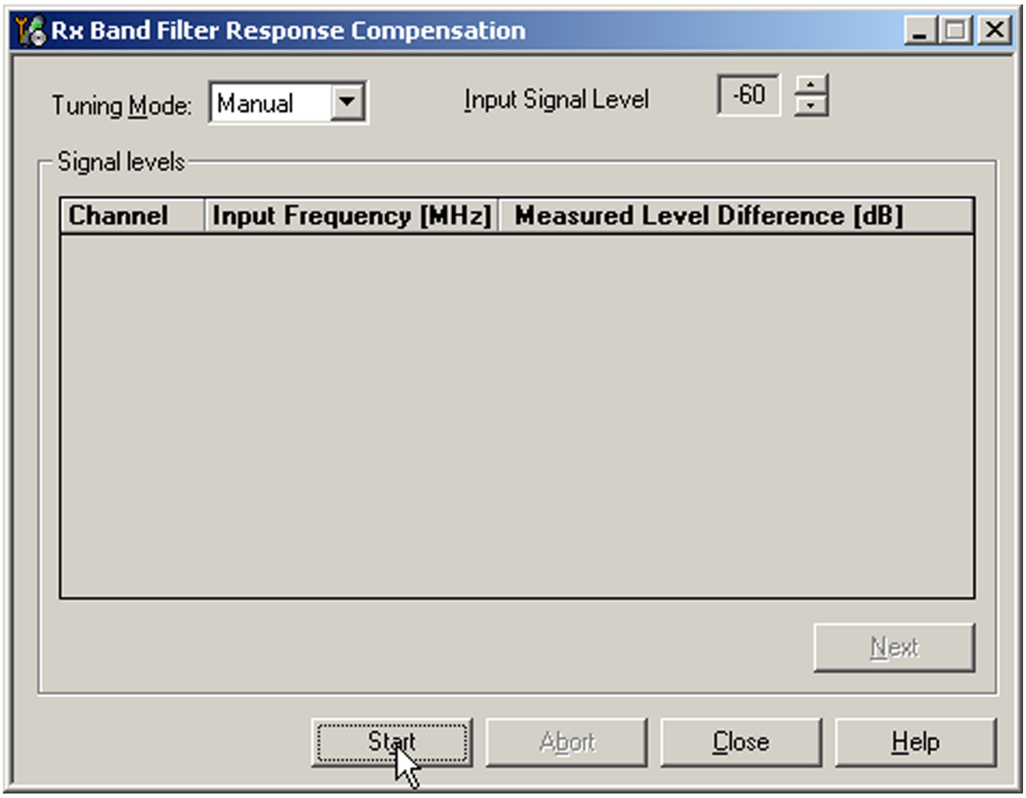
Context

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

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. Choose **File Scan Product**.
4. From the **Operating mode** drop-down menu, set mode to **Local**.
5. Select **GSM900** band.
6. Choose **Tuning→GSM→Rx Band Filter Response Compensation.**
7. From the *Tuning mode* drop-down menu, select **Manual**.
8. Click **Start**.



Rx Band Filter Response Compensation

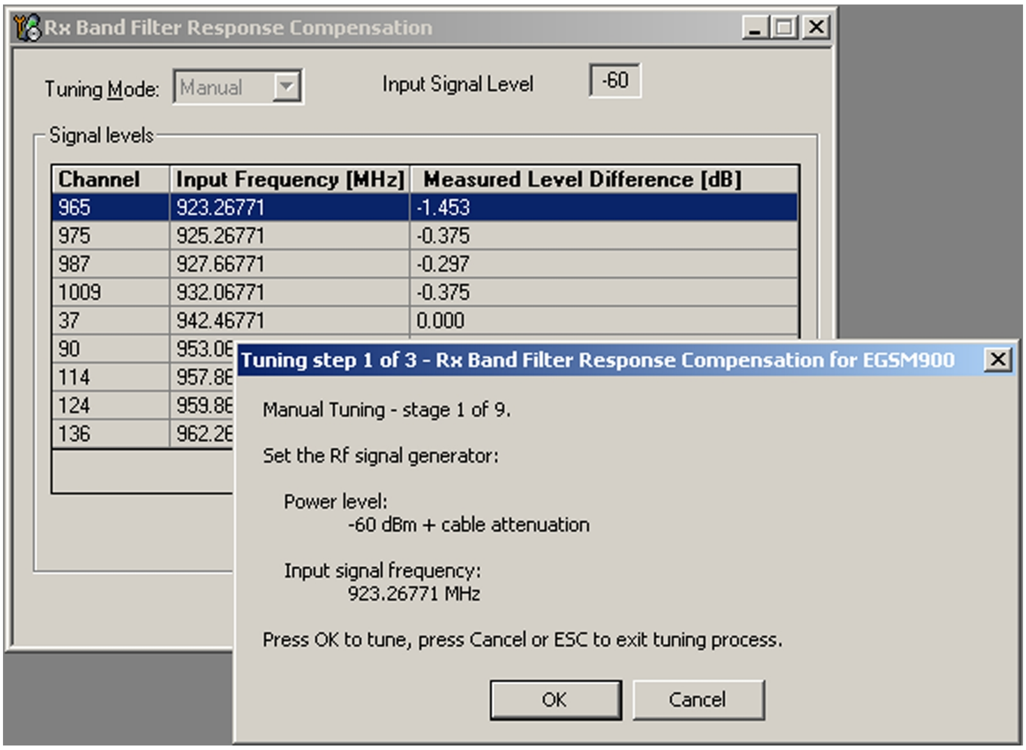
Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]

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



Rx Band Filter Response Compensation

Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-1.453
975	925.26771	-0.375
987	927.66771	-0.297
1009	932.06771	-0.375
37	942.46771	0.000
90	953.06	
114	957.86	
124	959.86	
136	962.26	

Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900

Manual Tuning - stage 1 of 9.

Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

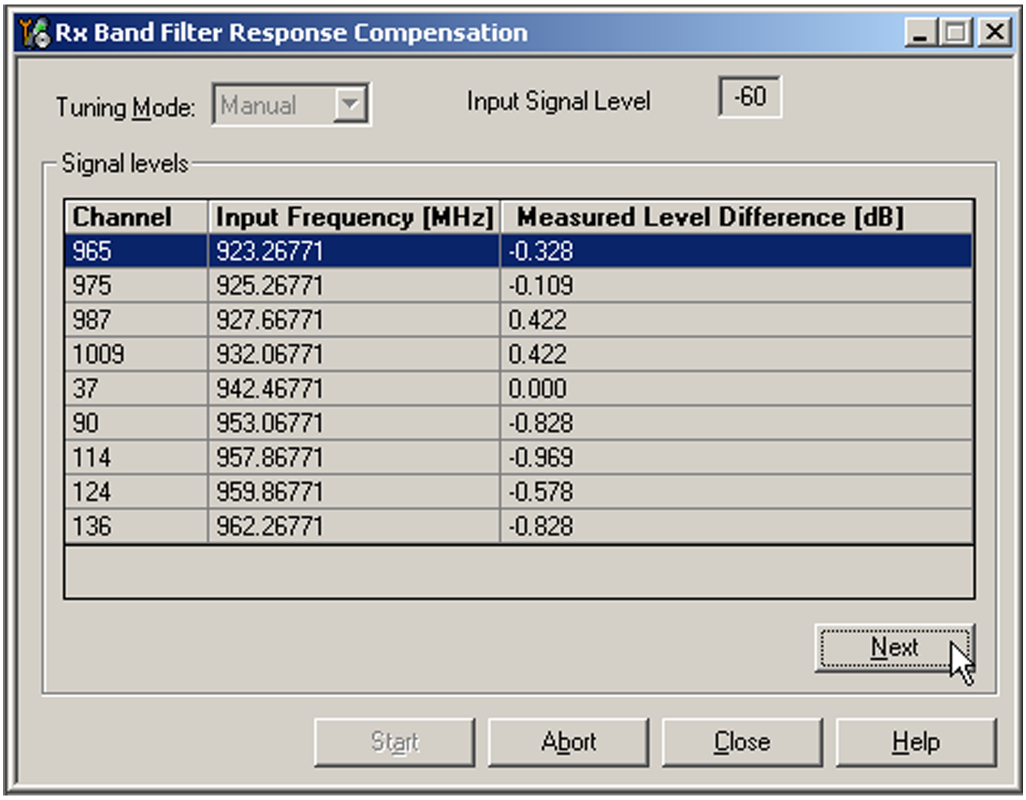
Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

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

11. Go through all 9 frequencies.

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



Rx Band Filter Response Compensation

Tuning Mode: Manual

Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

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

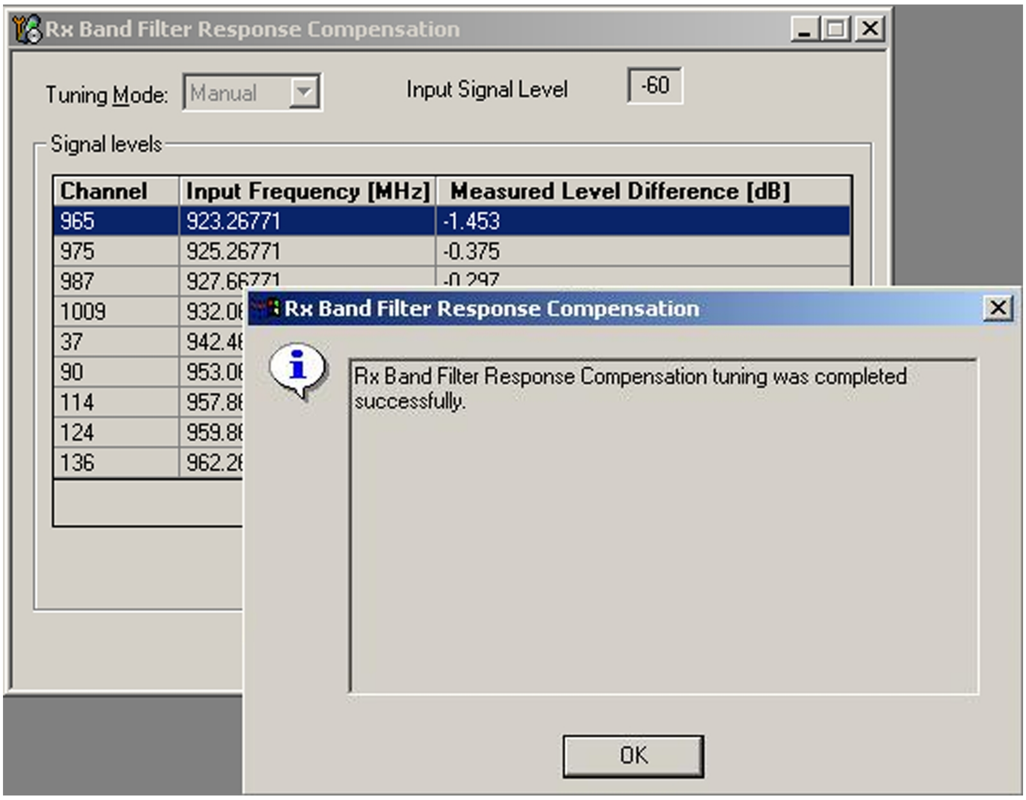
	Min	Typ	Max	Unit
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB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

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

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

14. Go through all bands, and click **Close** to end the tuning.

Results



Tuning Mode: Manual
Input Signal Level -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-1.453
975	925.26771	-0.375
987	927.66771	-0.297
1009	932.0	
37	942.4	
90	953.0	
114	957.8	
124	959.8	
136	962.2	

Rx Band Filter Response Compensation tuning was completed successfully.

Rx AM suppression (GSM)

Context

Rx AM suppression is used to tune the AM suppression capabilities of the GSM receiver.

AM suppression is related to the ability of the receiver to operate when there is a disturbing AM modulated signal near the received channel signal frequency.

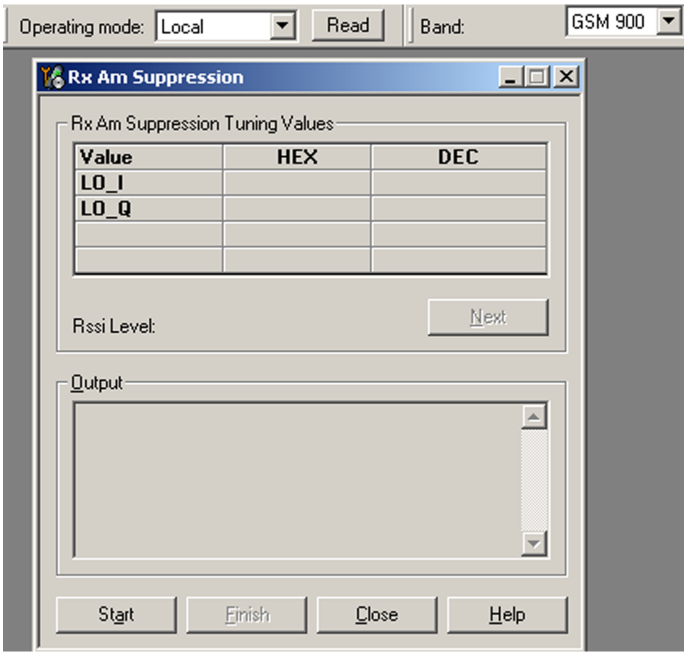
RFIC has a tunable compensation circuit which has an effect on the AM suppression ability.

In Rx AM suppression, a continuous signal accompanied with an AM modulated signal 10 MHz above the current channel is feed to the antenna. RFIC control word values are iterated until a minimum RSSI signal is found.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. Choose **File→Scan Product.**
4. From the drop-down menus, set **Operating mode** to **Local**, and select the **GSM900** band.
5. Choose **Tuning→GSM→Rx AM Suppression.**

6. Click **Start**.



Operating mode: Local

Band: GSM 900

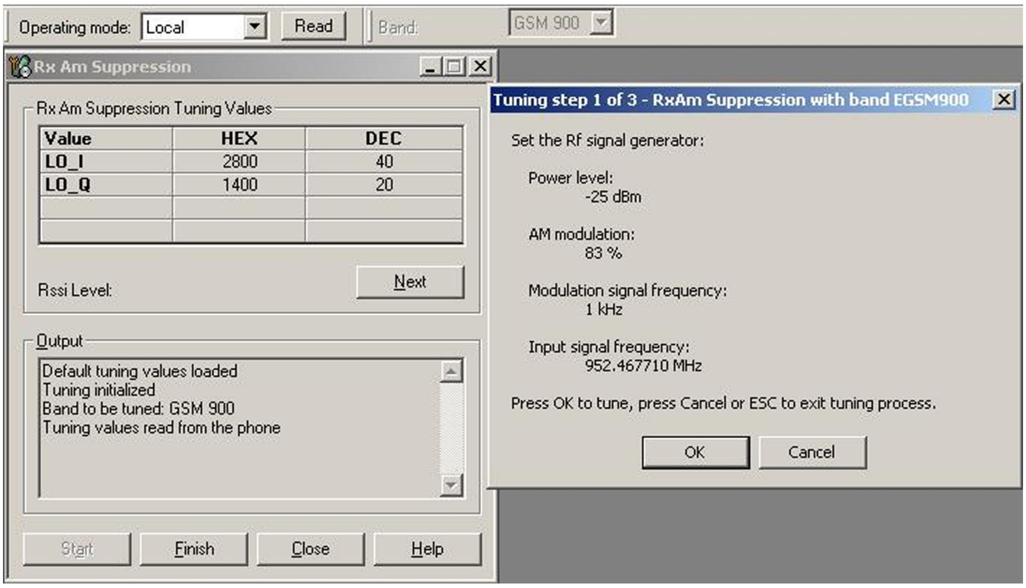
Rx Am Suppression

Rx Am Suppression Tuning Values

Value	HEX	DEC
LO_I		
LO_Q		

Rssi Level:

7. Connect the signal generator to the phone according to the frequency and modulation parameters displayed in the pop-up window:



Operating mode: Local

Band: GSM 900

Rx Am Suppression

Rx Am Suppression Tuning Values

Value	HEX	DEC
LO_I	2800	40
LO_Q	1400	20

Rssi Level:

Output

Default tuning values loaded
Tuning initialized
Band to be tuned: GSM 900
Tuning values read from the phone

Tuning step 1 of 3 - RxAm Suppression with band EGSM900

Set the Rf signal generator:

Power level:
-25 dBm

AM modulation:
83 %

Modulation signal frequency:
1 kHz

Input signal frequency:
952.467710 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

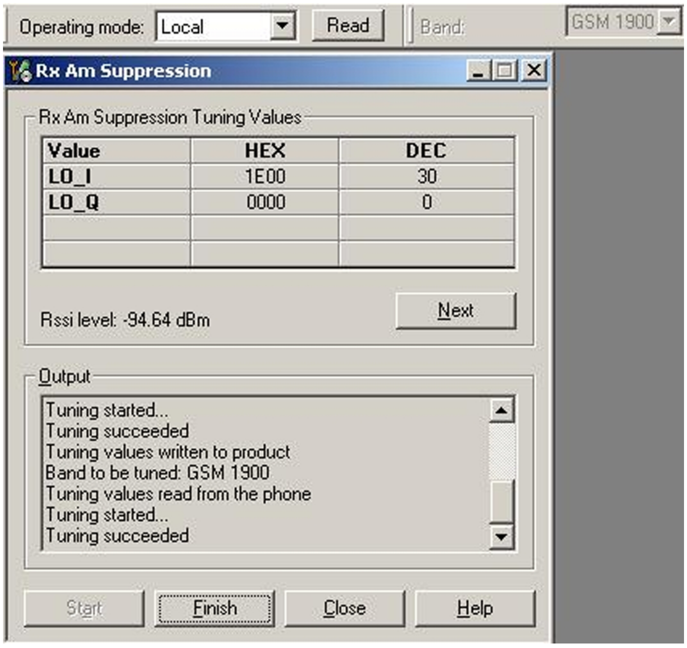
8. Click **OK**.

9. Check that RSSI level value is between the limits presented in the following table.

Table 14 RSSI level values

Band	Min	Max	Unit
GSM900	-115	-90	dB
GSM1800	-115	-85	dB
GSM1900	-115	-100	dB

10. To proceed to the next band, click **Next**.
11. Go through all bands.
12. To end the tuning, click **Finish** and **Close**.



Value	HEX	DEC
LO_I	1E00	30
LO_Q	0000	0

Rssi level: -94.64 dBm

```
Tuning started...
Tuning succeeded
Tuning values written to product
Band to be tuned: GSM 1900
Tuning values read from the phone
Tuning started...
Tuning succeeded
```

GSM transmitter tunings

Tx IQ tuning (GSM)

Context

- The Tx path branches to I and Q signals at the RF I/Q modulator. Modulator and analog hardware located after the modulator cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.
- Tx IQ tuning must be performed on all GSM bands.

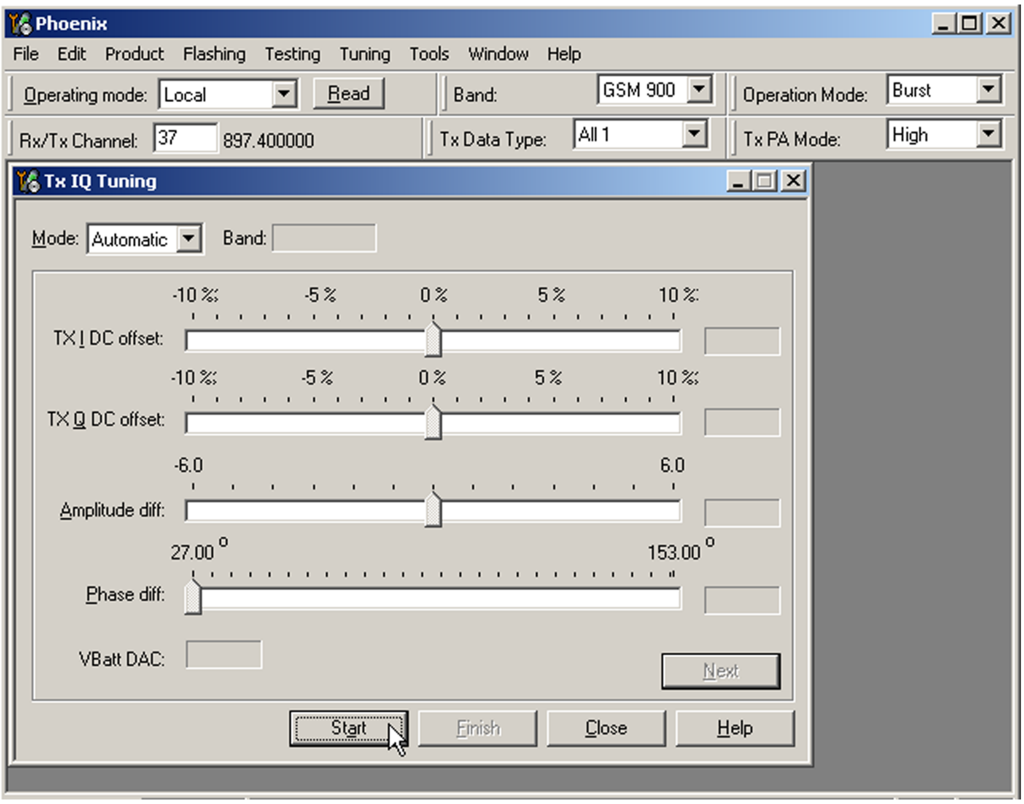
Steps

1. Start *Phoenix* service software.
2. Choose **File→Scan Product.**
3. From the **Operating mode** drop-down menu, set mode to **Local.**
4. Choose **Tuning→GSM→Tx IQ Tuning.**
5. From the **Band** drop-down menu, choose **GSM900**.
6. In the *Tx IQ Tuning* window, set mode to **Automatic**.
7. Click **Start**.

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

   Values are written to the phone memory automatically.

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

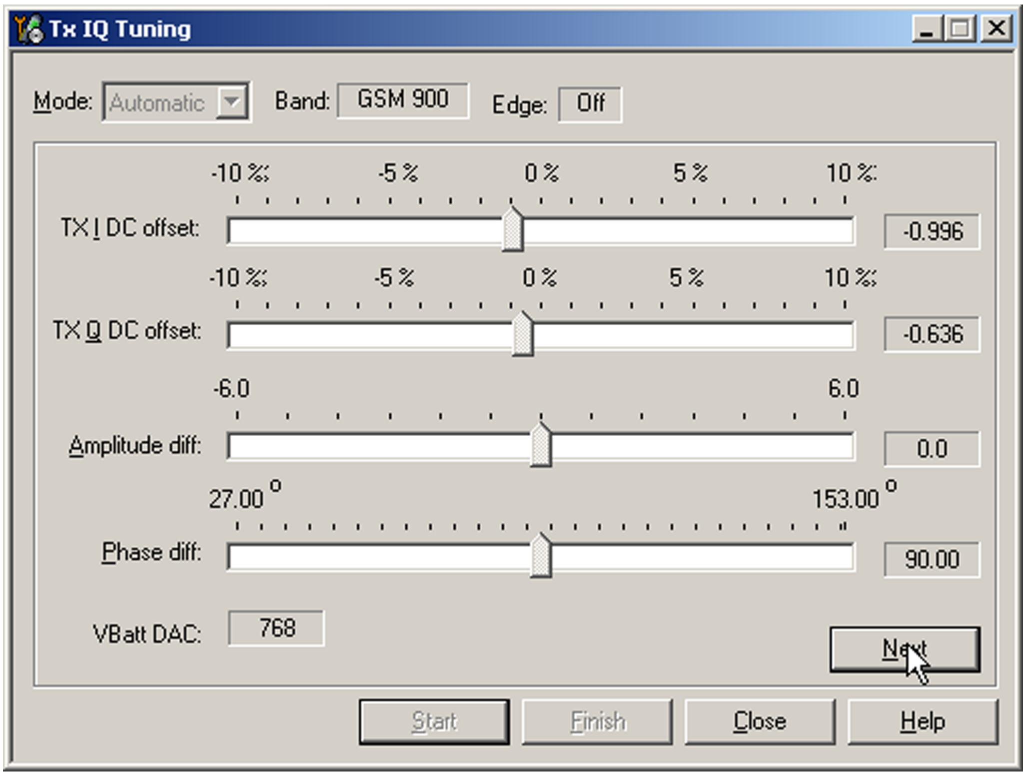


Operating mode: Local
Band: GSM 900
Operation Mode: Burst
Rx/Tx Channel: 37 897.400000
Tx Data Type: All 1
Tx PA Mode: High
Mode: Automatic

Table 15 Tx IQ tuning limits

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

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



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

Next actions

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

Tx power level tuning (GSM)

Context

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

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

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

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

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning.**

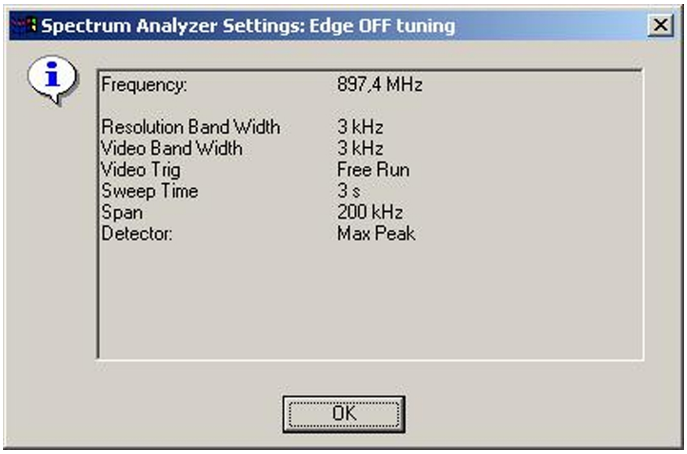
5. Click **Start**.

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

6. Set the spectrum analyzer for power level tuning:

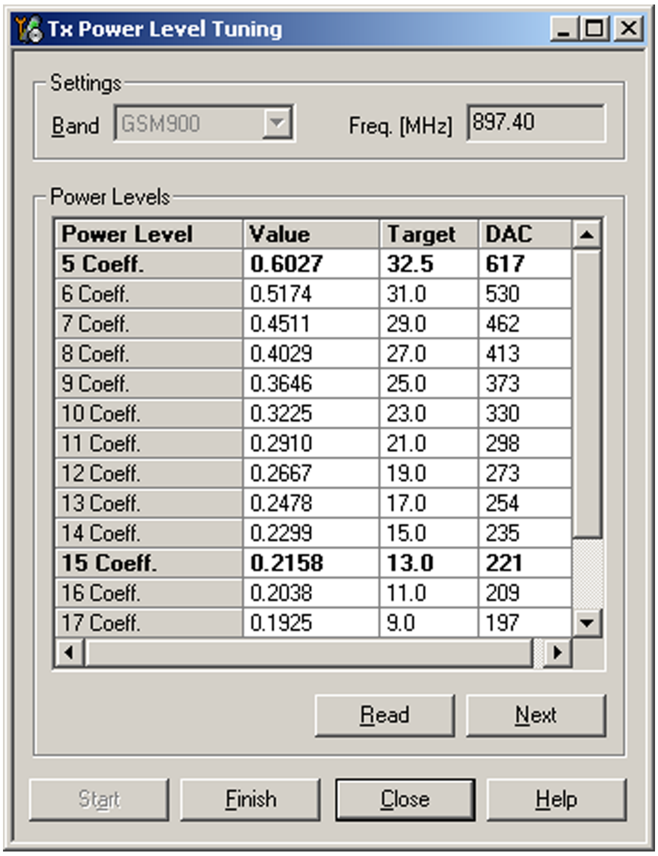
Frequency	channel frequency (897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900)
Span	200 kHz
Sweep time	3s
Trigger	Video triggering: Free run
Resolution BW	3 kHz
Video BW	3 kHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

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



Frequency:	897,4 MHz
Resolution Band Width	3 kHz
Video Band Width	3 kHz
Video Trig	Free Run
Sweep Time	3 s
Span	200 kHz
Detector:	Max Peak

7. Adjust power levels **5**, **15** and **19** to correspond the *Target dBm* column by pressing + or – keys.



Band: GSM900

Freq. [MHz]: 897.40

Power Level	Value	Target	DAC
5 Coeff.	**0.6027**	**32.5**	**617**
6 Coeff.	0.5174	31.0	530
7 Coeff.	0.4511	29.0	462
8 Coeff.	0.4029	27.0	413
9 Coeff.	0.3646	25.0	373
10 Coeff.	0.3225	23.0	330
11 Coeff.	0.2910	21.0	298
12 Coeff.	0.2667	19.0	273
13 Coeff.	0.2478	17.0	254
14 Coeff.	0.2299	15.0	235
15 Coeff.	**0.2158**	**13.0**	**221**
16 Coeff.	0.2038	11.0	209
17 Coeff.	0.1925	9.0	197

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

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

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

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

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

8 — Camera Module Troubleshooting

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Table of Contents

List of Figures

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Introduction to camera module troubleshooting

Background, tools and terminology

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

1. Camera is not functional at all; no image can be taken.
2. Images can be taken but there is nothing recognizable in them.
3. Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded.

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

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

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

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

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

Terms

Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination.
Resolution	Usually the amount of pixels in the camera sensor. In some occasions the term resolution is used for describing the sharpness of the images.
Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.

Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

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

Distance to target

The lens in the module is specified to operate satisfactorily from 64 cm to infinite distance of scene objects. In practice, the operation is such that close objects may be noticed to get more blurred when distance to them is shorter than 64 cm. The lack of sharpness is first visible in full resolution images. If observing just the viewfinder, even very close objects may seem to appear sharp. This is normal; do not change the camera module.

Figure 66 Blurred image. Target too close.

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in the night mode is ¼ seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

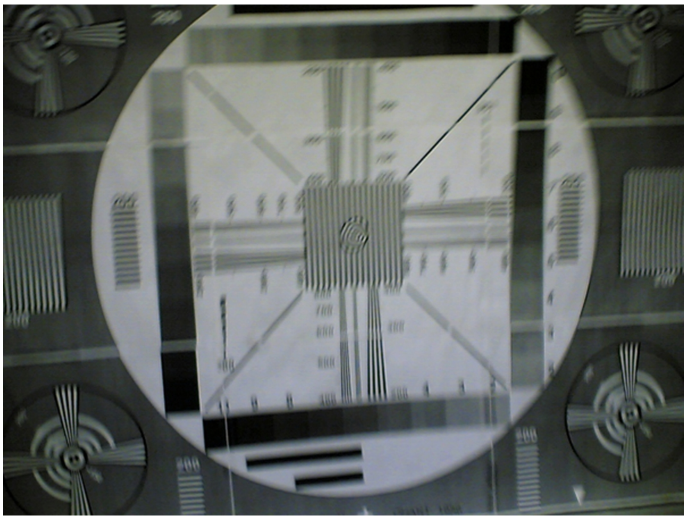


Figure 67 Blurring caused by shaking hands

Movement in bright light

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

Figure 68 Near objects get skewed when taking images from a moving vehicle

Temperature

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

Figure 69 Noisy image taken in +70 degrees Celsius

Phone display

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

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

Figure 70 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. This is normal behaviour; do not change the camera module.

Figure 71 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

Figure 72 A lens reflection effect caused by sunshine

Examples of good quality images

Figure 73 Good image taken indoors

Figure 74 Good image taken outdoors

Image quality analysis

Testing for dust in camera module

Symptoms and diagnosis

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

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

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

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

Figure 75 Effects of dust on optical path

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

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

Testing camera image sharpness

Symptoms and diagnosis

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

1. The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.
2. The photographed object is too close – the camera lens operates with distances from 64 cm to infinity. This is no cause to replace camera module.
3. User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.
4. There is dirt between the protection window and camera lens.

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

6 The camera lens is misfocused because of a manufacturing error.

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

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

- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

Steps

1. Take several images of small objects in the distance of 1-2 metres.
2. Analyse the images on a PC screen at 100% scaling with the reference images.

   Pay attention to the computer display settings: at least 65000 colors (16-bit) have to be used. True colour (24-bit, 16 million colours) or 32-bit (full colour) setting is recommended.

Next actions

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have a misfocused lens -> change the module.

Re-check the resolution after changing the camera module.

If the changed module produces the same result, the fault is probably in the camera window. Check the window by looking carefully through it when replacing the module.

Dirty camera lens protection window

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

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

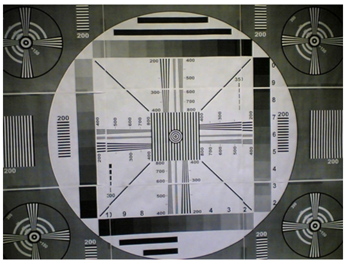


Figure 76 Image taken with clean protection window

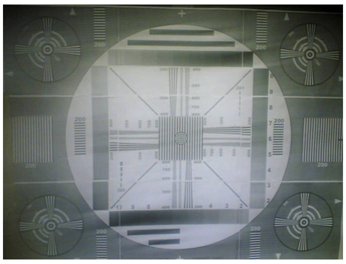


Figure 77 Image taken with greasy protection window

Image bit errors

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

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

Figure 78 Bit errors caused by JPEG compression

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

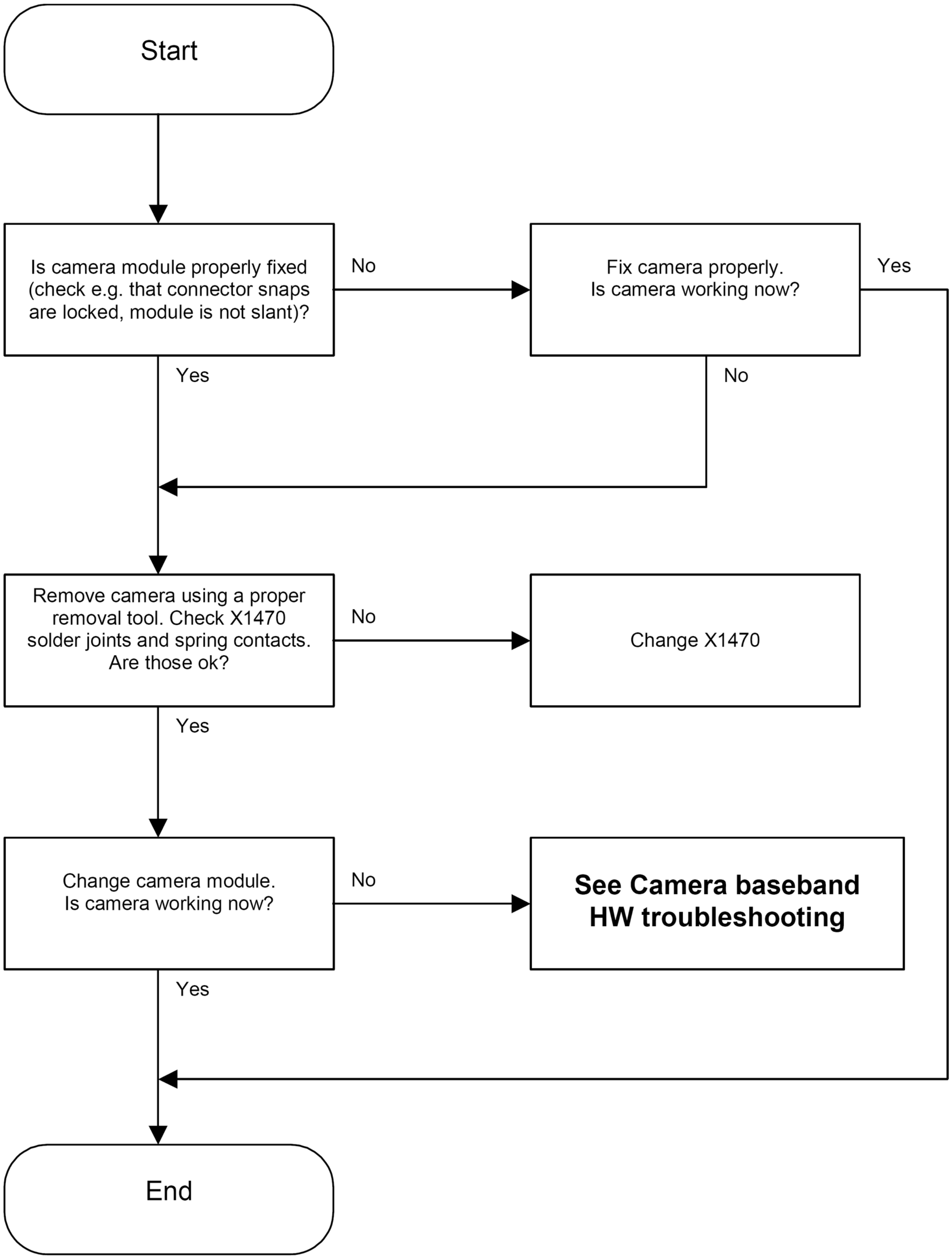
If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

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

Camera troubleshooting flowcharts

Camera hardware failure message troubleshooting

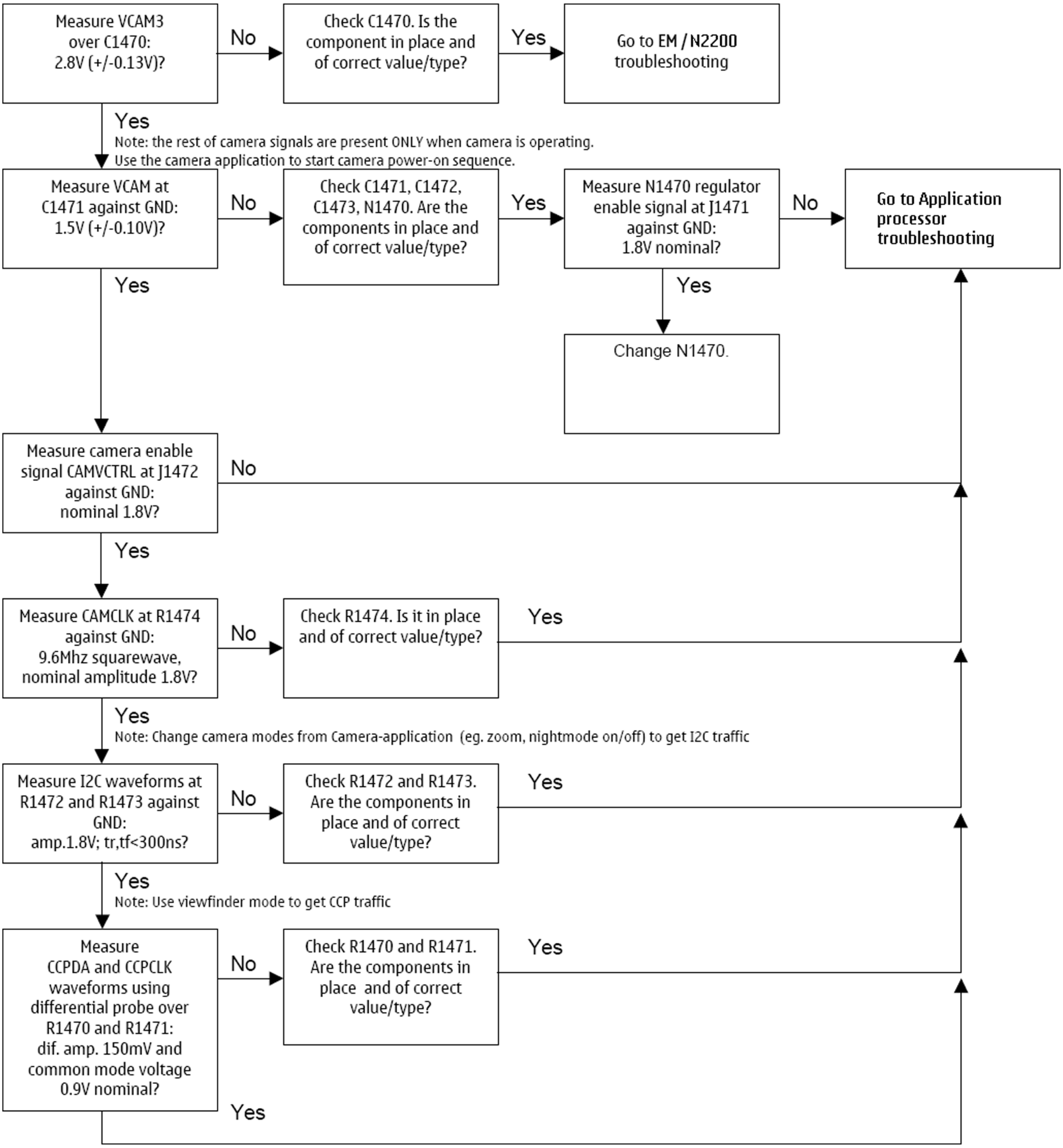
Troubleshooting flow



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

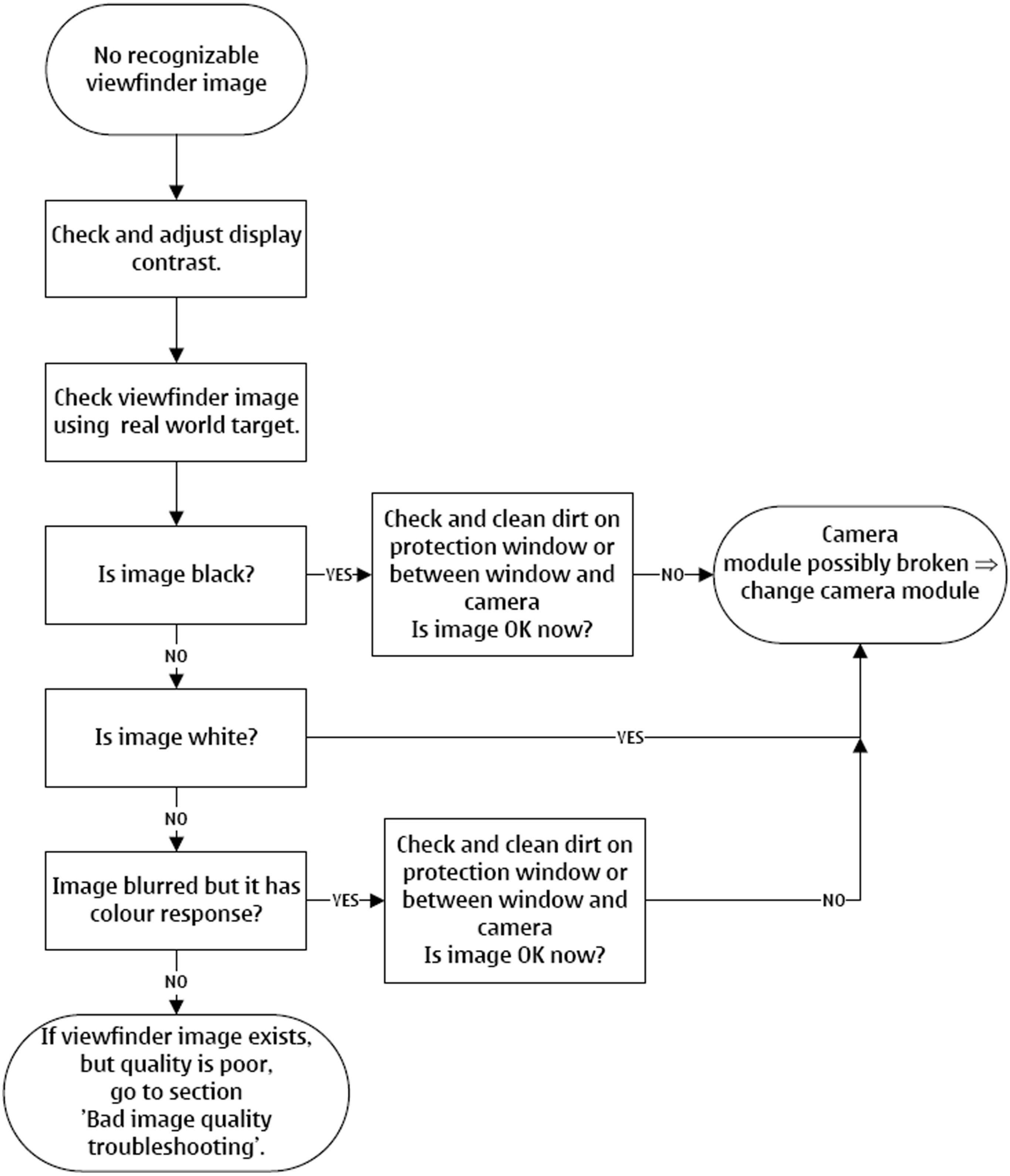
Camera baseband HW troubleshooting

Troubleshooting flow



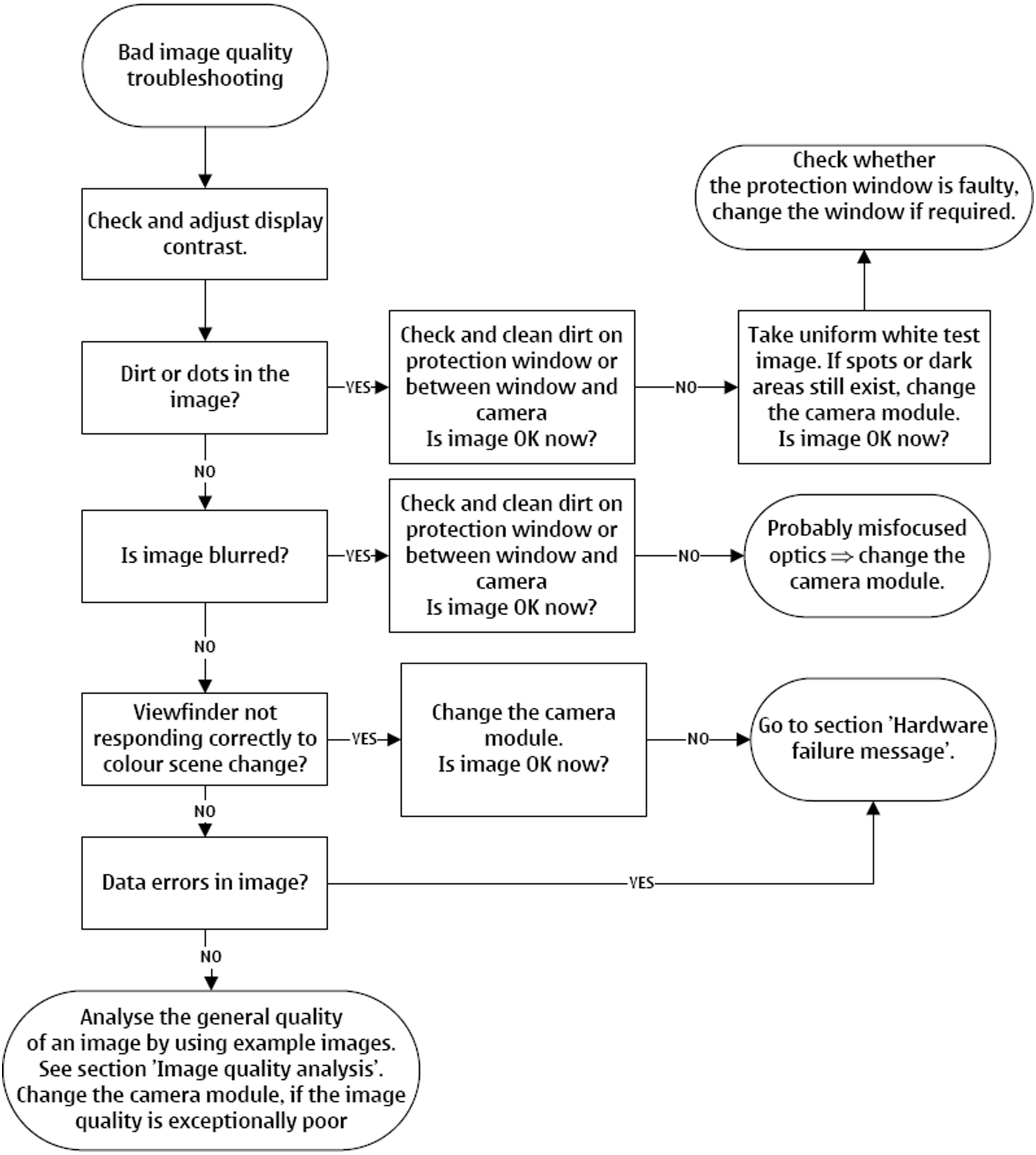
Camera viewfinder troubleshooting

Troubleshooting flow



Bad camera image quality troubleshooting

Troubleshooting flow



Flash LED troubleshooting

Introduction to flash LED troubleshooting

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

1. Flash is not functional at all (no light output at all).
2. Images can be taken and they are recognizable but for some reason the quality of images is degraded.

   Examples of quality degradations:

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

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

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

Flash LED and image taking conditions

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

Figure 79 Example of a good quality image taken with the flash LED

Distance to the target (too close)

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

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

Figure 80 overexposed image

Distance to the target (too far away):

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

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

Figure 81 Dark and noisy image

Shaken (= blurred) images

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

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

Figure 82 Shaken image

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

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

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

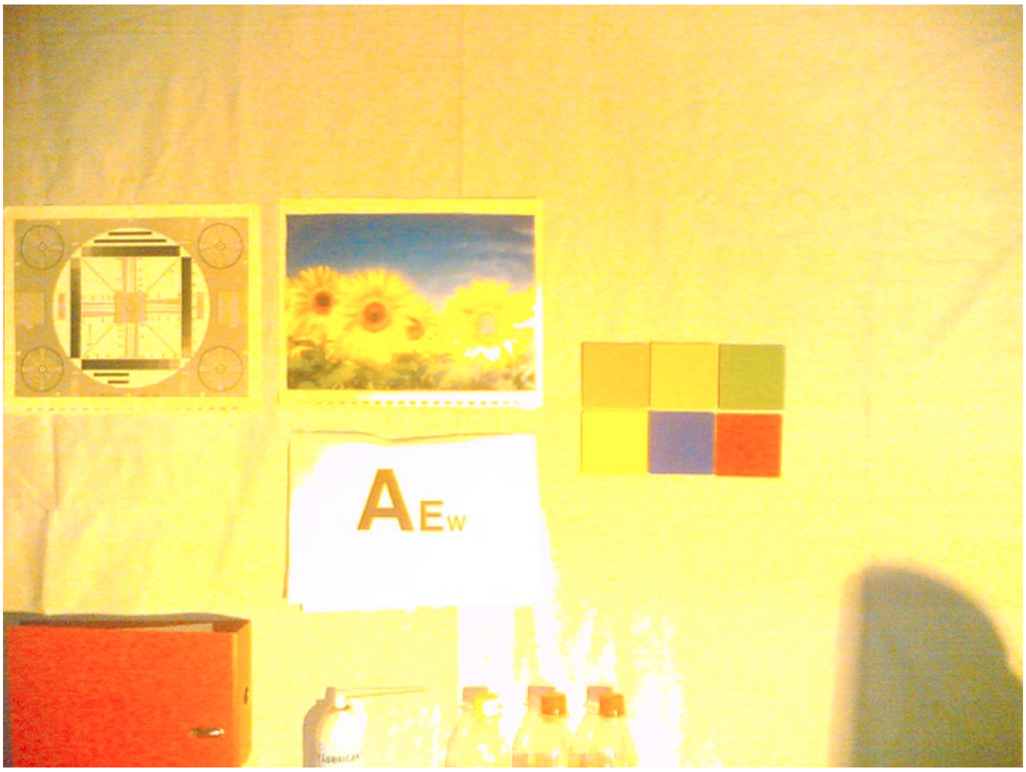


Figure 83 Camera white balance failure and overexposure

Colour difference between different modules

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

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

Figure 84 Color difference between flash colour limit samples

Flash LED construction

This section describes the mechanical construction of the LED flash module.

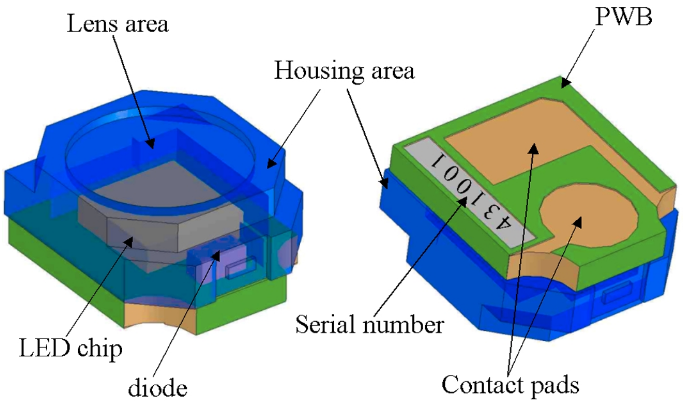


Figure 85 Mechanical construction of the flash LED module

The flash LED module as a component is not a repairable part, meaning that. components or parts in the module cannot be changed. Only cleaning dust from the lens is allowed using clean compressed air.

The main parts of the module are:

- Housing, which is glued to the PWB
- Lens area (round area on top of the housing with circle patterns)
- LED chip (yellow chip inside the housing), which is soldered to the PWB
- ESD protection diode (black passive component inside the housing), which is soldered to the PWB
- PWB
- Contact pads
- Laser marked serial number

The flash LED is fixed to the phone mechanics with special clips. The contacts to the main PWB are formed by using spring connectors.

Analysing image quality

Possible faults in image quality

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

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

Testing flash module functionality

Context

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

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

Steps

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

Results

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

Testing image colours with flash

Context

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

Steps

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

Results

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

Testing flash power

Context

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

Steps

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

Results

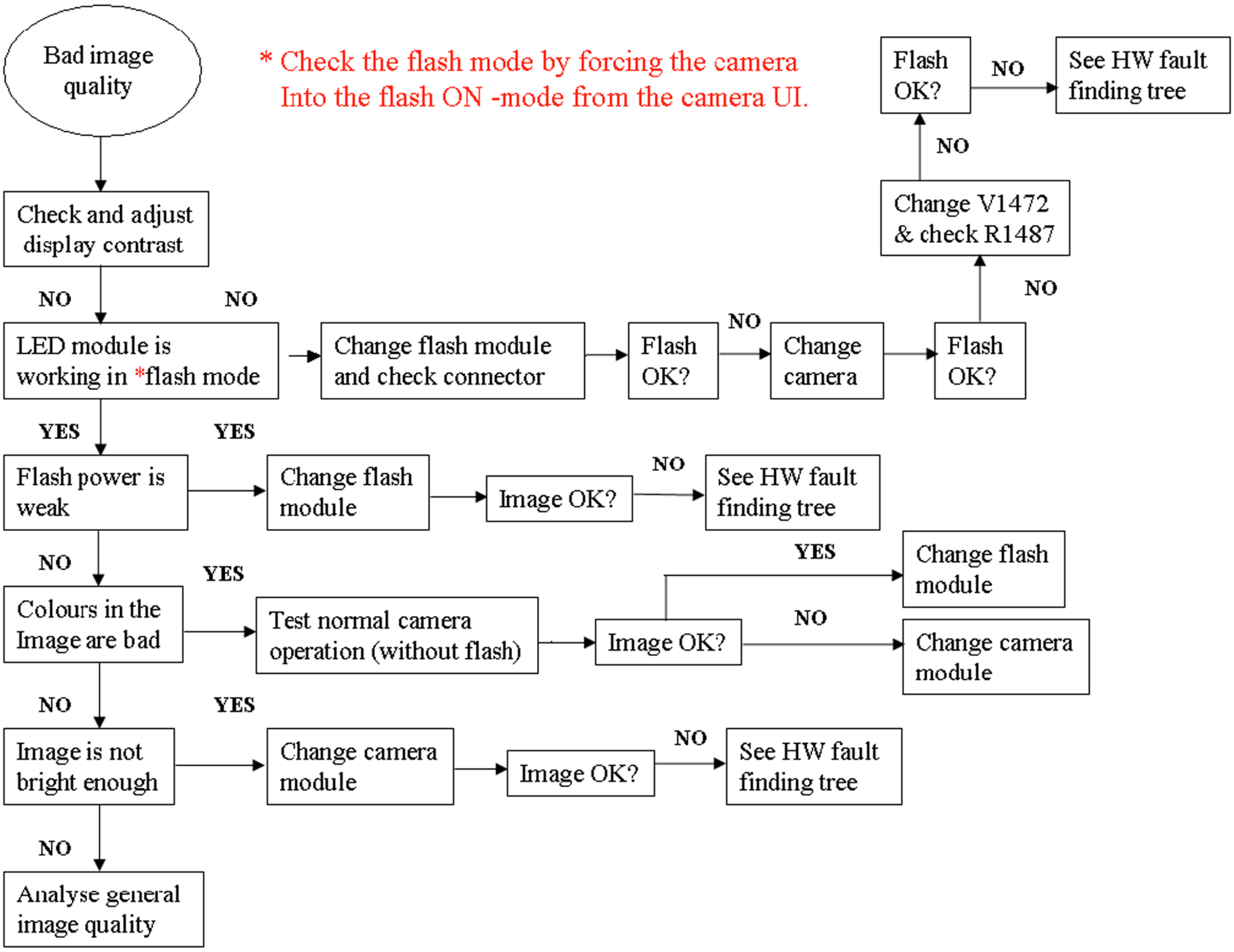
If the flash is working normally with adequate power level, the image is correctly exposed between distances 80 cm to 1 m.

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

Flash LED troubleshooting flowcharts

Bad image quality when using flash LED

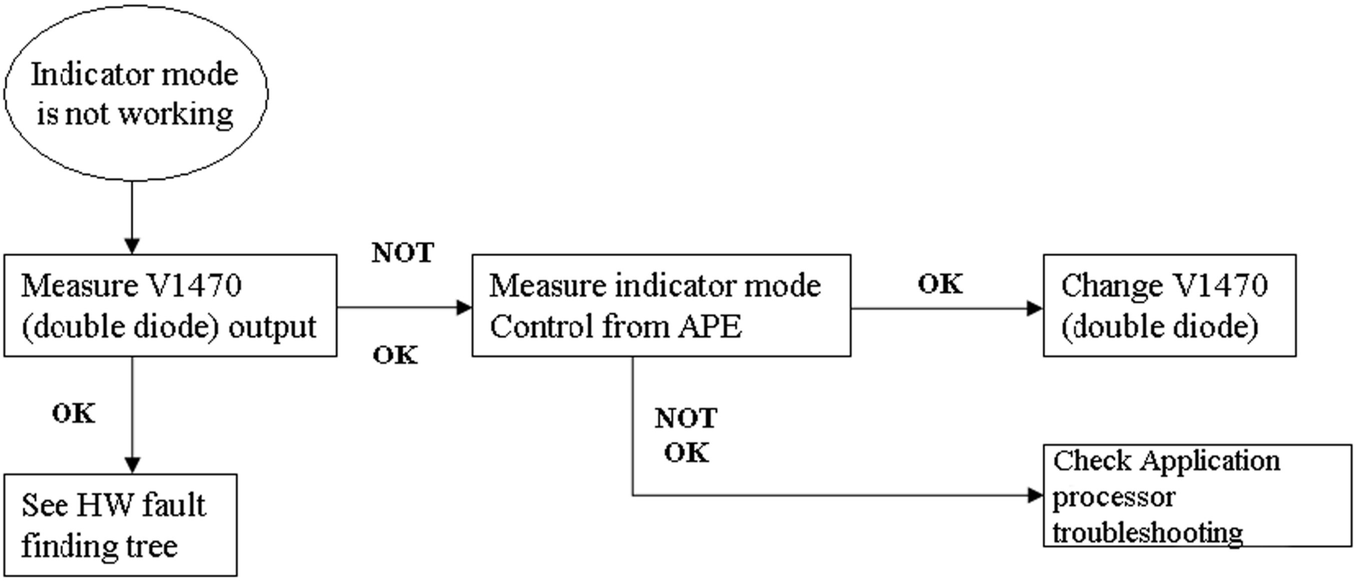
Troubleshooting flow



Flash LED indicator mode troubleshooting

Troubleshooting flow

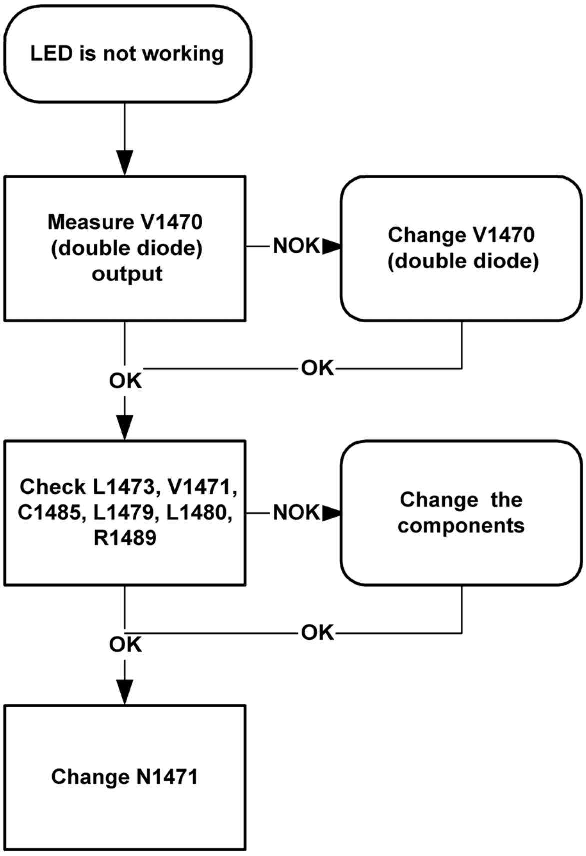
For checking the indicator mode functionality, force the camera to record a video clip and monitor the flash led at the same time. The flash LED should work with very low brightness constantly during the video recording.



Flash LED HW baseband troubleshooting

Troubleshooting flow

If there are problems in the flash LED driver circuit, the testing procedure is complicated, because the driver circuit output cannot be reliably measured without the load (LED). Load (LED) is always disconnected from the output when the phone is disassembled.



9 — System Module

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Baseband description

System module block diagram

The device consists of two different main modules: transceiver and UI. The transceiver board consists of baseband and RF components. The UI board consists of key domes and keypad backlights. Connection between the UI and the transceiver board is established via a board-to-board spring connector.

Note: In this description, the user interface hardware includes the following components: display, camera, keyboard, keyboard backlight and ALS.

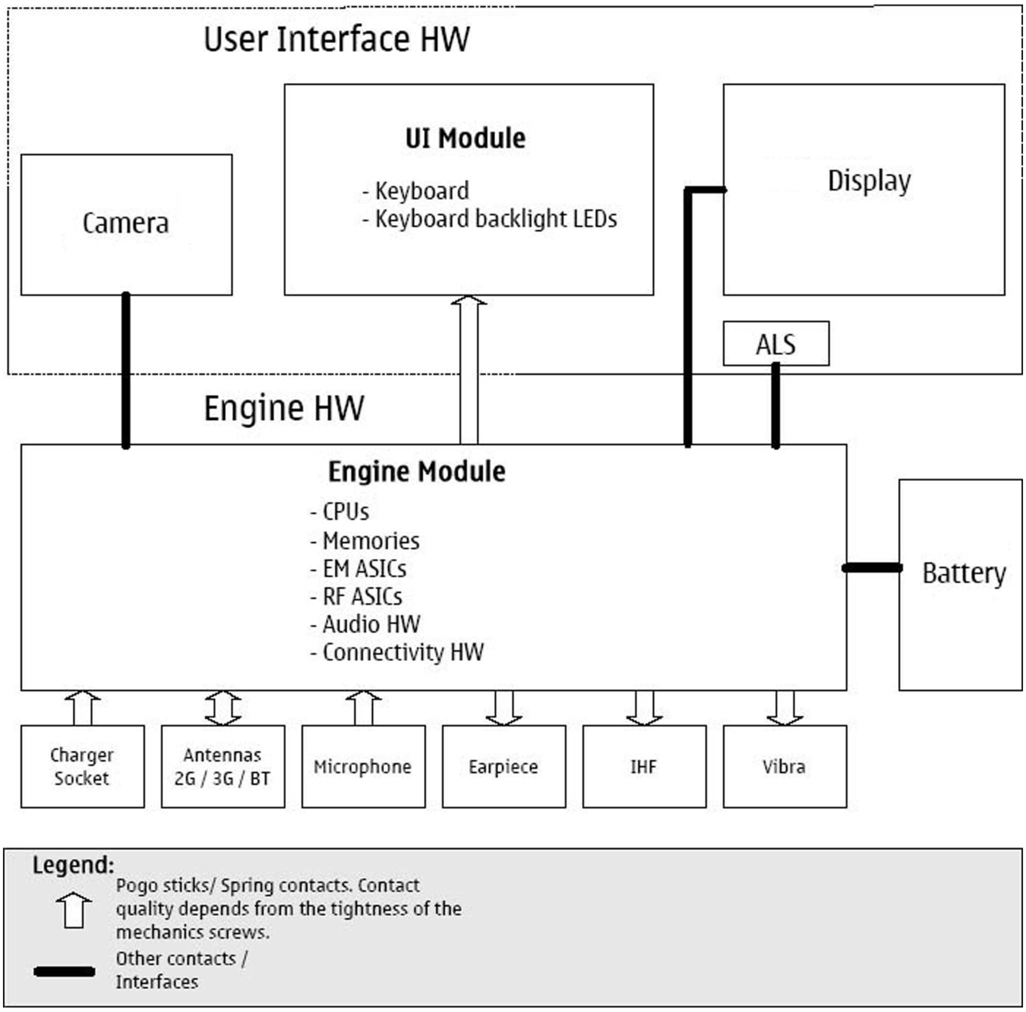


Figure 86 System level block diagram

Baseband functional description

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

The modem section consists of a RAP ASIC with NOR FLASH and SDRAM memory as the core. RAP supports the GSM (EDGE class 10, GPRS phase2) cellular protocol. The modem SDRAM memory has 64Mbits of memory and NOR flash has 64Mbits of memory. RAP operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

The application section includes an application processor ASIC with DDR/NAND combo memory as the core. The ASIC uses a 19.2 MHz clock, which comes from the RAP divided by two from the 38.4 MHz system clock.

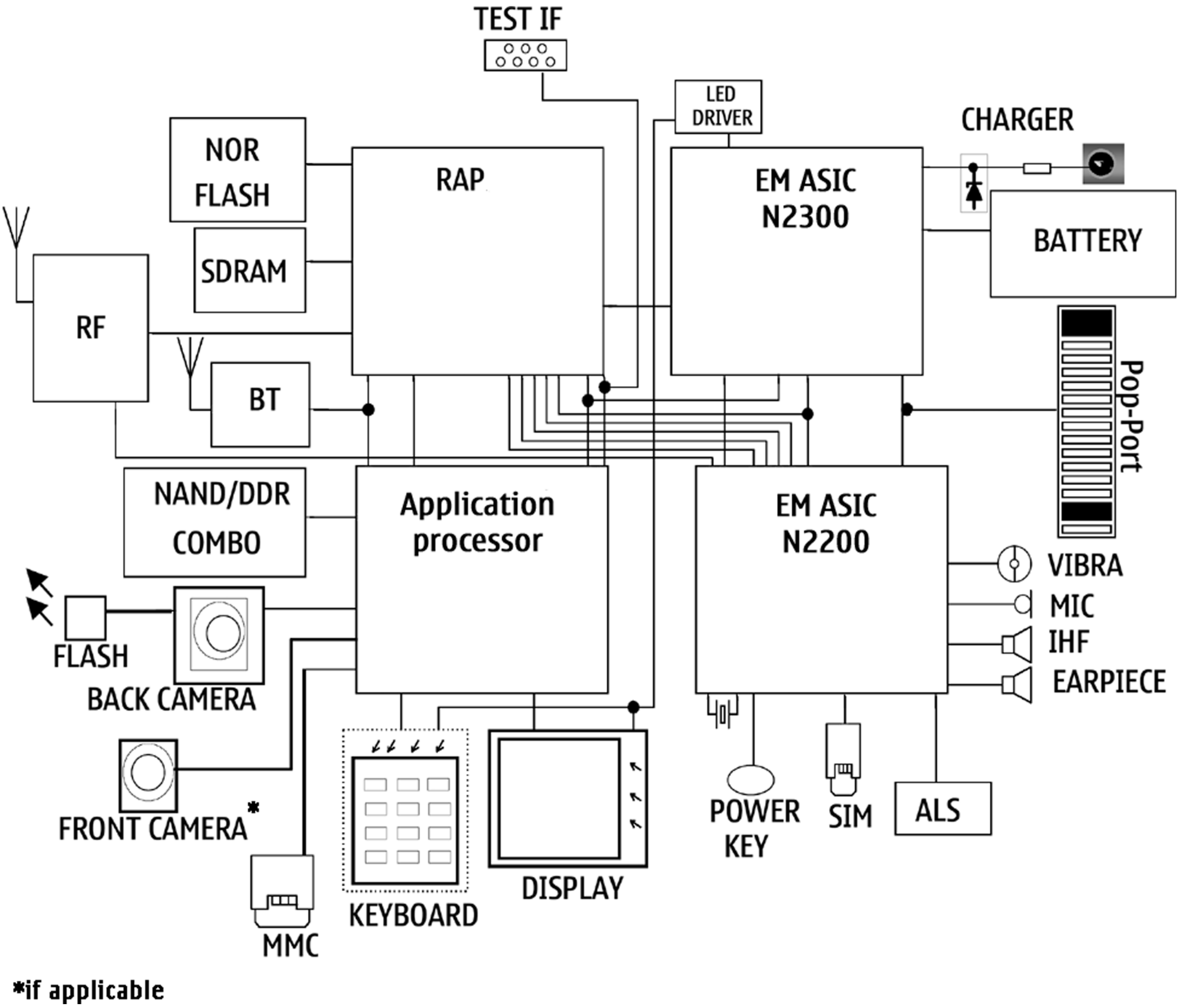


Figure 87 Functional block diagram

The application processor processes the application SW and handles the UI SW. It consists of OMAP3.3 and peripheral subsystems such as camera, display and keyboard driver blocks.

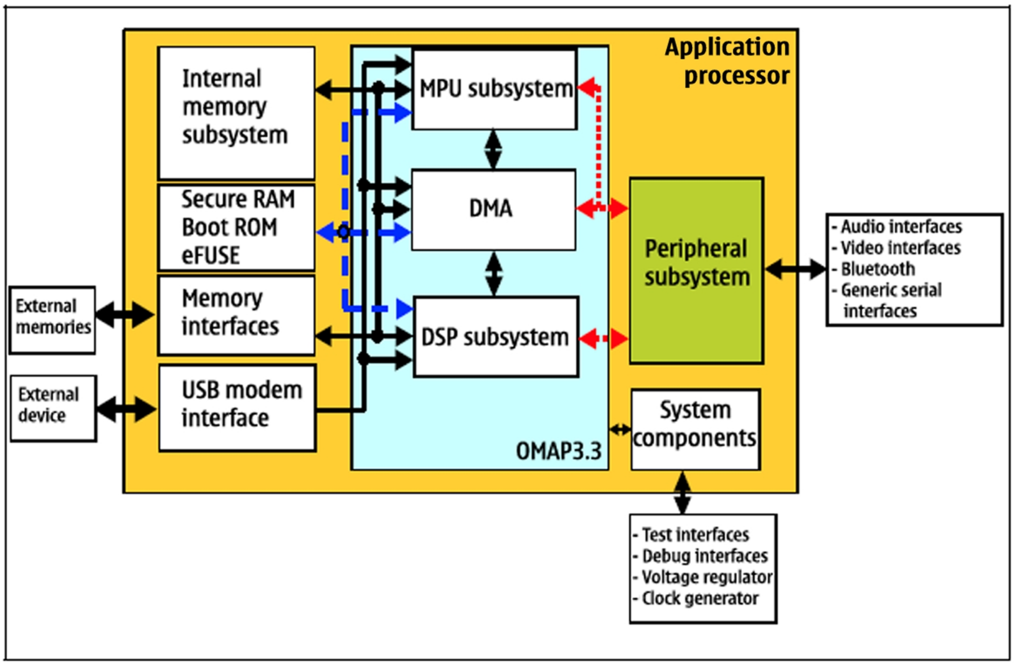


Figure 88 Application processor high level block diagram

Section	Description
Application processor	also called an application ASIC because it is processing application SW and handles the UI SW. It consists of OMAP3.3 and peripheral subsystems like camera, display and keyboard driver blocks.
OMAP3.3	consists of ARM926 (MPU subsystem), TMS320C55x (DSP subsystem), DMA and OMAP3.3s internal peripherals.
Helen3 (OMAP1710) MPU subsystem	based on an ARM926EJ. MPU is able to perform most of the application operations on the chip.
System DMA component	mainly used to help the MPU and DSP perform data memory transfer-specific tasks, leaving more available MIPS for both processors.
DSP subsystem	based on a TMS320C55x™ DSP core, which is responsible for intensive data computing tasks like real-time audio and video handling on application side, e.g. voice recording.
Internal memory subsystem	composed of a single port SRAM.
Secure modules	Application processor contains a set of several components, including ROM, a single port SRAM, and eFUSE cells. These components enable the system to support secure applications.
Memory interfaces	The memory interfaces define the system memory access organization of application processor.

Section	Description
USB & modem interface	These two modules enable the platform to support a universal serial link and a dedicated modem interface, enabling a high data transfer rate between the modem and the application chip.
System components	System components are group of modules responsible for managing system interactions such as interrupt, clock control and idle.
Peripheral subsystem	The peripheral subsystem defines all the components used to interface application processor with specific external devices such as camera, keyboard, display, etc.

Absolute maximum ratings

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

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2200 master reset threshold.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16 ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. There are in principle three different sleep modes: • Application processor sleep • RAP sleep • Application processor and RAP sleep (deep sleep)
FLASHING	FLASHING mode is for SW downloading.

Voltage limits

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

The master reset threshold controls the internal reset of N2200 / (N2300). If battery voltage is above VMSTR, N2300's charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, N2300 allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

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

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

Power distribution

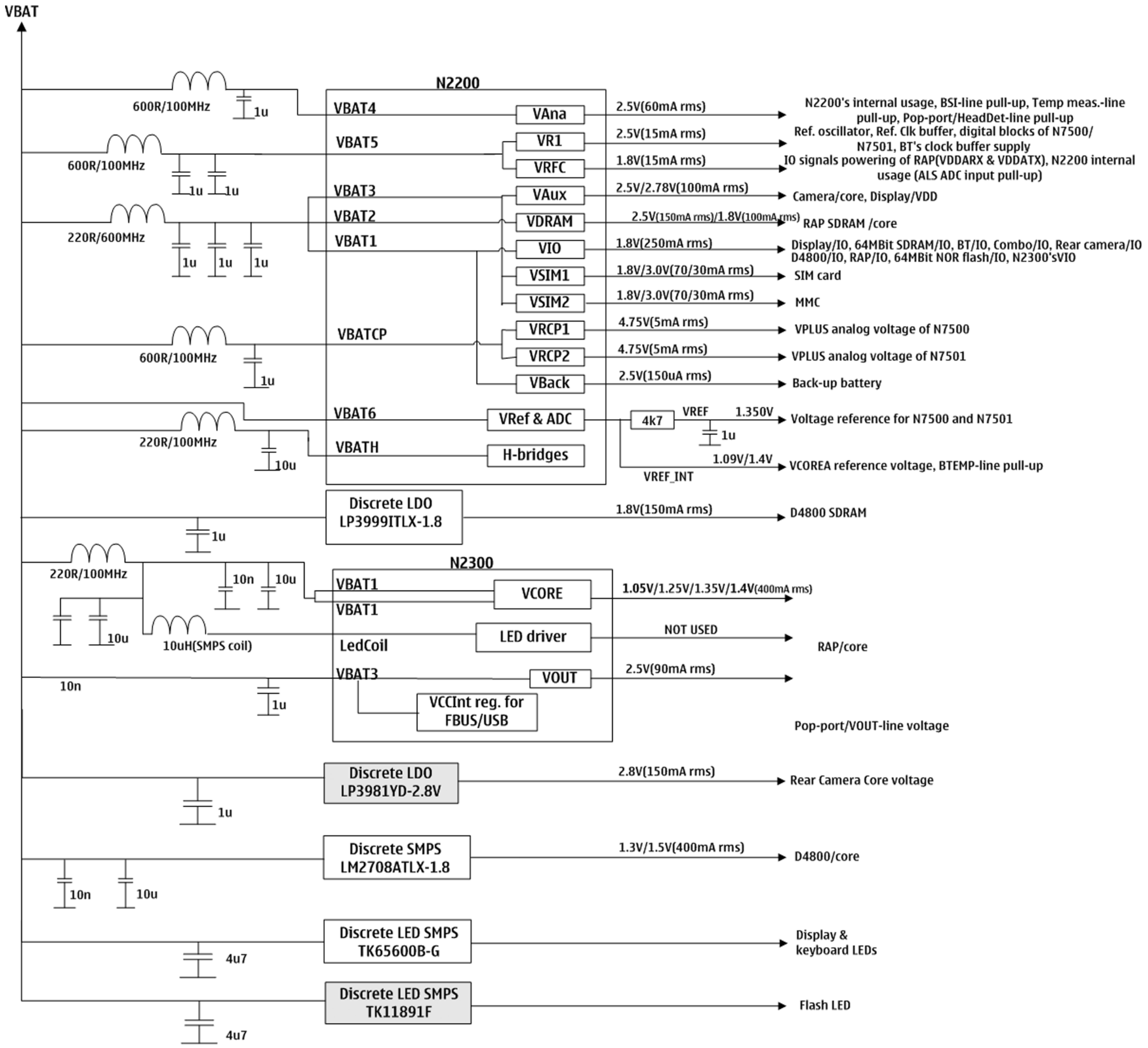


Figure 89 Power distribution diagram

Power supply components:

- N2200
- N2300
- D4800 VCORE SMPS
- BT
- LDO
- camera LDO
- backlight SMPS

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA) and for RF ASICs N7500(Rx) & N7501 (Tx).

Discrete power supplies are used to generate 2.8 V to BT, 1.5 V for the camera IO voltage, 1.3V/1.5V for D4800 and 18V for the backlight LEDs.

The device supports both 1.8V/3 V SIM cards which are powered by N2200 / VSIM1. N2200s VSIM2 is used to power RS MMC 1.8 V only. USB accessories which needs power from the device are powered by N2300 / VOUT.

Because LED driver in N2300 is not used, the external SMPS is used instead. External LED SMPS is still controlled by N2300 and powered by battery voltage.

System power-up

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

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

After that:

- N2200 activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at N2200’s RSTX pin is used for enabling N2300 ASIC.
- N2300 enables VCORE regulator and its internal RC-oscillator (600kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- N2200 will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for N2300 is started to be produced. After PURX is released and two rising edges of 2.4MHz synchronous clock have been detected in SMPSClk input N2300 is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.

Clocking scheme

There are two main clocks in the system: a 38.4 MHz RF clock produced by VCTCXO in the RF section, and a 32.768 kHz sleep clock produced by EM ASIC N2200 with an external crystal.

The RF clock is generated only when VCTCXO is powered on by an N2200 regulator. The regulator itself is activated by SleepX signals from both RAP and the application processor. When both CPUs are on sleep, the RF clock is stopped.

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

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

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

BT Clk is a 38.4 MHz signal from Tx ASIC N7501 to the Bluetooth system.

CLK600 is a 600 kHz signal from N2300 to APE VCORE SMPS. The clock source is an internal RC oscillator in N2300 (during the power-up sequence) or RAP SMPS Clk divided by 4 after the power-up sequence.

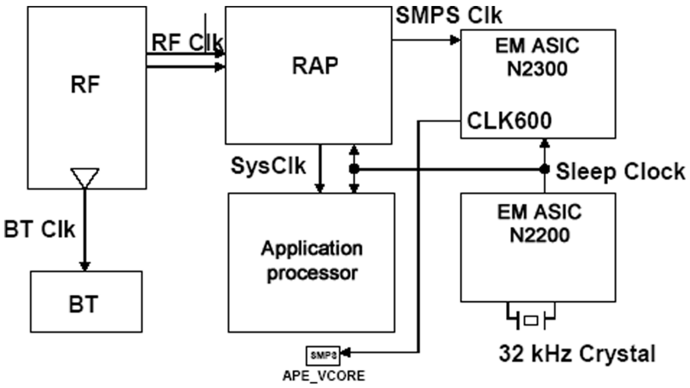


Figure 90 Clocking scheme

Bluetooth/FM module

The device has a module version of Bluetooth, in which BT and FM radio solutions are combined to a single BTHFM module. The module includes all external components except the antenna. However, the two solutions are electrically isolated from one another.

Bluetooth

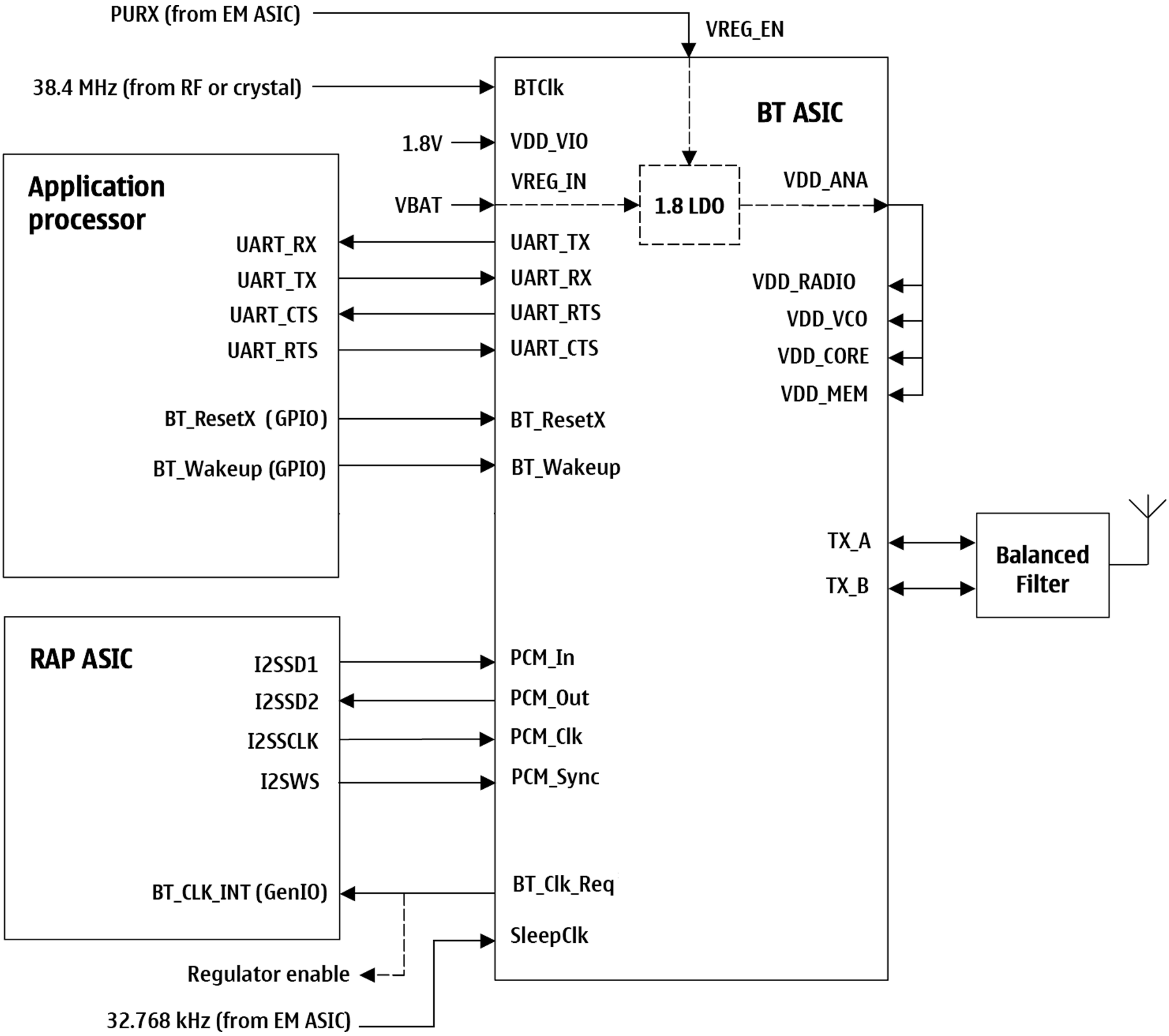
Bluetooth is an open specification for wireless communication of data and voice. It is based on a low-cost short-range radio link between two or more devices. The traditional example is a link between a mobile phone and a laptop computer or a headset.

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

The device Bluetooth is based on the BC4 BT ASIC (BTHFM1.0).

The UART1 interface handles the transfer of control and data information between the application processor and the Bluetooth system. The PCM interface is used for audio data transfer between the RAP ASIC and the Bluetooth system.

The following block diagram shows how the Bluetooth system is connected to the host side.



FM radio

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

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

USB

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

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

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:

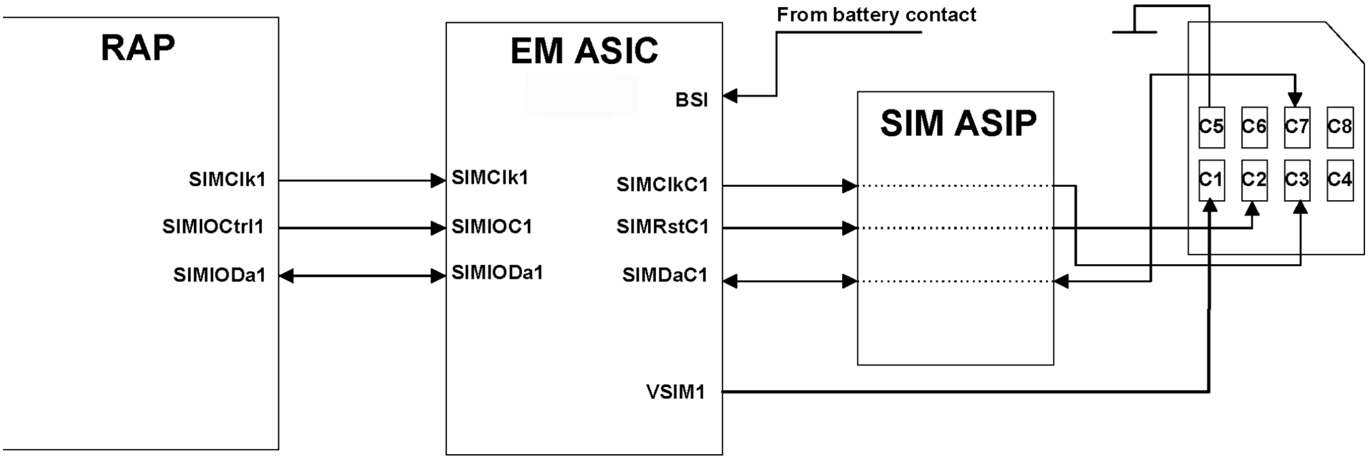


Figure 91 SIM interface

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.

RS MMC interface

The reduced size (24 mm x 18 mm x 1.4 mm) multimedia card slot is located under the battery. The device supports RS MMC hot insertion, which enables to remove/insert the card when the phone is powered on.

The RS MMC card is connected to the application processor MMC/SDIO2 (1.8 V) interface. The MMC interface is shown in the following figure:

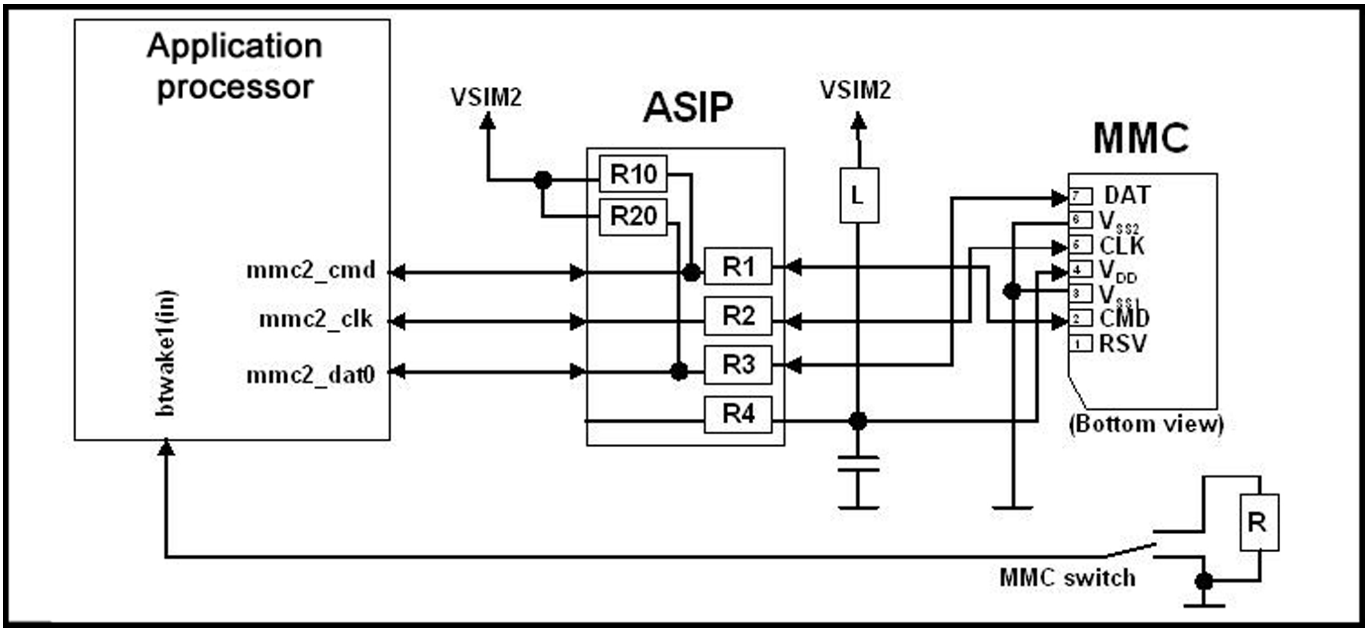


Figure 92 MMC interface

The basic multimedia card concept is based on the following communication signals: CLK, CMD and DAT.

With each cycle of the CLK signal, one bit transfer on the DAT and CMD line is performed. The maximum CLK frequency is 20 MHz.

CMD is a bi-directional command channel used for card initialization and data transfer commands. The CMD signal has two operational modes: open-drain and push-pull mode. The open-drain mode is used for card initialization and the push-pull mode for fast command transfer. CMD commands are sent by the host and CMD responses are sent by the card.

DAT is a bi-directional data channel, which operates in the push-pull mode.

The detection of the RS MMC card removal/insertion is done via the RS MMC cover switch. The RS MMC cover switch gives an interrupt to the SW when the cover is opened or closed. After opening the RS MMC cover lid (RS MMC SW signal is connected to GND via cover switch), SW powers down the card and switches off the RS MMC power supply (VSIM2). When the RS MMC cover lid is closed (RS MMC SW signal is internally connected in the application processor to 1.8 V), the inserted card is identified.

Note: Removing the RS MMC while writing to it, may corrupt the data stored in the card.

Related information

- RS MMC interface connections (page 9–36)

Battery interface

The battery interface supports a 3-pole battery interface. The interface consists of three connectors: VBAT, BSI and GND.

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

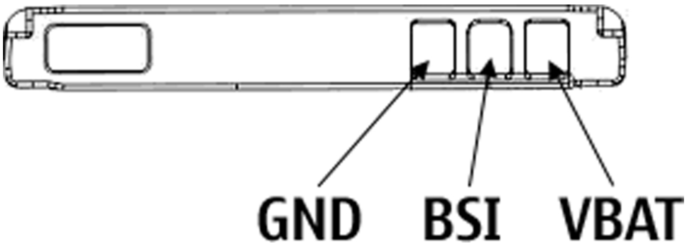


Figure 93 Battery pin order

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

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

Camera interface

Camera interface

The device uses a 2.0 megapixel camera module with a sensor resolution of 1600 x 1200. The following block diagram shows how a CCP bus is used to transfer image data from the camera module to the phone engine. This bi-directional control bus is a software-implemented I2C interface.

The camera regulator N1470 powers the digital parts of the camera, and a camera regulator N1471 is used for powering the analogue parts.

A CAMVCTRL signal (Vctrl) is used for activating the camera module. When the Vctrl signal is Low, the module enters the power on mode. When the signal is High, the module enters the power off mode.

A CAMCLK signal feeds the system clock for the camera module.

Camera construction

This section describes the mechanical construction of the camera module for getting a better understanding of the actual mechanical structure of the module.

Table 16 Camera specifications

Sensor type	CMOS Sensor
Photo detectors	1.9 million
F number/Aperture	f/3.2
Focal length	4.8 mm (35 mm equivalent 37 mm)
Focus range	64 cm to infinity
Still Image resolutions	1600x1200, 640x480
Still images file format	EXIF (JPEG), *.jpg
Video resolutions	352x288, 176x144. Both at 30 frames per second
Video clip length	10 seconds or free, maximal clip length in free mode is 1 hour (limited by the data storing capabilities of the device)
Video file format	3GPP, *.3gp
Exposure	Automatic
White Balance	Automatic

Colours	16.7 million / 24-bit
Capture Modes	Night mode, Sequence mode, self timer

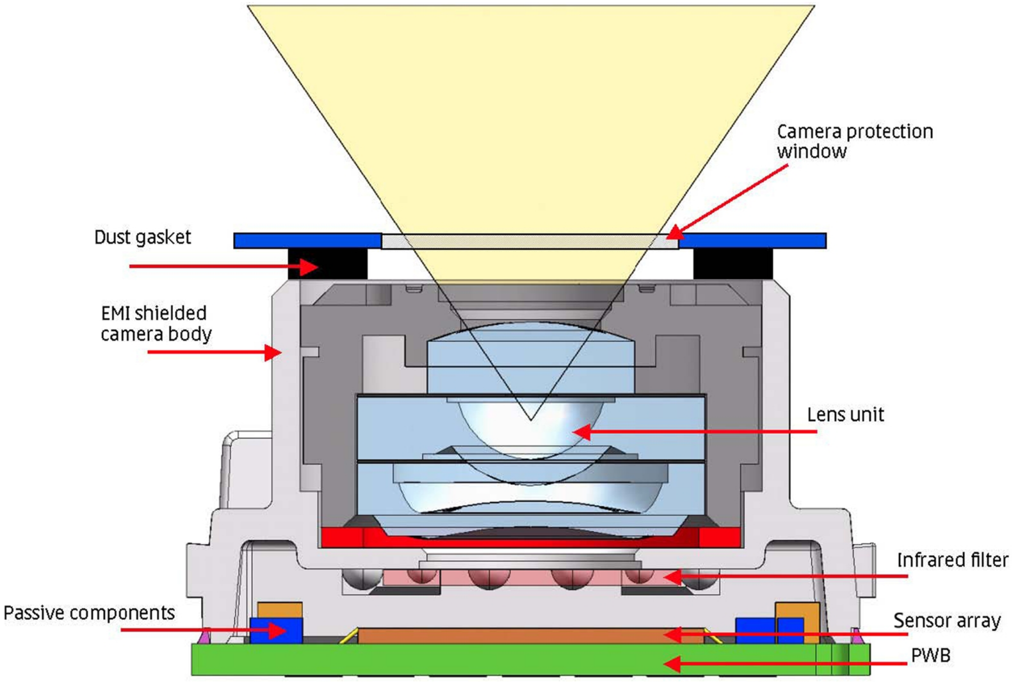


Figure 94 Camera module cross section and assembly principle

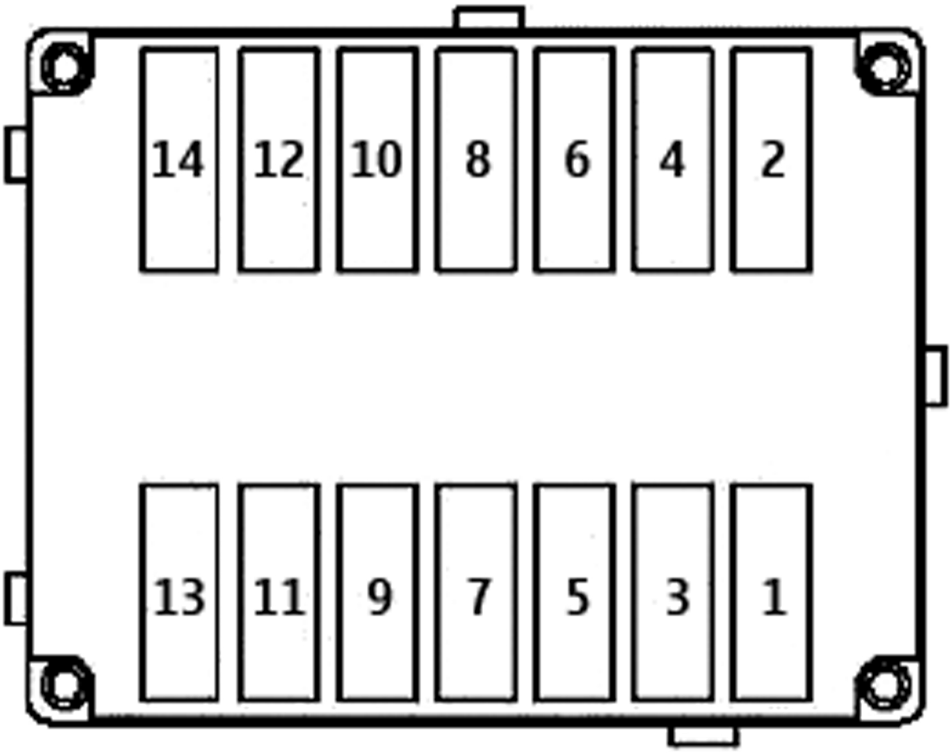


Figure 95 Camera module bottom view including serial numbering

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

The camera module uses socket type connecting. For versioning, laser marked serial numbering is used on the PWB.

The main parts of the module are:

- Lens unit including lens aperture.
- Infrared filter; used to prevent infrared light from contaminating the image colours. The IR filter is glued to the EMI shielded camera body.
- Camera body; made of conductive metallized plastic and attached to the PWB with glue.
- Sensor array including DSP functions is glued and wire-bonded to the PWB.
- PWB, FR-4 type
- Passive components
- Camera protection window; part of the phone cover mechanics
- Dust gasket between the lens unit and camera protection window

Back camera slider detection switch

The back camera and flash LED have a cover slider, which position is detected with a slider switch (slider sensor).

When the slider covers the back camera and flash LED (upper position), the slider switch is open circuit (not pressed) and the application processor is connected to VIO. When the slider is slid down, the switch is pressed and it connects the Helen pin mcbsp1_sync to GND (typical 160mV) and activates the back camera application

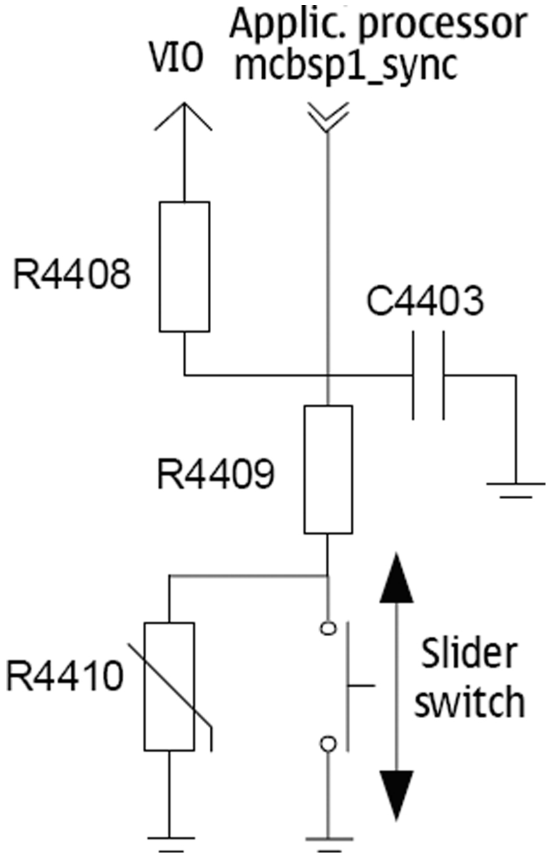


Figure 96 Slider switch connection

Flash LED

The device back camera has a flash LED (FLED), providing better lighting conditions in darker environments. The same LED is also used as an indicator light to indicate video clip recording.

The FLED is located next to the back camera under the camera slide. It cannot be used when the slide is closed, and it is only used in the still image mode or as an indicator for video recording or image capturing. The operating range of the FLED is approximately 1 m (~22 Lux) and 1.5 m (~9 Lux).

The connections between the main PWB and the FLED are implemented with a small PWB attached to the device mechanics.

The FLED has four white LEDs connected in series in one module. The module also includes a lens with its plastic housing.

The dimensions of the FLED are 6.5 x 7.5 x 3.5 mm.

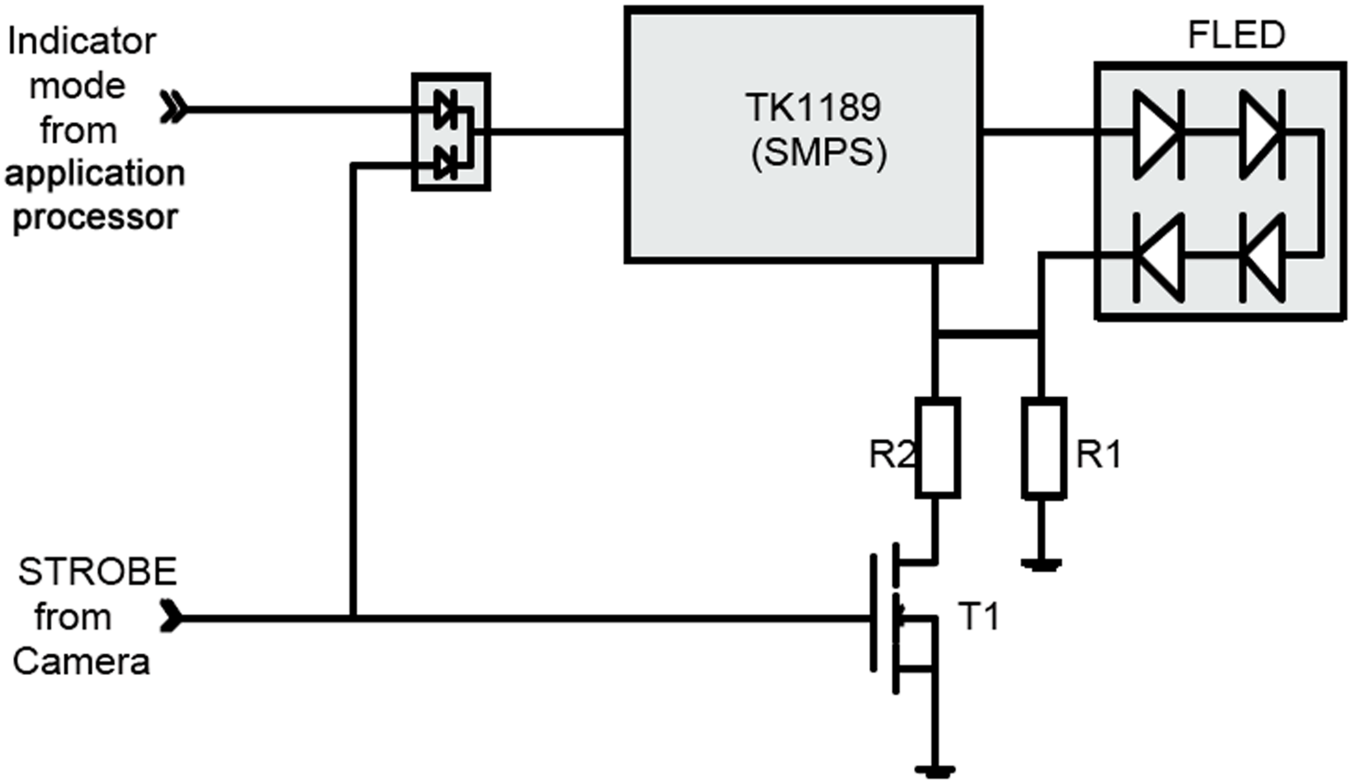


Figure 97 Simplified flash LED connection

User interface

Display interface

Display module mechanical concept

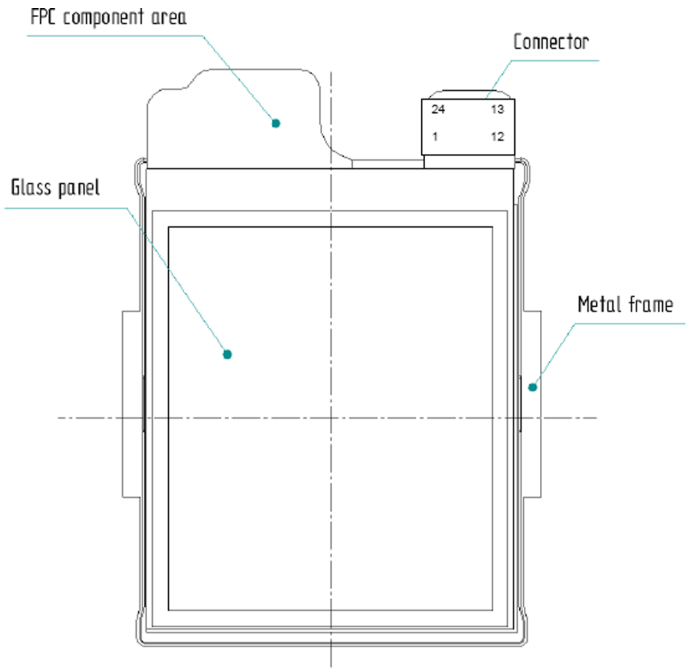


Figure 98 General diagram of the LCD module

Display features:

- 262,144 colours
- Partial display function Power saving by pausing display process on part of the screen.
- Built-in RAM capacity 176 rows x 208 lines x 18 bits = 658,944 bits

The display has two different operating modes:

1. Normal mode, Full screen, 260k colours
2. Partial idle mode, 8 colours and only part of the display is active

The module includes:

- FPWB foil including connector and discretes and driver circuits
- display panel (glass)
- drivers including display controller and 176 x 208 x 18 bits RAM
- backlight system: lightguide, LEDs and necessary optical sheets
- supporting mechanics
- metal frame (stainless steel)
- plastic frame

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

The display is controlled via a MeSSi-8 interface by the application processor. All MeSSi-8 signals go through the EMC filtering ASIPs.

The display module does not require any tunings in service.

Keyboard

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

The keymatrix has six rows and four columns. The voice key on the main PWB and the navigation key are connected to the same keymatrix.

Table 17 Keymatrix

Key	Row# kbc_#	Column# kbr#	Switch Ref.
0	6	0	U21
1	3	2	U19
2	2	1	U14
3	2	2	U16
4	5	3	U23
5	3	0	U18
6	3	3	U20
7	2	0	U15
8	2	3	U17
9	4	0	U22
*	4	1	U21
#	4	3	S2
END	5	0	U13
SEND	1	1	U1
EDIT	6	1	U11
CLEAR	6	2	U10
APPS	6	3	U12
Operator	5	2	U9
NAVI Left	0	2	S320
NAVI Right	0	3	
NAVI Up	1	2	
NAVI Down	1	3	
NAVI Select	1	0	
Left Soft Key	0	0	U7
Right Soft Key	0	1	U6
Camera	4	2	S1
Voice	Not Required		

Keyboard layout

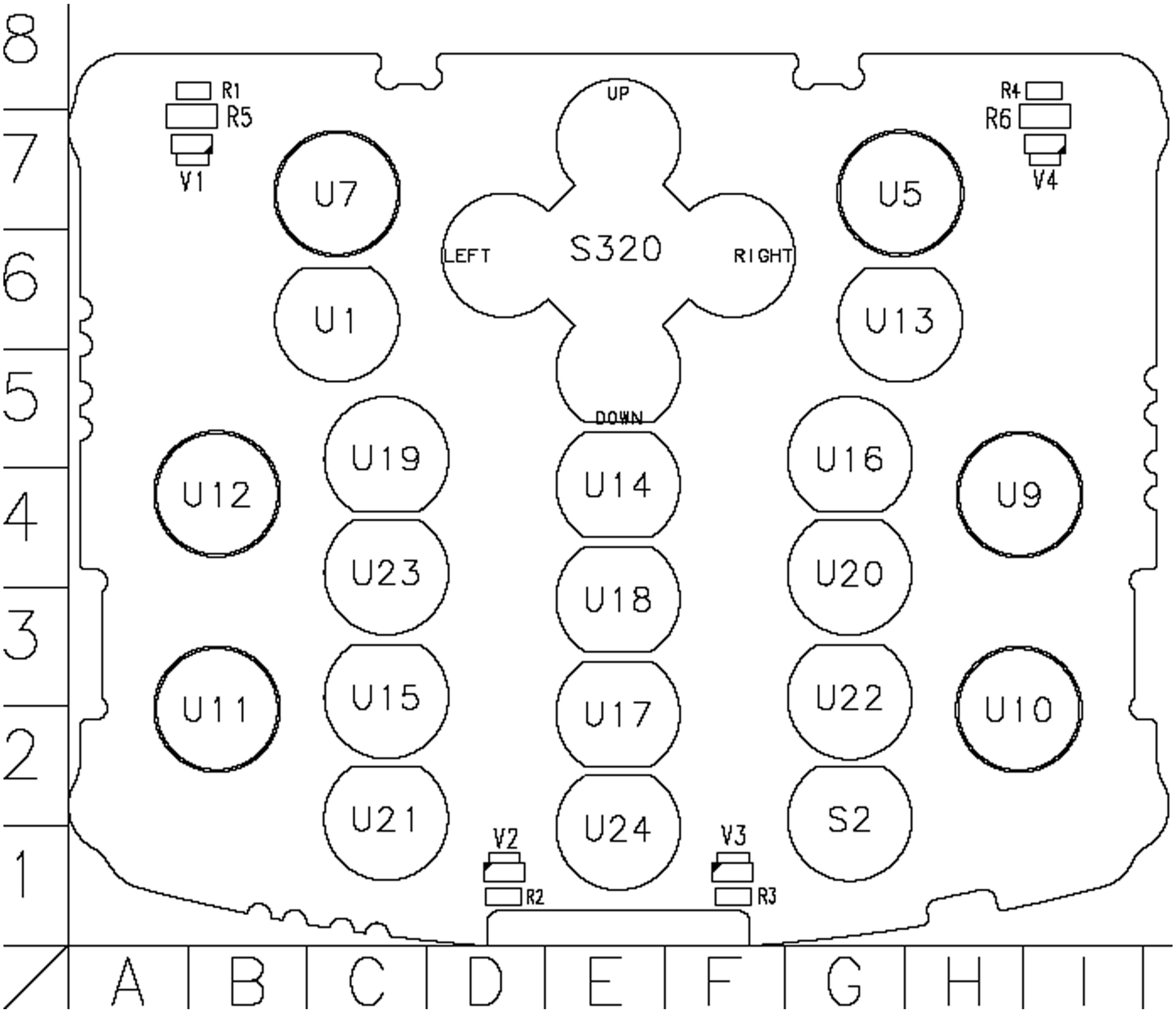


Figure 99 Keyboard layout

Display and keyboard backlight

The device has one LED Driver (SMPS) that is used to drive both display and keyboard LEDs.

The LED driver consists of two LED chains: display LED chain and keyboard LED chain. Both chains contain four LEDs, eight in total.

The current adjustment of the driver is done from the display LED branch. The keyboard current also depends on the display brightness.

Typically, keyboard LEDs are turned ON only in dark ambient lighting conditions.

Table 18 LED driver control signals

	From	To	Voltage	Function
GenOut1	EM ASIC (N2300)	R2302 (10k)	0V / 1.8V	Maximum current control (0V ->max curr.)
GenOut2	EM ASIC (N2300)	R2301 (4k7)	0V / 1.8V	
PWM	EM ASIC (N2300)	J2309, N2301	PWM 0%-100%, 1.8V	Current PWM control (16 steps)
GenOut3	EM ASIC (N2300)	V2300	0V / 1.8V	Keyboard LEDs ON (1.8V) /OFF (0V)

ALS interface

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

- lightguide (part of the front cover)
- phototransistor (V4400) + resistor (R4401)
- NTC + resistors (R4400, R4402, R4403)
- EM ASIC (N2200)

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

- Keypad lighting is switched on only when the environment is dark / dim
- Display backlights are dimmed, when the environment is dark / dim

The ambient light sensor itself is a photo transistor, which is temperature-compensated by an external NTC resistor. N2200 reads the light sensor (LS) and temperature (LST) results.

ALS calibration is not possible in the service points. ALS is serviced by replacing faulty phototransistors.

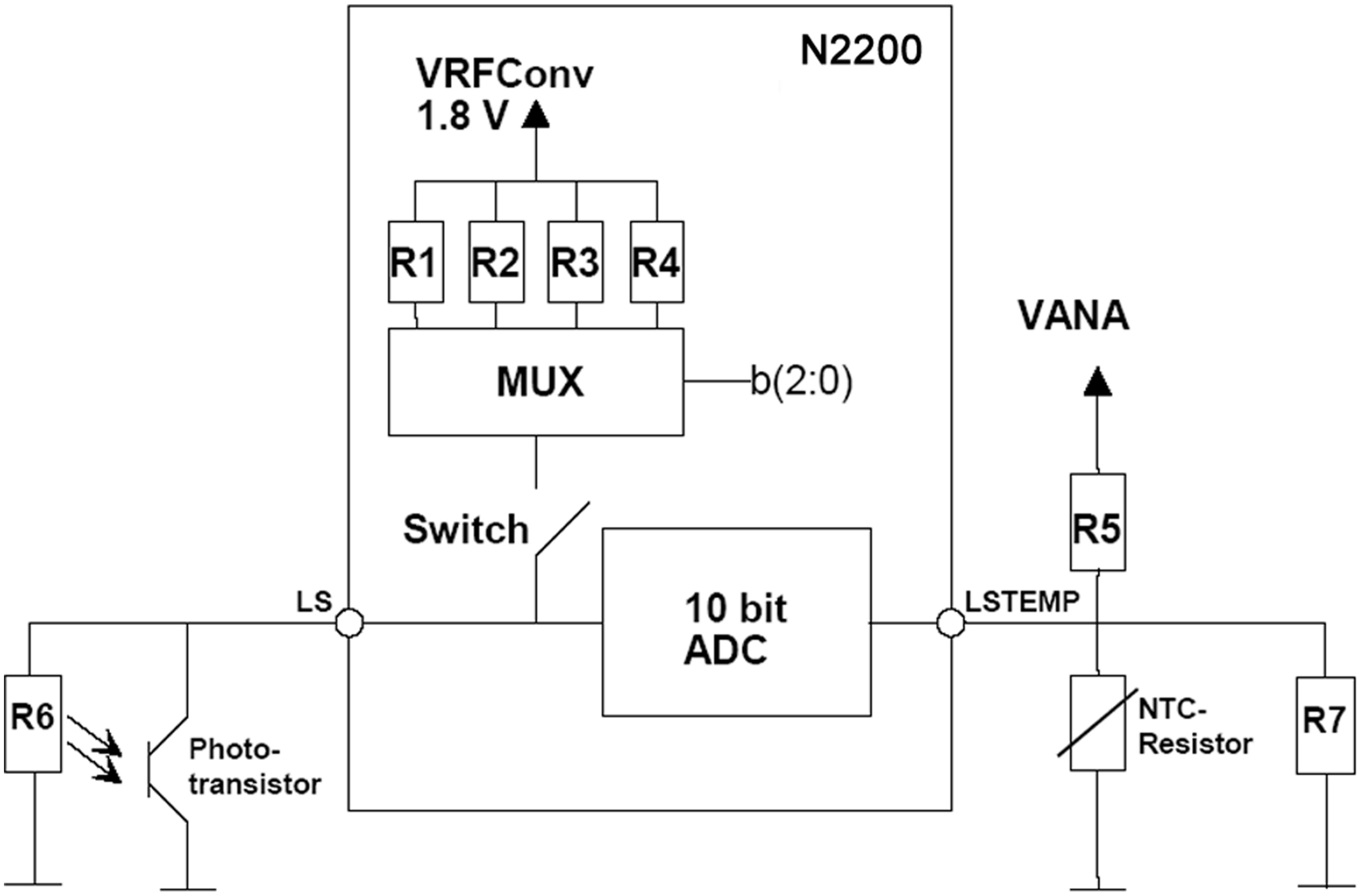


Figure 100 ALS HW implementation

Table 19 ALS resistor values

Symbol	R1	R2	R3	R4	R5	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	470 kOhm	100 kohm	470 kohm	47 kOhm

ASICs

RAP ASIC

RAP ASIC is a 2G Radio Application Processor.

In general RAP consists of three separate parts:

- Processor subsystem (PSS) that includes the main processor and related functions
- MCU peripherals that are mainly controlled by MCU
- DSP peripherals that are mainly controlled by DSP

RAP core voltage (1.4 V) is generated from the EM ASIC (N2300) VCORE and I/O voltage (1.8 V) is from the EM ASIC (N2200) VIO. The core voltage in sleep mode is 1.05 V.

EM ASIC N2200

EM ASIC N2200 includes the following functional blocks:

- Start up logic and reset control
- Charger detection

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

EM ASIC N2300

EM ASIC N2300 includes the following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- External LED driver control interface
- Digital interface (CBUS)
- Accessory supply voltage regulator
- Vout - accessory

Device memories

RAP memories NOR flash and SDRAM

The modem memory consists of 64 Mbit SDRAM and 64 Mbit NOR flash memories.

SDRAM is a dynamic memory for ISA (Intelligent Software Architecture) SW.

NOR is used for ISA SW code and PM data and CDSP (Cellular Digital Signal Processor) SW code.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. The stacked DDR/NAND application memory has 512 Mbits of DDR memory and 512 Mbits of flash memory. DDR DRAM memory is stacked above the NAND flash.

Both NAND core and I/O voltages are 1.8 V generated by VIO.

Table 20 Supply voltages for combo memory interfaces

Parameter	Symbol	min	max	unit	note
Supply voltage	VBAT			V	Battery voltage
Combo memory core voltage	Vore	1.65	1.95	V	Nominal 1.8V s

Parameter	Symbol	min	max	unit	note
Host I/O supply voltage1.8 V	VIO	1.71	1.89	V	Nominal 1.8V

Audio concept

Audio HW architecture

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

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

There are three audio transducers:

- 8 mm dynamic earpiece
- 16 mm dynamic speaker
- electret microphone module

In addition to the audio transducers, the mixed-signal ASIC also provides an output for the dynamic vibra component.

All galvanic audio accessories are connected to the system connector.

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

There is also a separate application ASIC for Symbian applications.

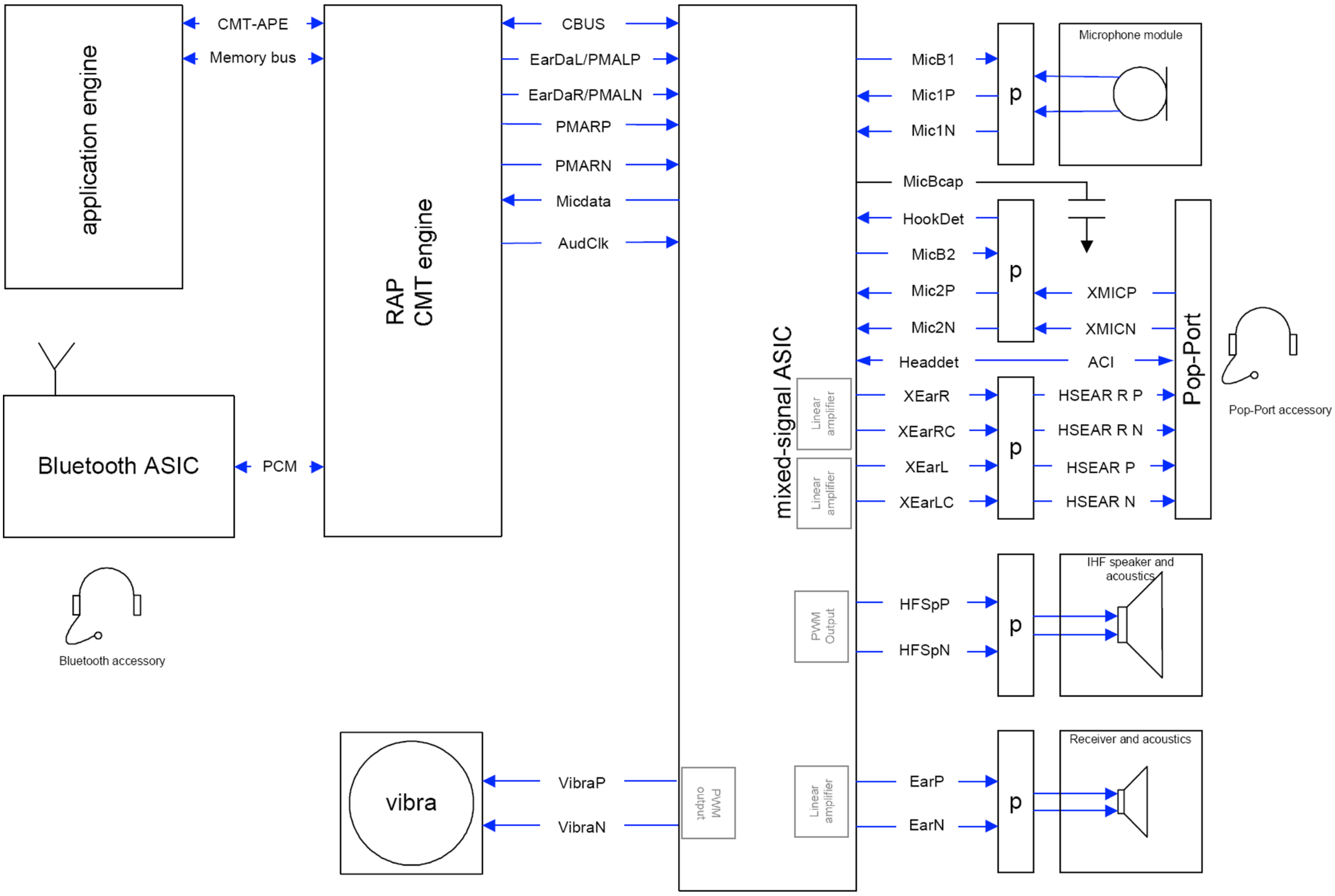


Figure 101 Audio block diagram

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.

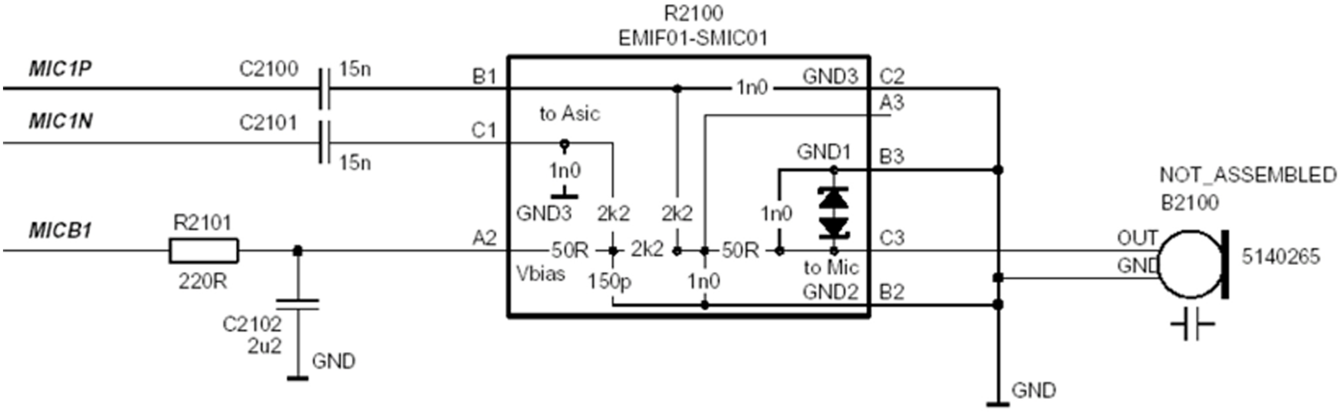


Figure 102 Internal microphone circuitry

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.

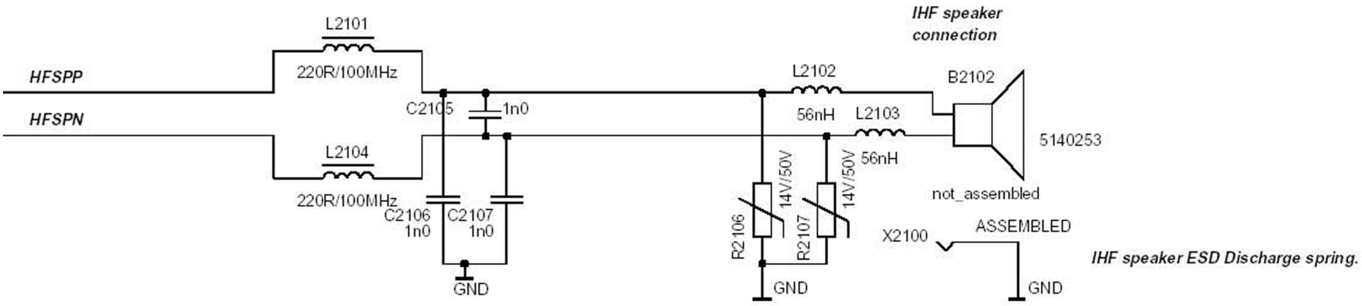


Figure 103 External microphone circuitry (Pop-Port™ connects to the right side)

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.

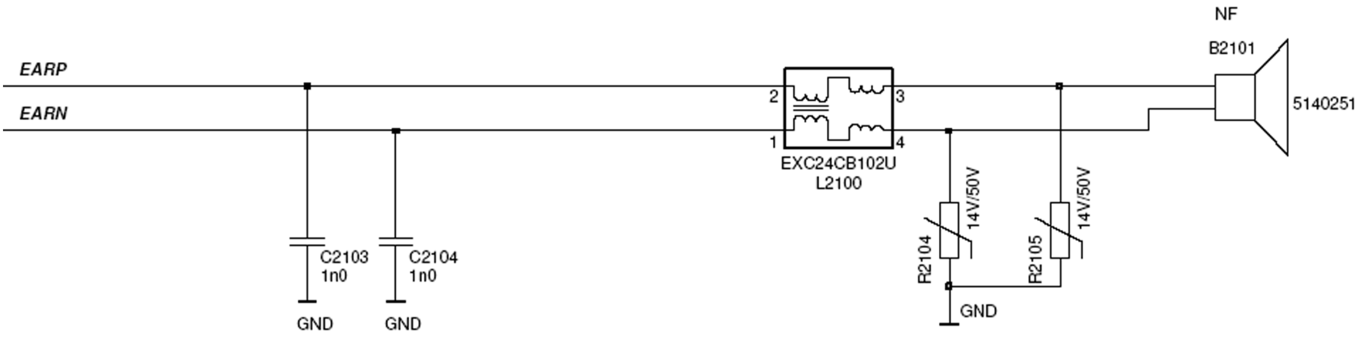


Figure 104 Internal earpiece circuitry

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).

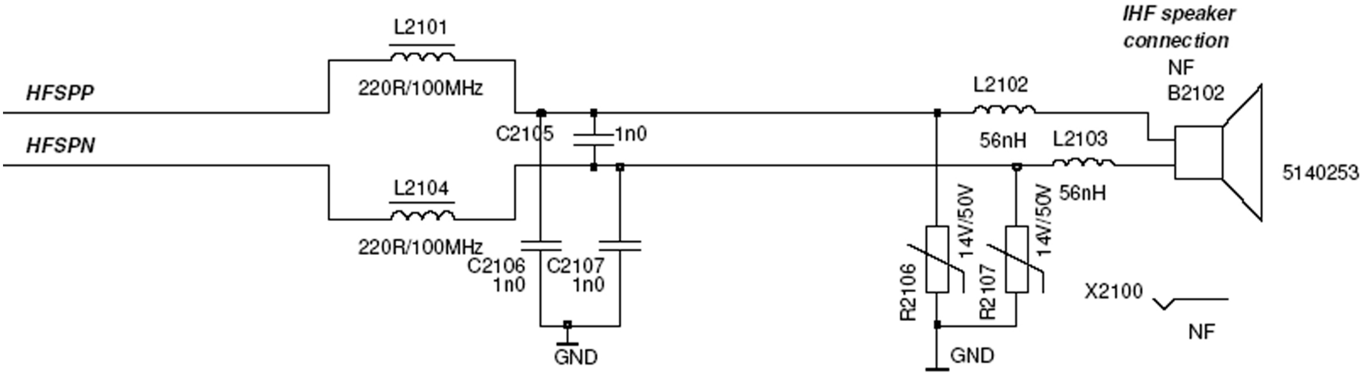


Figure 105 Internal speaker circuitry

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.

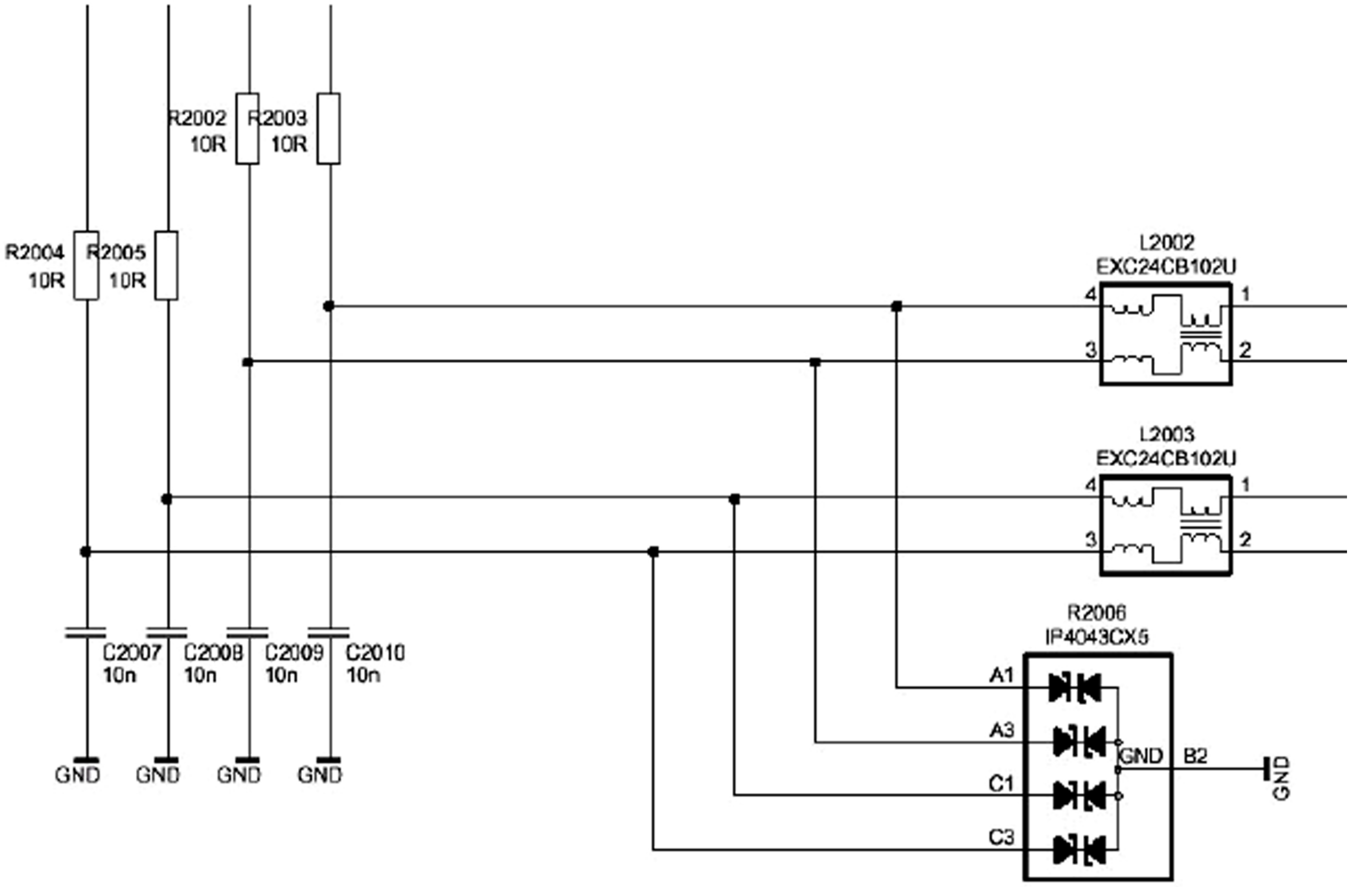


Figure 106 External earpiece circuitry (system connector connected on the right)

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.

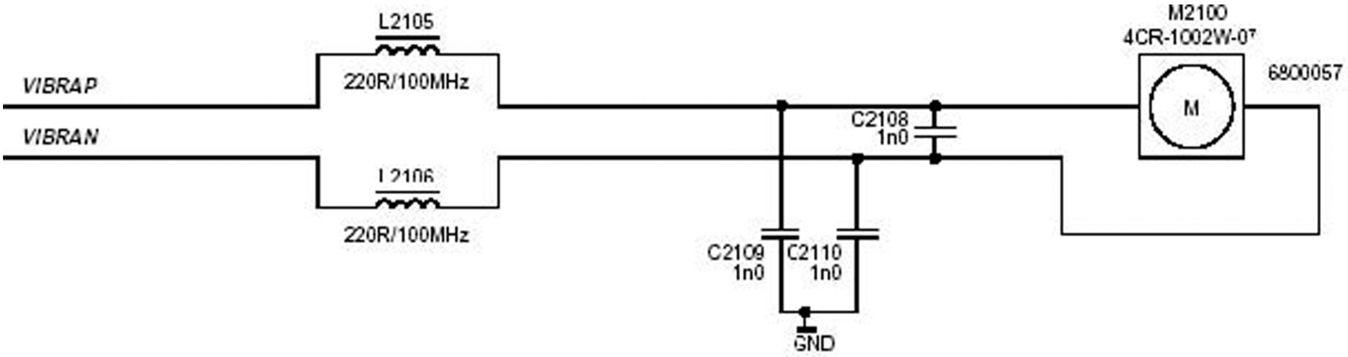


Figure 107 Vibra circuitry

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 EM ASIC (N2200) is meant for the headset.

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

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

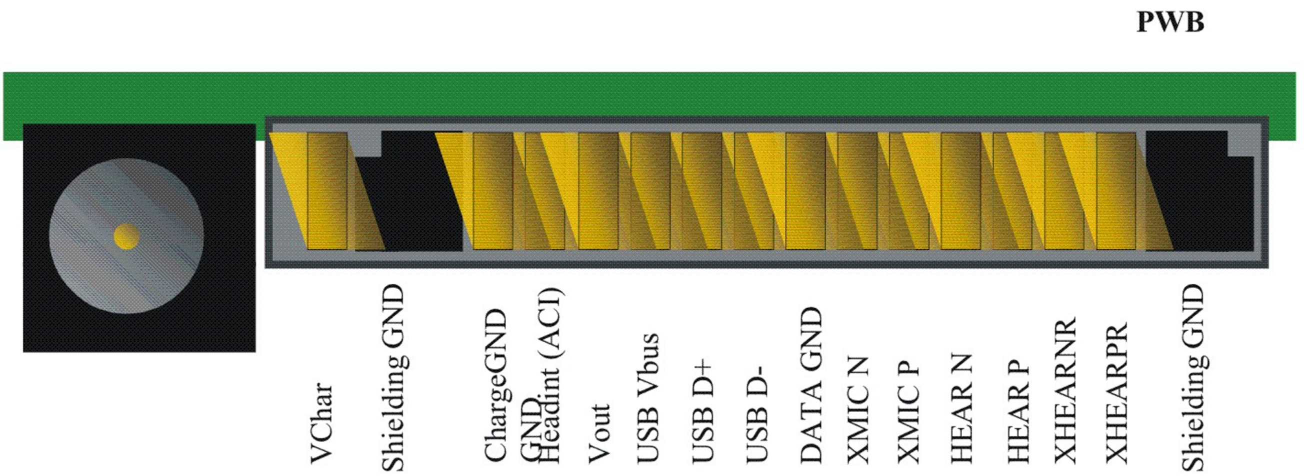


Figure 108 External audio connector

Table 21 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N	Audio out	20-20k	1Vpp	10Ω	
12 / HEAR P	Audio out	20-20k	1Vpp	10Ω	

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
13 / HEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Baseband technical specifications

External interfaces

External interfaces

Name of Connection	Connector reference
USB	X2001
Charger	X2000
Headset	X2001
SIM	X2700
RS MMC	X5200
Battery connector	X2070

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						
Headset detection threshold		1.75	1.9	2.05	V	N2200 specific
Headset detection hysteresis			25		mV	
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage.	V_{IH}	1.9 x V_{DDS}	2.5/2.98	3.0	V	N2200 specific
Low-level input voltage	V_{IL}	0	0.2	0.7 x V_{DDS}	V	

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level output voltage	V_{OH}	2.4	2.5	2.6	V	
Low-level output voltage	V_{OL}	0		0.3	V	
Rise/fall time	tR/tF			12.5	ns	

VOUT electrical characteristics

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

USB IF electrical characteristics

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

Description	Parameter	Min	Max	Unit	Notes
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

FBUS interface electrical characteristics (between RAP and N2300)

Description	Parameter	Min	Max	Unit
High-level input voltage	V_{IH}	0.7 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level Input voltage	V_{IL}	0	0.3 x V_{DDSHV2}	V
High-level output voltage	V_{OH}	0.8 x V_{DDSHV2}	V_{DDSHV2}	V
Low-level output voltage	V_{OL}	0	0.22 x V_{DDSHV2}	V
Rise/fall time	tR/tF	0	25	ns
(VDDSHV2 = 1.8V)				

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside N2200. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

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

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	N2200	VSIM1	Supply voltage to SIM card, 1.8 V or 3.0 V.
C2	SIMRST	Out	N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	N2200	SIM1DaC	Data input / output

RS MMC interface connections

Pin	Signal	I/O	Engine connection		Notes
1	RSV		NC	NC	Reserved for future use
2	CMD	<->	D4800	MMC2_CMD	Command/ Response
3	Vss1		GND		Ground

Pin	Signal	I/O	Engine connection		Notes
4	V_{DD}	<-	N2200	VSIM2	VSIM2, supply voltage 1.8 (Max 70mA)
5	CLK	<-	D4800	MMC2_CLK	External clock for the MMC card, Max 20 MHz
6	Vss2		GND		Ground
7	DAT	<->	D4800	MMC2_DAT0	Bi-directional data bus
-	MMCDET	->	D4800	btwake1(in) [P10]	MMC card detect

Charger connector and charging interface connections & electrical characteristics

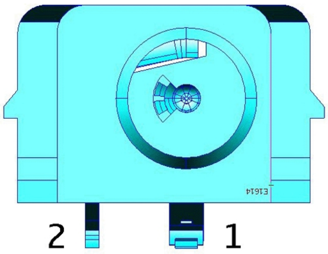


Figure 109 Charger connector

Table 22 Charging interface connections

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

Table 23 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	
Threshold for charging, rising (N2300)	V_{MSTR+}	2.1		V	Typical value

Description	Parameter	Min	Max	Unit	Notes
Threshold for charging, falling (N2300)	V_{MSTR-}	1.9		V	Typical value

Battery connector and interface connections & electrical characteristics

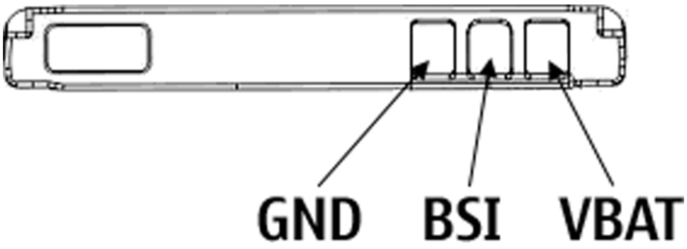


Figure 110 Battery connector

Table 24 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	EM ASIC N2200	VBAT	Battery voltage
2	BSI	->	EM ASIC N2200	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 25 Battery IF electrical characteristics

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

Internal interfaces

Internal interfaces

Name of Connection	Connector reference
UI connector	X4400
Display	X4401
Back camera	X1470
Front camera	X1472
ALS	V4400
Vibra	M2100
Microphone	B2100

Name of Connection	Connector reference
Earpiece	B2101
IHF speaker	B2102

UI connections

Table 26 User interface connections

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

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row

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

Display connector and interface connections

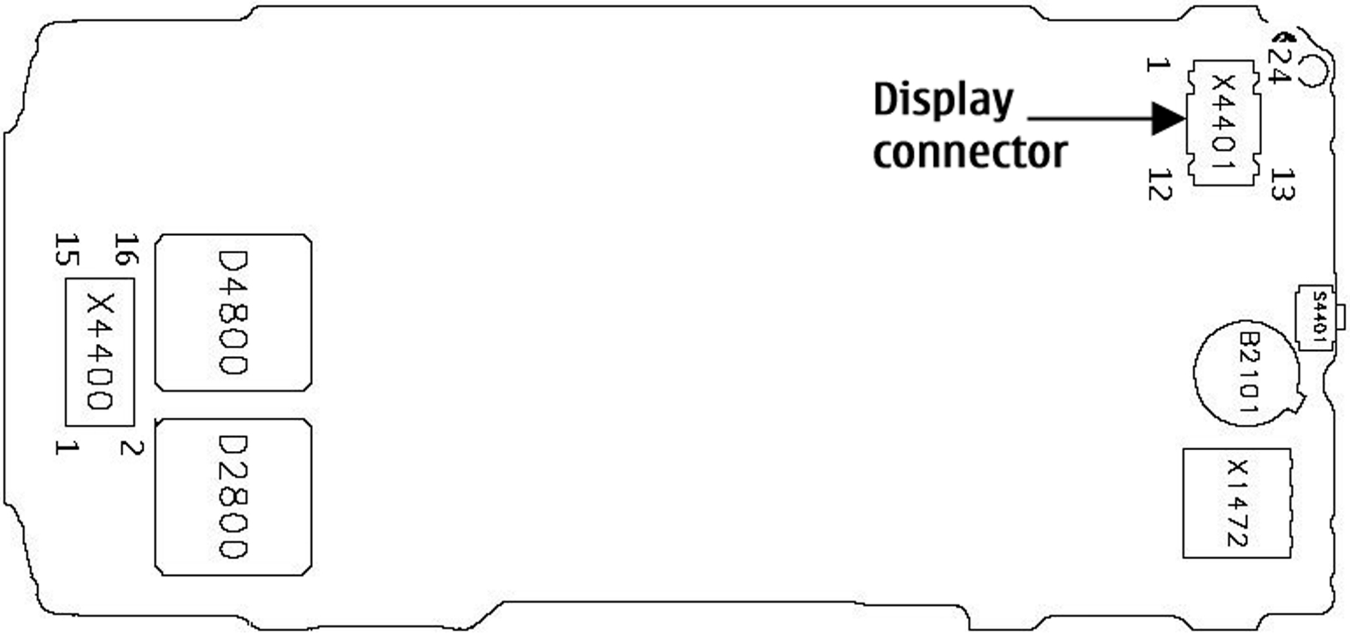


Figure 111 Display connector

Table 27 Display interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND				
2	WRX	->	D4800	Lcdwrx	Write Enable (active low)
3	GND				
4	D0	<->	D4800	Lcdda0	Data
5	D1	<->	D4800	Lcdda1	Data
6	D2	<->	D4800	Lcdda2	Data
7	D3	<->	D4800	Lcdda3	Data
8	GND				
9	VDDI	<-	N2200	VIO	Interface voltage
10	VDD	<-	N2200	VAUX	Core voltage

Pin	Signal	I/O	Engine connection		Notes
11	GND				
12	LEDin	<-	N2301	VLEDOUT1	N2301 is controlled by N2300
13	LEDout	->	R2304	SETCURR1	Sink resistor
14	GND				
15	CSX	<-	D4800	Lcdcsx	Chip Select (active low)
16	D/CX	<-	D4800	Lcdcmd	Data/ Command select (high=data, low =command)
17	GND				
18	D7	<->	D4800	Lcdda7	Data
19	D6	<->	D4800	Lcdda6	Data
20	D5	<->	D4800	Lcdda5	Data
21	D4	<->	D4800	Lcdda4	Data
22	TE	->	D4800	Te	Tearing Effect
23	RDX	<-	D4800	Lcdrdx	Read Enable (active low)
24	RESX	<-	D4800	Gpio_60	Reset (active low)

Camera interface connections and electrical characteristics

Table 28 Camera interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND				
2	SDA	<->	D4800	sda	I2C serial control bus data
3	D+	->	D4800	Ccpdap	Differential serial data, positive node
4	SCL	<-	D4800	scl	I2C serial control bus clock
5	D-	->	D4800	Ccpdan	Differential serial data, negative node

Pin	Signal	I/O	Engine connection		Notes
6	CAMCLK	<-	D4800	ExtClk	System clock for camera module
7	VDDI	<-	N1470 1.8V regulator	VOUT	Camera Digital Voltage
8	GND				
9	CLK+	->	D4800	Ccpclkp	Differential serial clock, positive node
10	CAMVCTRL	<-	D4800	VCtrl	Camera module activating signal
11	CLK-	->	D4800	Ccpclkn	Differential serial clock, negative node
12	VDD	<-	N1471 2.8V Regulator	VOUT	Camera analogue Voltage
13	Strobe	->			No Connect. Signal Unused.
14	GND				

Table 29 Camera CCP IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Common mode voltage	VCMF	0.7	0.75	0.85	V	-1
Differential voltage swing	VOD	130	185	250	mV	-2
Operating frequency	fCLK	120		160	MHz	SW controls frequency
Differential rise and fall time		300		800	ps	-3

Note:

- Common mode voltage is a mean value of high and low states of one single-ended signal.
- Differential voltage swing is differential amplitude between signals of differential pair.
- Differential transitions should be only measured with good equipment (bandwidth > 1 GHz), otherwise results will seem too slow.

Table 30 Camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Camera analogue voltage	VDD	2.65	2.78	2.91	V
Camera digital voltage	VDDI	1.7	1.8	1.91	V

Table 31 Camera control IF electrical characteristics

Description	Parameter	Min	Typ.	Max	Unit	Notes
SDA, SCL, Vctrl, ExtClk	VIH	1.5	1.8	VDD	V	High-level input voltage
SDA, SCL, Vctrl, ExtClk	VIL	0	-	0.54	V	Low-level input voltage
SDA	VOL	0	-	0.4	V	High-level output voltage
Regulator Enable	VOH	1.35	1.8	2.3 V	V	D4800 GPIO High-level output voltage
Cam_strobe	VOH	0.8 x VDD	-	VDD		High-level output voltage
Cam_strobe	VOL	0	-	0.4	V	Low-level output voltage
ExtClk	fExtClk		9.6		MHz	SW controls frequency
SDA, SCL	tR			300	ns	Rise time

Flash LED interface and electrical characteristics

Table 32 Flash LED interface connections

Signal name	From	To	Description
GPIO28	D4800	N1471	Indicator mode enable signal
ARMIO4	D4800	N1471, V1472	Flash mode enable test signal (only test use)
VBAT	Battery	N1471	Battery nominal voltage
STROBE	Camera	N1471, V1472	Flash light enable signal from back camera

Table 33 Flash LED interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
GPIO28	GPIO output	1.72	1.8	1.92	V
ARMIO4	GPIO output	1.72	1.8	1.92	V
STROBE	Strobe signal output	2	-	2.5	V

Slider switch electrical characteristics

Signal name	From	To	Low value	High value	Description
GPIO53	Application processor	S5202	160 mV	1.8 V	Slider switch cover status signal.

Back-up battery interface connections and electrical characteristics

Table 34 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	N2200, VBack	Back-up battery G2200 is connected to N2200 via coil

Table 35 Back-up battery electrical characteristics

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

RF description

Receiver

Introduction to receiver functionality

Receiver functions are implemented in an RF ASIC.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA (Low Noise Amplifier) and demodulator) for each supported system. After the demodulators, the signal paths are combined to one common BB path.

GSM receiver

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 switch module contains PIN diode switches for a band and Rx/Tx selection and also Rx SAW filters.

The antenna switch module is followed by integrated LNAs (Low Noise Amplifier) residing in an RF ASIC.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals. The channel select filter is set to 115 kHz.

Transmitter

Introduction to transmitter functionality

Transmitter functions are implemented in an RF ASIC. The ASIC contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, the ASIC contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

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.

After the VGA stage the signal exits the RF ASIC. In case of GSM1800/1900 the signal goes directly to the GSM PA module. In case of EGSM900 (and GSM850), the PA module is preceded by a SAW filter. After the filter, the signal is fed to the GSM PA module. Finally, the signal is routed via the antenna switch to the antenna.

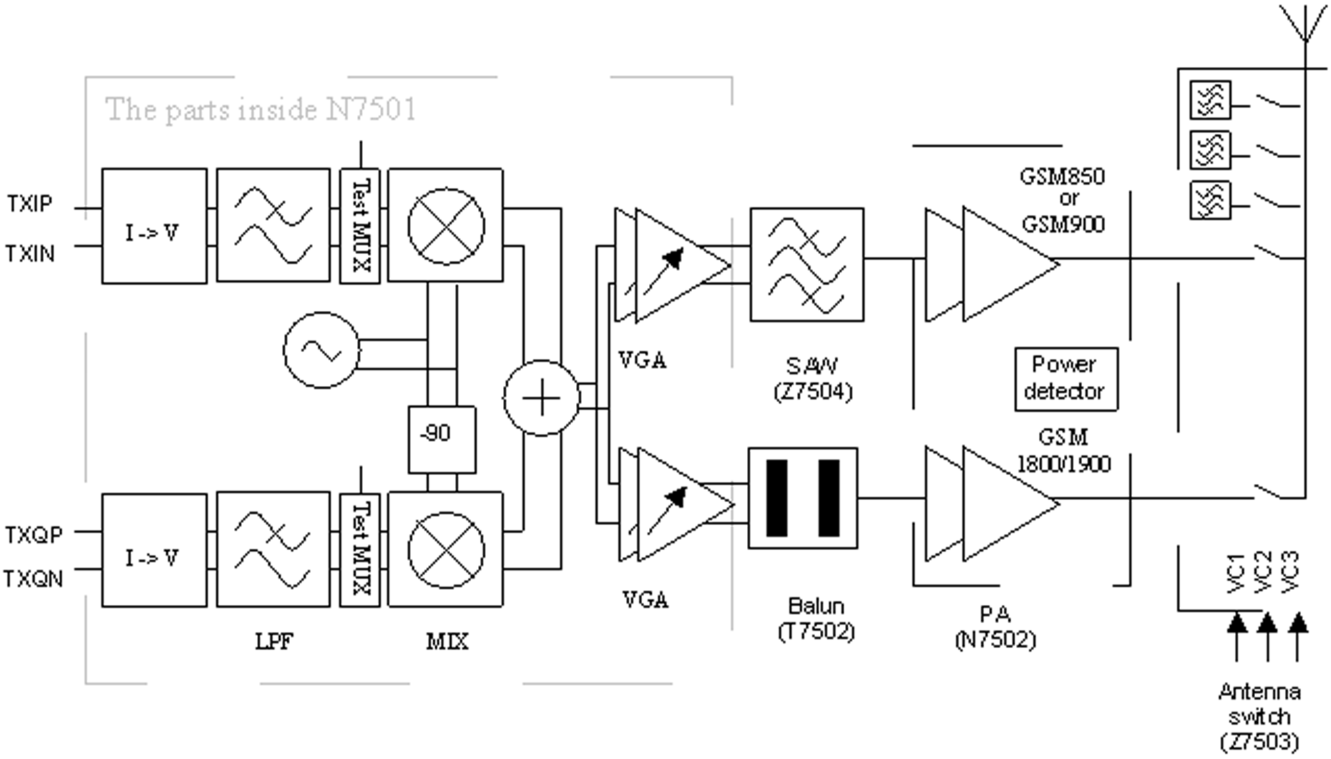


Figure 112 GSM transmitter

GSM power control

A closed control loop comprise an integrated power detector (in PA module) and an error amplifier. The error amplifier resides in N7501, and it controls the transmitter power of GSM.

GSM PA module

A single GSM/EDGE PA module contains two separate amplifier chains, one for EGSM900 (and GSM850) 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 ASICs 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.

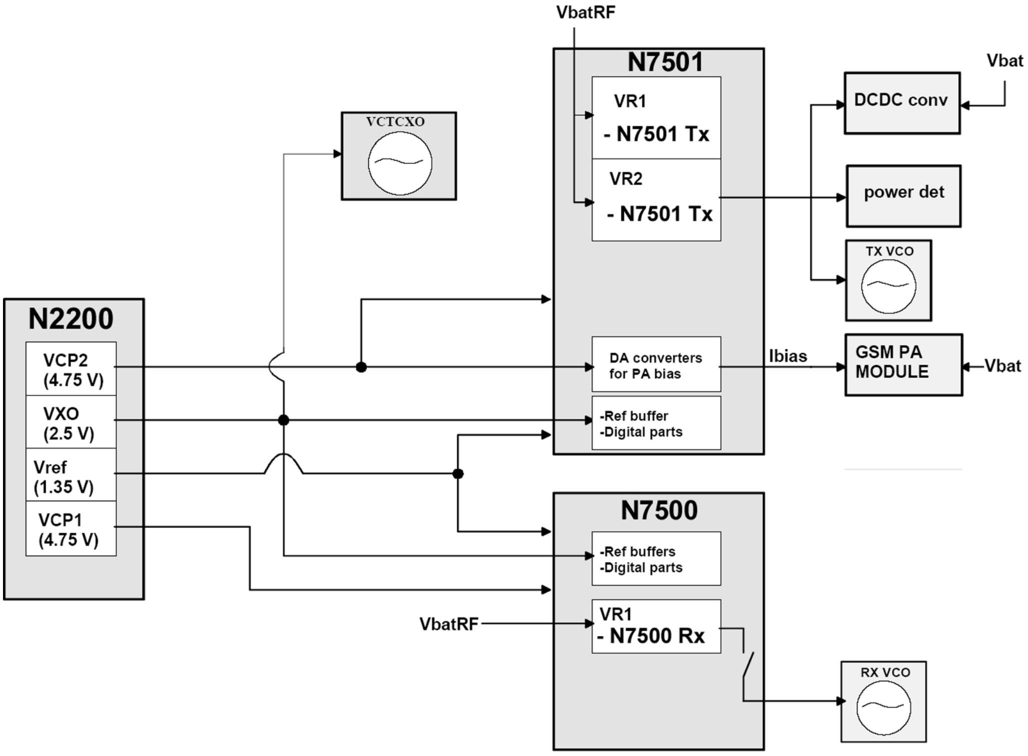


Figure 113 RF supply connections from the BB mixed mode ASIC

Frequency mappings

EGSM900 frequencies

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

GSM1800 frequencies

Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx	Ch	Tx	Rx	VCO Tx	VCO Rx
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

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10 — Schematics

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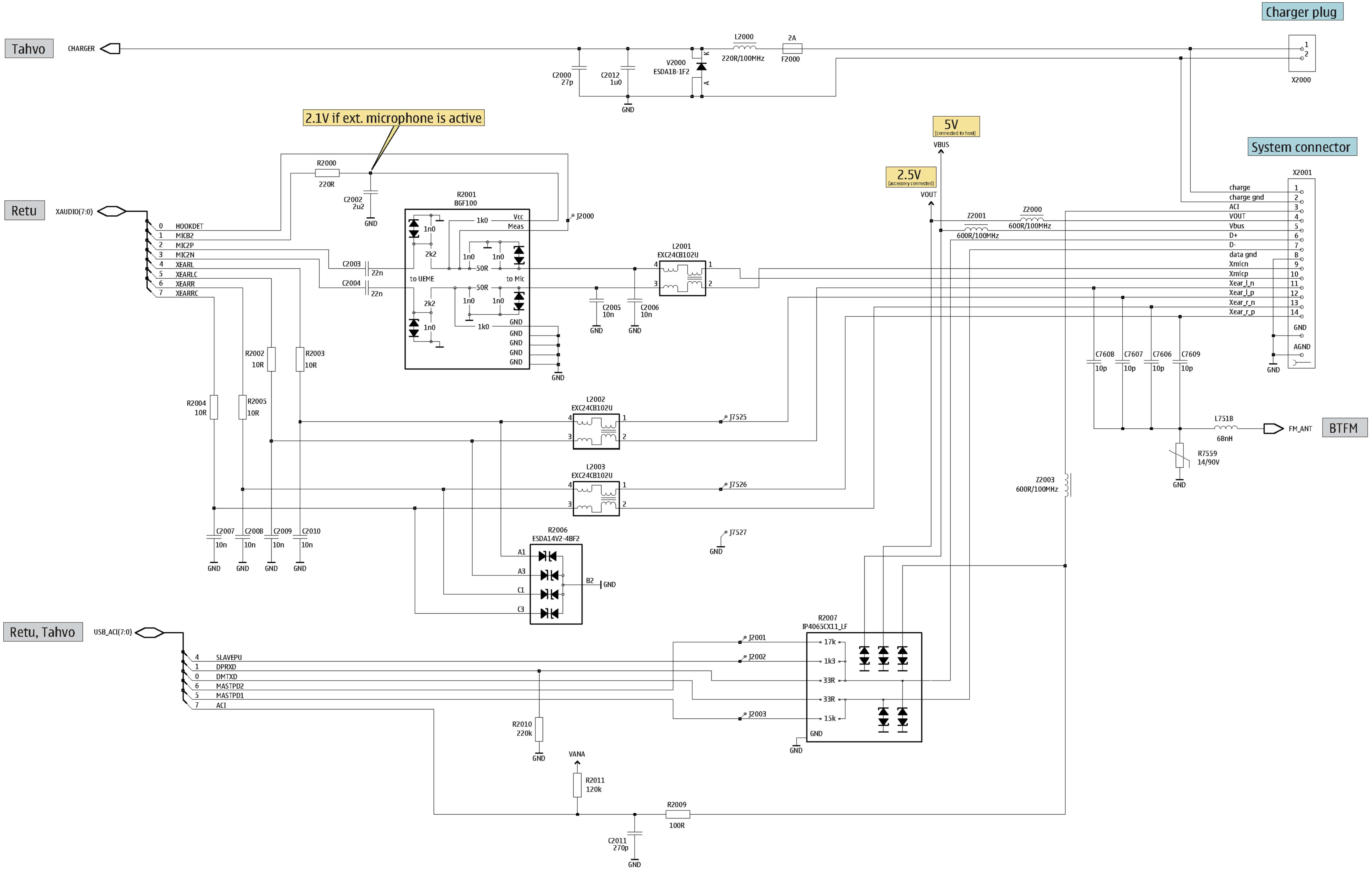
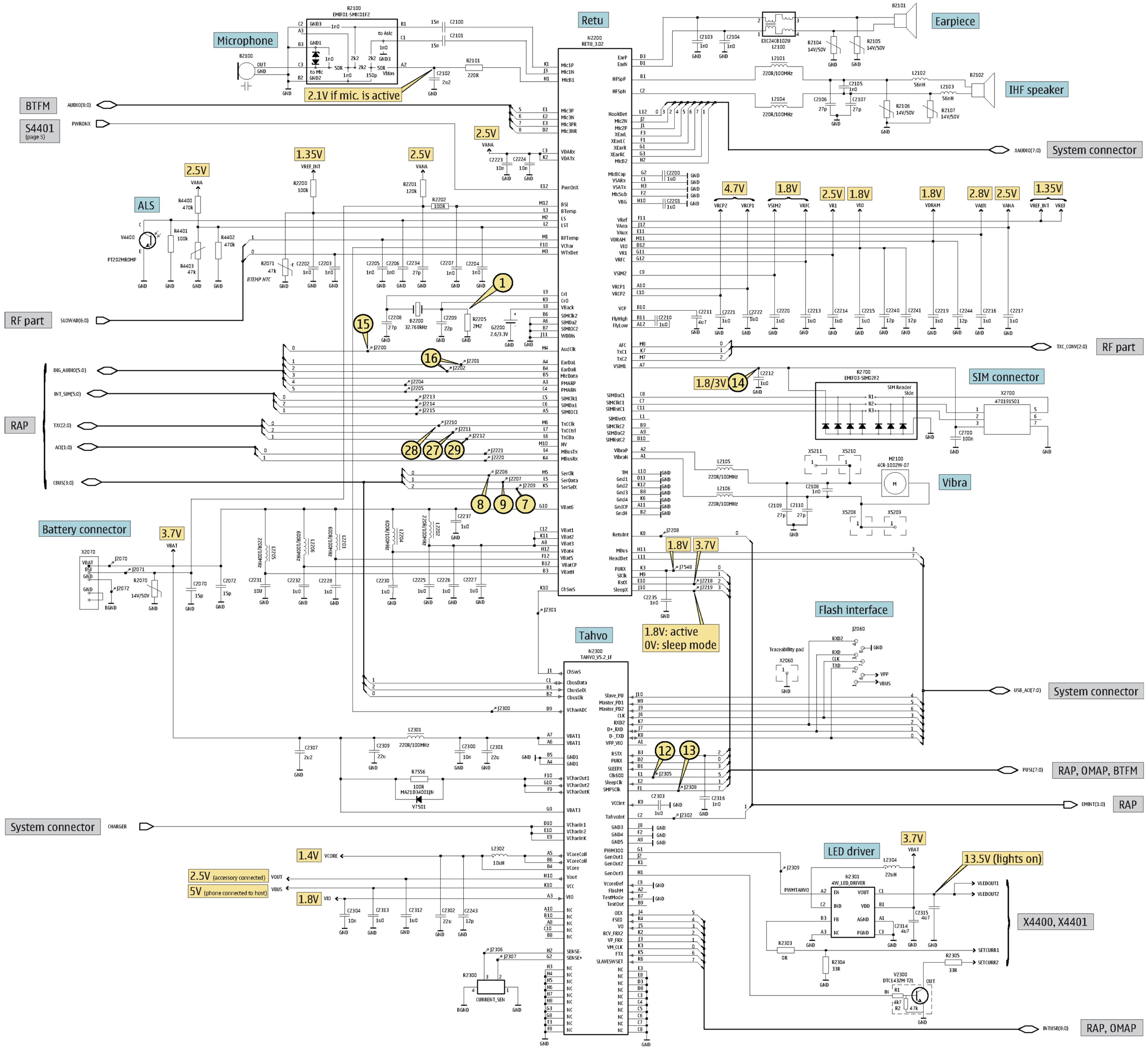
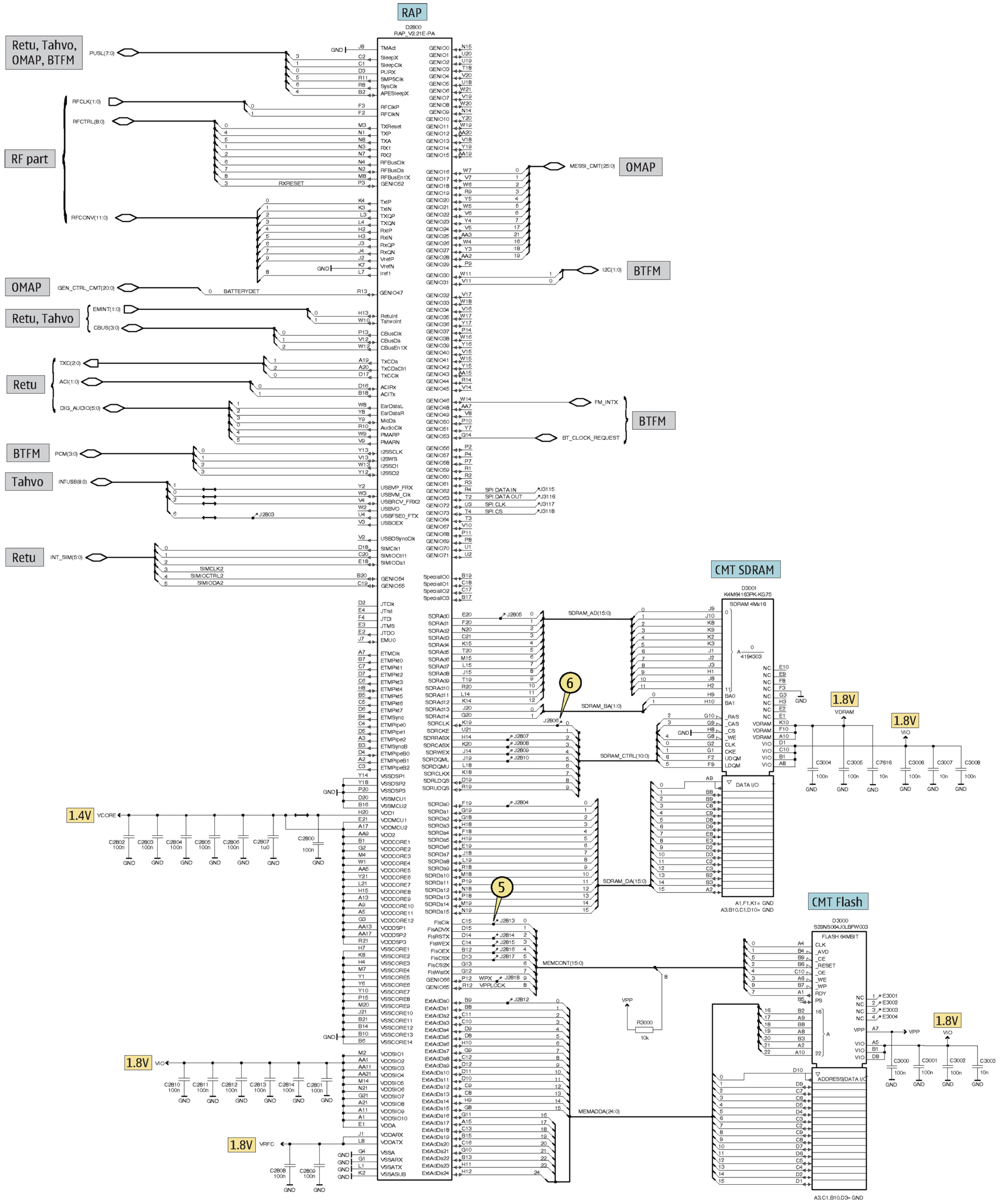
System connector



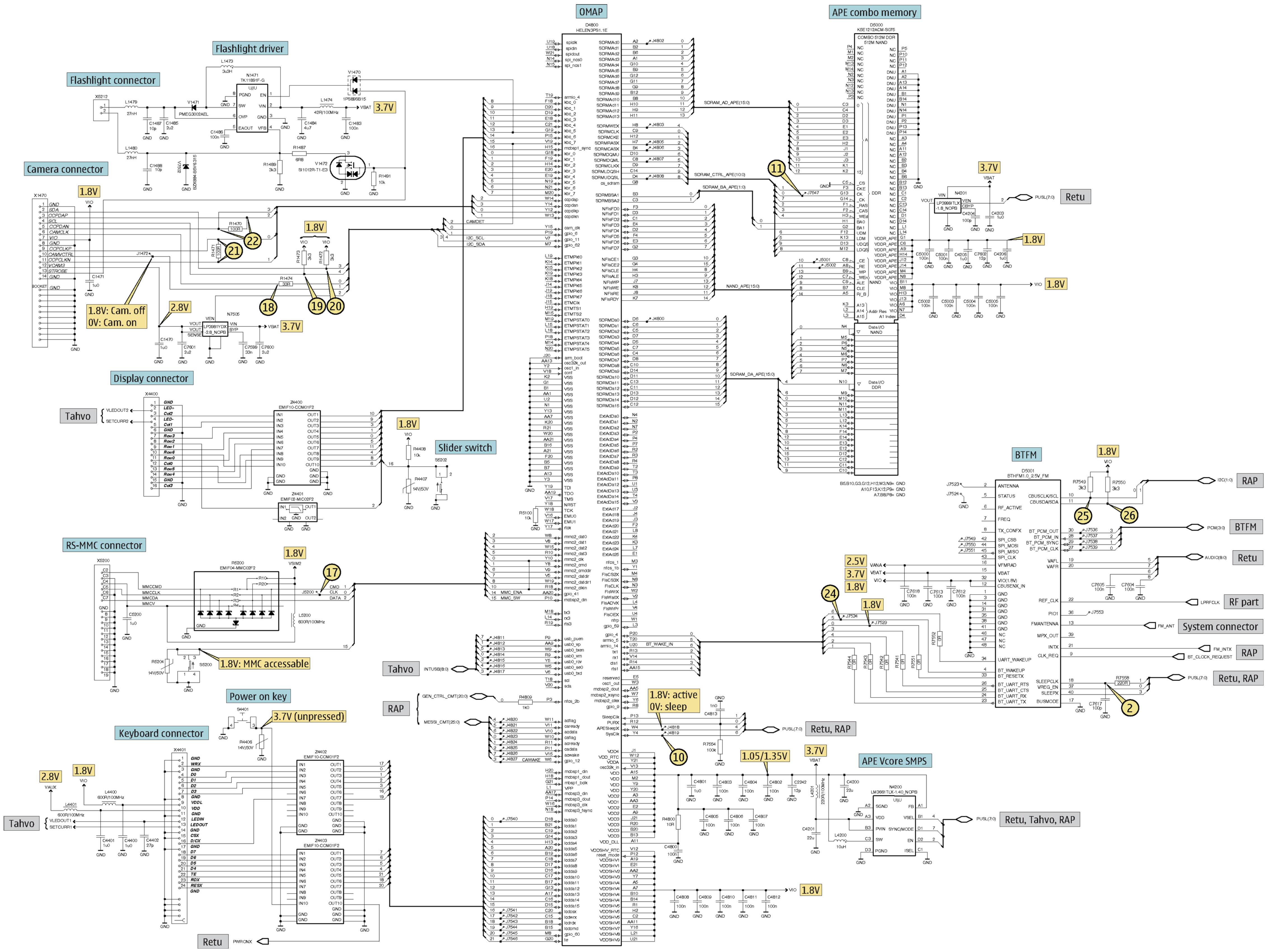
■ RETU, TAHVO, audio, SIM



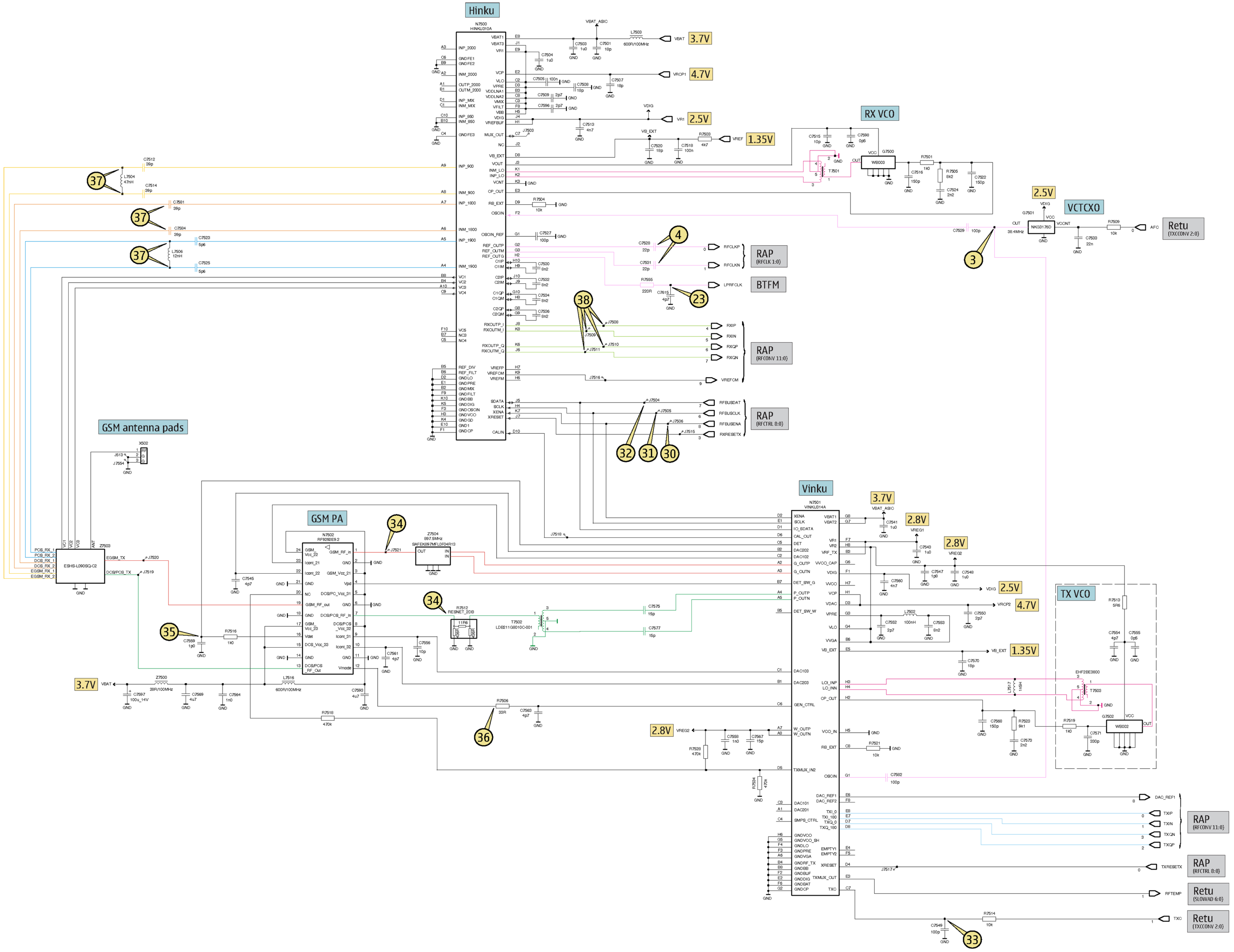
RAP, memories



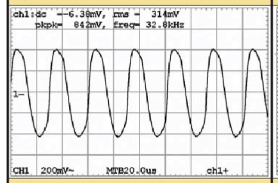
OMAP, combo memory, BTHFM

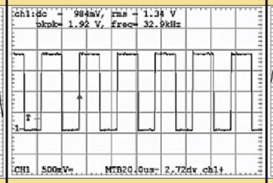


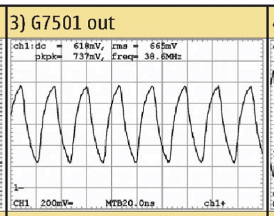
RF part

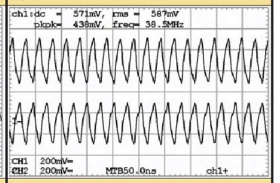

Hinku
N7500
HINKU_D10A
3.7V
4.7V
2.5V
1.35V
RX VCO
2.5V
VCTCXO
Retu
(TXCCONV 2:0)
AFC
RAP
(RFCLK 1:0)
BTFM
RAP
(RFCONV 11:0)
RAP
(RFCTRL 8:0)
37
37
37
37
4
3
23
38
32
31
30
GSM antenna pads
X600
Z7503
GSM PA
N7502
34
34
35
36
3.7V
VBAT
Vinku
N7501
3.7V
2.8V
2.8V
2.5V
4.7V
1.35V
2.8V
TX VCO
RAP
(RFCONV 11:0)
RAP
(RFCTRL 8:0)
Retu
(SLOWAD 6:0)
Retu
(TXCCONV 2:0)
33

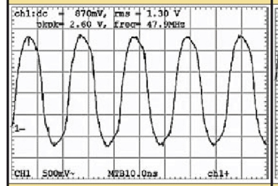
Signal overview

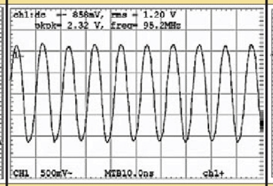

1) 32.768kHz at R2205

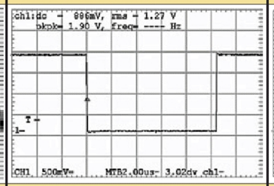

2) Sleepclock at C7617

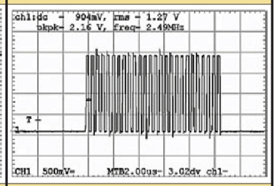

3) G7501 out

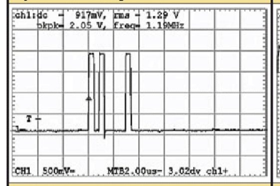

4) RFCLK at C7528/7531

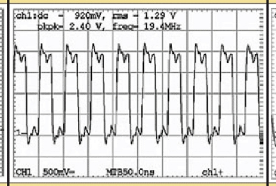

5) FLSCLK at J2813

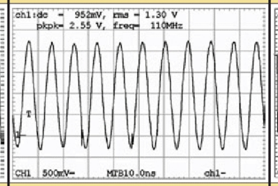

6) SDRCLK at J2806

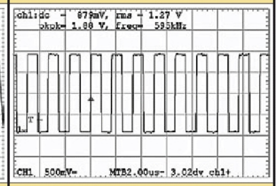

7) CBUSEna at J2209

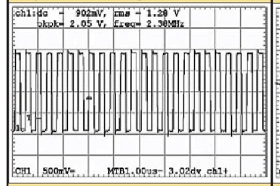

8) CBUSClk at J2206

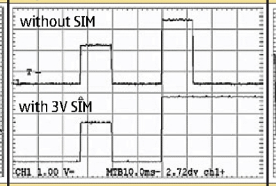

9) CBUSDa at J2207

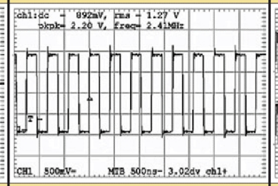

10) SYSCLK at J4819

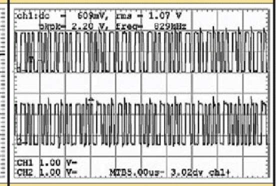

11) SDRAMCLK at J7547

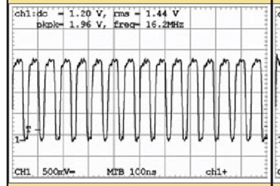

12) CLK600 at J2305

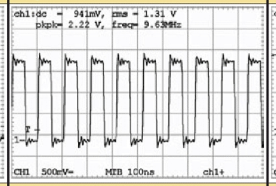

13) SMPSCLK at J2308

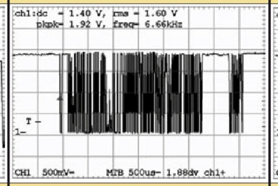

14) VSIM at C2212

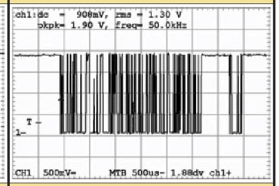

15) AUDIOCLK at J2200

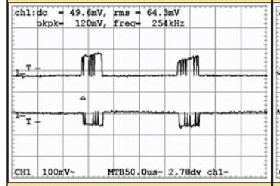

16) EARDATA at J2201/2202

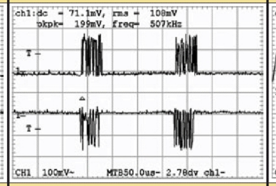

17) MMCCLK at J5200

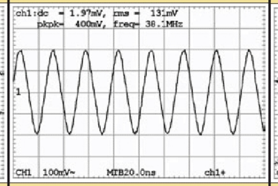

18) CAMCLK at R1474

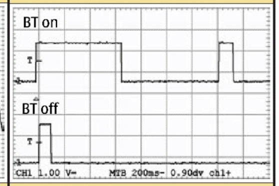

19) CAMSCL at R1473

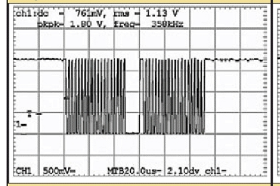

20) CAMSDA at R1472


21) CCPDAP/N at R1470

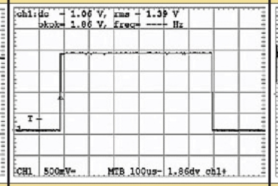

22) CCPCLKP/N at R1471

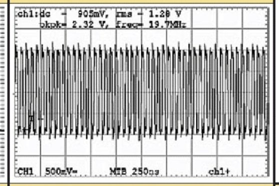

23) LPRFCLK at C7615

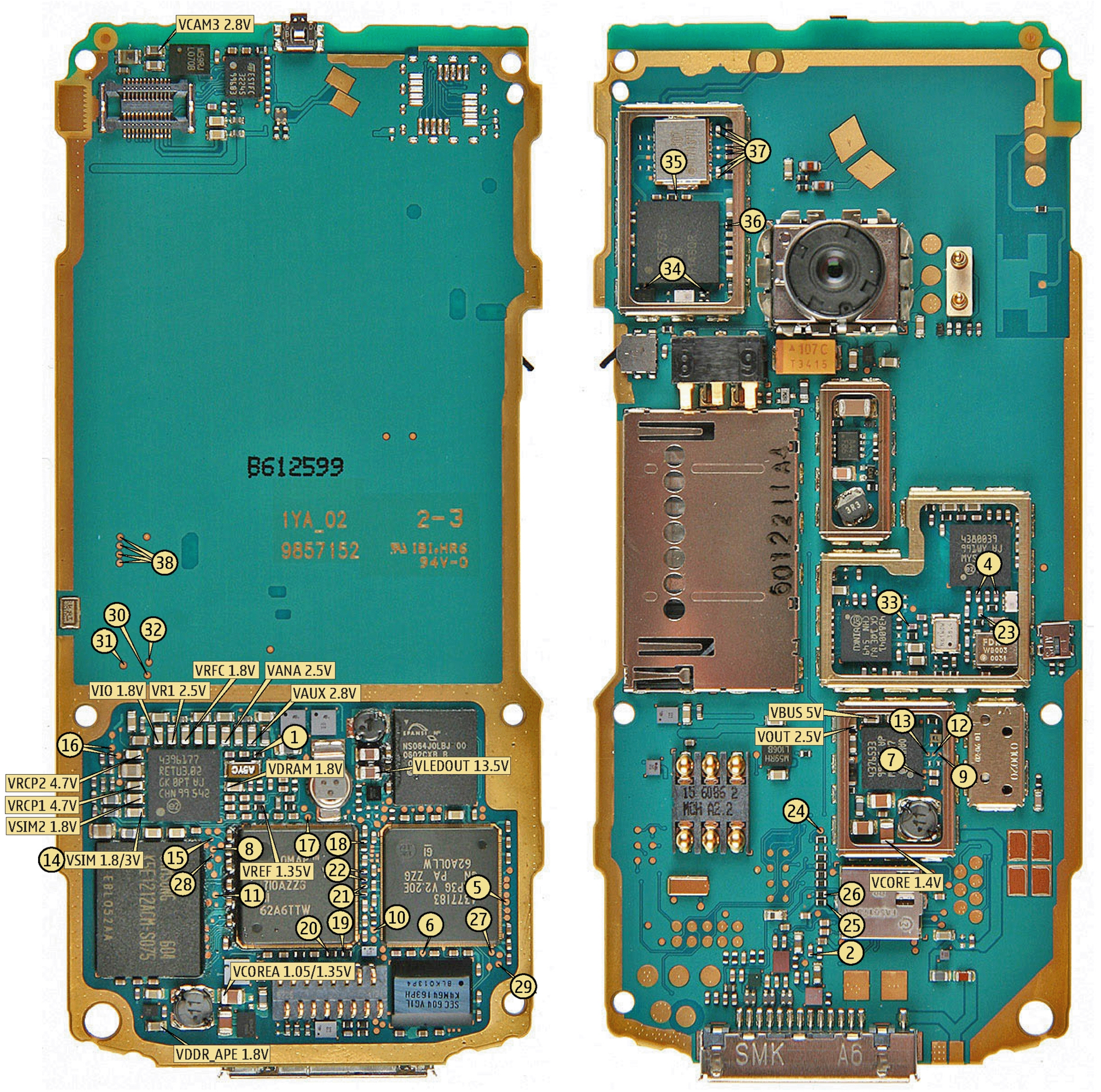

24) BTWakeup at J7534

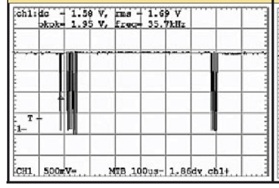

25) FM SCL at R7549

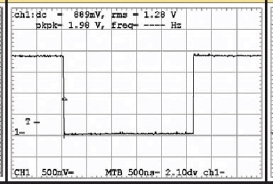

26) FM SDA at R7550

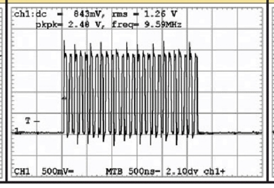

27) TXCCTRL at J2211

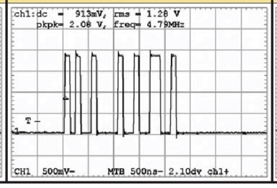

28) TXCCLK at J2210

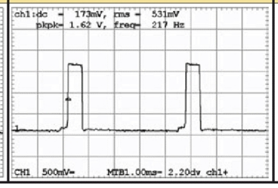


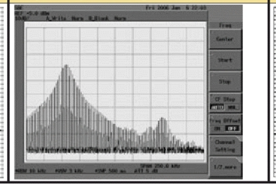

29) TXCDA at J2212

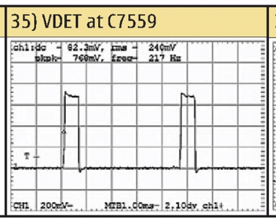

30) RFBUSENA at J7506

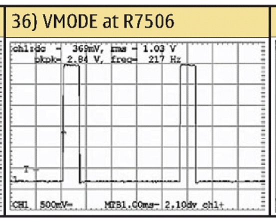

31) RFBUSCLK at J7505

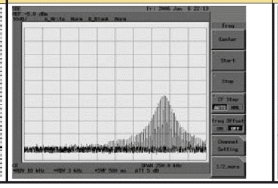

32) RFBUSDAT at J7504

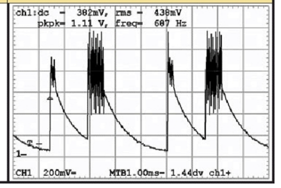

33) TXC at C7549


34) TX spect. at J7521/R7512


35) VDET at C7559


36) VMODE at R7506


37) RX at L7504/06 & C7581/84


38) RXIQ at J7508-J7511

Component finder

B		C2802	I3	C7568	E8	J2817	I4	J7553	E4	R4407	A8
B2200	D6	C2803	I5	C7569	G17	J2818	H4	J7554	H20	R4408	A8
C		C2804	G4	C7570	E9	J3100	I5	J7555	A16	R4800	D5
C1470	D15	C2805	G3	C7571	B6	J3101	I6	**L**		R4809	E3
C1471	F18	C2806	G5	C7573	A6	J3102	I5	L1473	E11	R4810	E6
C1472	F6	C2807	H5	C7575	E10	J3103	I5	L1474	E7	R5100	G5
C1473	G7	C2808	G4	C7577	E10	J3104	I5	L1479	C15	R5200	I7
C1479	E14	C2809	H5	C7581	G19	J3105	I5	L1480	C15	R5204	I15
C1480	D14	C2810	G5	C7582	D9	J3106	I5	L2000	C2	R7501	C9
C1481	D20	C2811	I5	C7584	G18	J3107	G3	L2001	F2	R7503	C11
C1482	D20	C2812	H3	C7593	G16	J3108	H3	L2002	G2	R7504	C11
C1483	E6	C2813	I3	C7596	C11	J3109	H3	L2003	G2	R7505	C9
C1484	E12	C2814	I3	C7597	F14	J3110	I5	L2100	E19	R7506	G17
C1485	E13	C3000	G7	C7598	B8	J3111	H3	L2101	B6	R7509	C8
C1486	E13	C3001	I5	C7599	D20	J3112	H3	L2102	F18	R7512	H16
C1487	C15	C3002	G6	C7600	B20	J3113	G3	L2103	F18	R7513	B7
C1488	C15	C3003	I5	C7601	B20	J3114	H3	L2104	B6	R7514	D9
C1489	E19	C3004	H1	C7602	B2	J3115	G5	L2105	B6	R7516	I18
C1490	E20	C3005	I1	C7604	F3	J3116	H6	L2106	A6	R7518	I17
C1491	D19	C3006	I2	C7605	F3	J3117	G6	L2202	E7	R7519	B6
C2000	C3	C3007	H1	C7606	H2	J3118	G5	L2203	C7	R7521	D9
C2002	F3	C3008	I2	C7607	H2	J4800	C3	L2204	D7	R7523	A6
C2003	F3	C4200	D2	C7608	H2	J4802	C3	L2205	B5	R7528	C8
C2004	G3	C4201	D1	C7609	G2	J4803	D4	L2206	B7	R7534	C8
C2005	F2	C4203	B2	C7612	C4	J4805	D3	L2301	E6	R7541	F4
C2006	G2	C4204	C2	C7613	F3	J4806	C3	L2302	D5	R7542	F4
C2007	G2	C4205	B5	C7615	C9	J4807	D4	L2304	G7	R7543	F4
C2008	G2	C4206	B1	C7616	F3	J4808	C3	L4200	C2	R7544	F5
C2009	G2	C4400	D19	C7617	F3	J4811	D7	L4201	E2	R7549	F4
C2010	G3	C4401	D19	C7618	F3	J4812	G5	L4400	D19	R7550	F4
C2011	F1	C4402	D19	**D**		J4813	F3	L4401	D19	R7551	C4
C2012	C3	C4800	D4	D2800	H4	J4814	G6	L5200	H7	R7552	F5
C2070	G14	C4801	E2	D3000	H7	J4815	H6	L7502	D8	R7554	G3
C2072	I15	C4802	G5	D3001	H2	J4816	G3	L7503	E10	R7555	B9
C2100	F2	C4803	G5	D4800	E4	J4817	G3	L7504	H19	R7556	E6
C2101	F2	C4804	E5	D5000	B4	J4818	G3	L7506	H18	R7558	F3
C2102	F2	C4805	G3	D5001	D4	J4819	G3	L7516	G16	R7559	G2
C2103	E6	C4806	E3	**F**		J4820	G5	L7517	E8	R7560	A17
C2104	E6	C4807	D4	F2000	C2	J4821	G5	L7518	G3	**S**	
C2105	A6	C4808	G3	**G**		J4822	G5	**N**		S4401	E21
C2106	A6	C4809	G4	G2200	F6	J4823	G4	N1470	G7	S5200	I14
C2107	A6	C4810	F3	G7500	B9	J4824	G5	N1471	E13	S5202	A9
C2108	B6	C4811	E3	G7501	C9	J4825	G5	N1472	E14	**T**	
C2109	B7	C4812	E5	G7502	B7	J4826	G5	N1474	D20	T7501	B10
C2110	A7	C4813	G4	**J**		J4827	G4	N2200	C6	T7502	H16
C2200	C5	C4814	E6	J513	H20	J5001	D4	N2300	D7	T7503	B7
C2201	C7	C5000	B2	J1471	G7	J5002	C5	N2301	G6	**V**	
C2202	D6	C5001	D3	J1472	F5	J5100	G5	N4200	D1	V1470	F14
C2203	D6	C5002	D4	J1473	E14	J5101	G4	N4201	B2	V1471	E13
C2204	E6	C5003	B2	J1502	D19	J5102	G4	N7500	C11	V1472	E12
C2205	D5	C5004	D3	J2000	F3	J5103	F5	N7501	E9	V2000	C3
C2206	D6	C5005	D5	J2001	G1	J5104	H3	N7502	H17	V2300	C7
C2207	E6	C5200	H7	J2002	G1	J5105	G4	N7505	C20	V4400	B20
C2208	D7	C7501	C11	J2003	G1	J5106	H3	**R**		V7501	E6
C2209	D7	C7503	C11	J2060	C4	J5107	H3	R1470	G4	V7502	C15
C2210	B7	C7504	C11	J2070	C17	J5108	F4	R1471	G4	**X**	
C2211	B6	C7505	B11	J2071	C16	J5109	F4	R1472	F3	X1470	E16
C2212	B6	C7507	C10	J2072	C15	J5110	F4	R1473	F3	X2001	F1
C2213	C7	C7508	B10	J2200	D5	J5200	E5	R1474	G5	X2060	A9
C2214	C7	C7509	C11	J2201	B7	J7503	A10	R1475	F7	X2070	H14
C2215	C7	C7512	G19	J2202	B7	J7504	B8	R1486	E20	X2700	H6
C2216	D7	C7513	B11	J2204	B6	J7505	B8	R1487	E12	X4400	F2
C2217	D7	C7514	G19	J2205	B7	J7506	B8	R1488	D19	X4401	B19
C2219	D6	C7515	C9	J2206	D5	J7506	B19	R1489	E13	X5200	H11
C2220	B6	C7516	C9	J2207	C7	J7508	B11	R1490	E20	X5207	H4
C2221	B7	C7518	E9	J2208	D8	J7509	B11	R1491	E12	X5208	B5
C2222	B6	C7520	C11	J2209	D6	J7510	B11	R2000	F3	X5209	B4
C2223	C5	C7522	C9	J2210	D5	J7511	B10	R2001	F3	X5210	A4
C2224	D5	C7523	G18	J2211	I3	J7515	B11	R2002	G3	X5211	A5
C2225	D7	C7524	B9	J2212	I2	J7516	B12	R2003	G3	X5212	C16
C2226	D7	C7525	G18	J2213	I3	J7517	E9	R2004	G3	**Z**	
C2227	B7	C7527	B10	J2214	I3	J7518	D9	R2005	H3	Z2000	E1
C2228	C7	C7528	B10	J2215	I3	J7519	I18	R2006	G2	Z2001	E1
C2230	D7	C7529	D9	J2218	D6	J7520	I18	R2007	F1	Z2003	E1
C2231	A5	C7530	B11	J2219	B7	J7521	I16	R2009	G1	Z4400	D2
C2232	C7	C7531	C10	J2220	I3	J7522	G4	R2010	F1	Z4401	G3
C2234	D6	C7532	B11	J2221	I4	J7523	H1	R2011	G1	Z4402	E7
C2235	D6	C7533	C8	J2300	C6	J7524	I2	R2070	G14	Z4403	F7
C2237	E7	C7534	B11	J2301	D7	J7525	H2	R2071	E6	Z7500	F14
C2240	B2	C7536	B11	J2302	H6	J7526	H2	R2100	F2	Z7503	H18
C2241	G3	C7541	D9	J2305	C7	J7527	I2	R2101	E2	Z7504	I16
C2242	E5	C7543	E10	J2306	G13	J7529	C4	R2104	E19		
C2243	I3	C7545	I17	J2307	H13	J7534	F5	R2105	E19		
C2244	G1	C7547	D9	J2308	D7	J7536	C4	R2106	F18		
C2300	D5	C7548	D8	J2309	G6	J7537	C3	R2107	F18		
C2301	D6	C7549	D9	J2802	H3	J7538	C3	R2200	E6		
C2302	D5	C7550	E8	J2803	H6	J7539	D3	R2201	E6		
C2303	D7	C7552	D8	J2804	I2	J7540	D5	R2202	E6		
C2304	C6	C7553	D8	J2805	G2	J7541	D5	R2205	E7		
C2307	E7	C7554	B6	J2806	H3	J7542	D4	R2303	F6		
C2309	E5	C7555	B6	J2807	H1	J7543	D5	R2304	F6		
C2312	E7	C7556	G16	J2808	H3	J7544	D5	R2305	C7		
C2313	E7	C7558	E10	J2809	H1	J7545	E7	R2700	I6		
C2314	G7	C7559	I18	J2810	H1	J7546	E6	R3000	G6		
C2315	G6	C7560	E9	J2812	I4	J7547	D4	R4400	E6		
C2316	C6	C7561	G17	J2813	I4	J7548	F4	R4401	E6		
C2700	H7	C7563	G17	J2814	I4	J7549	C4	R4402	E6		
C2800	H3	C7564	H18	J2815	I4	J7550	E3	R4403	B20		
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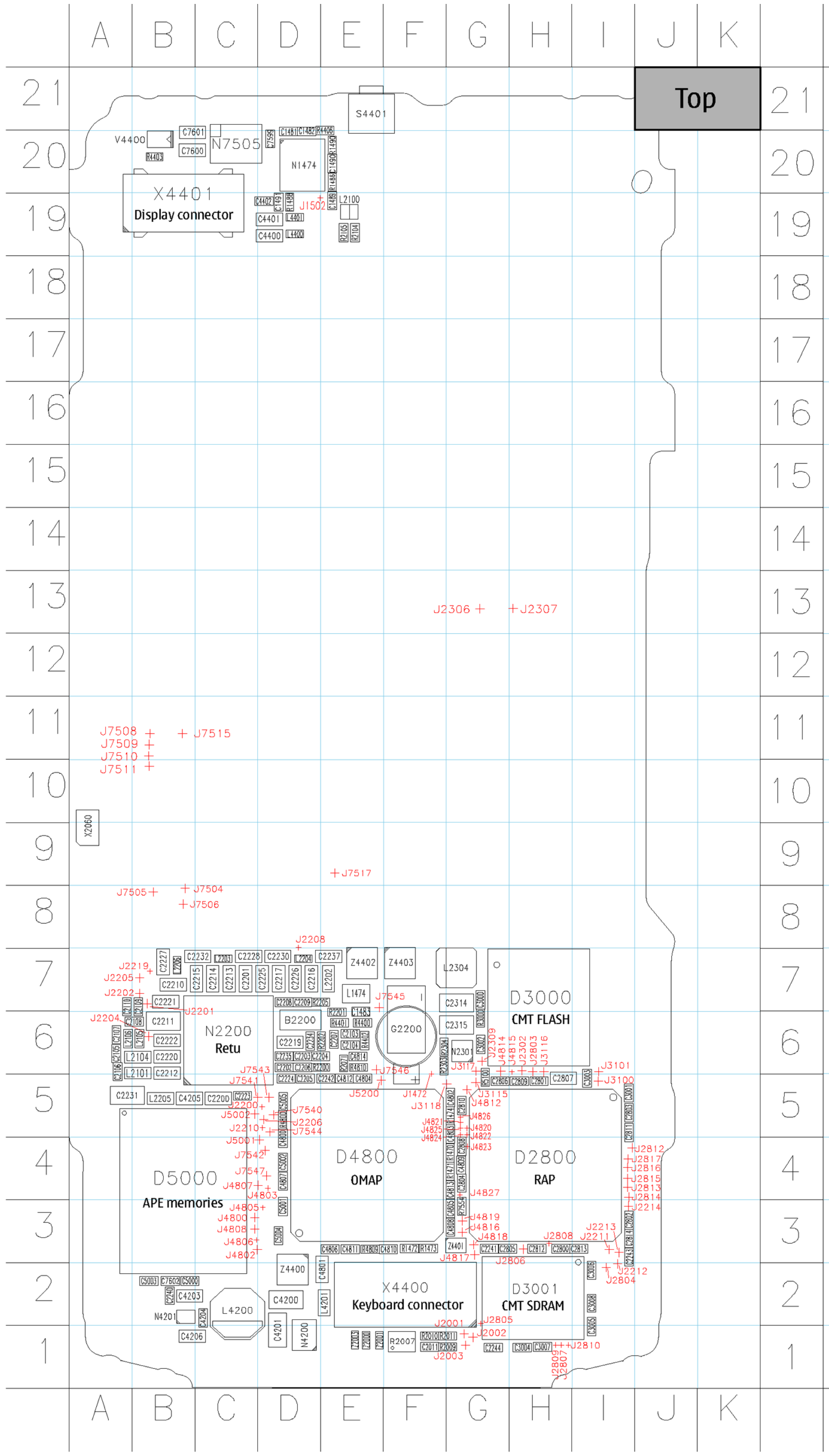

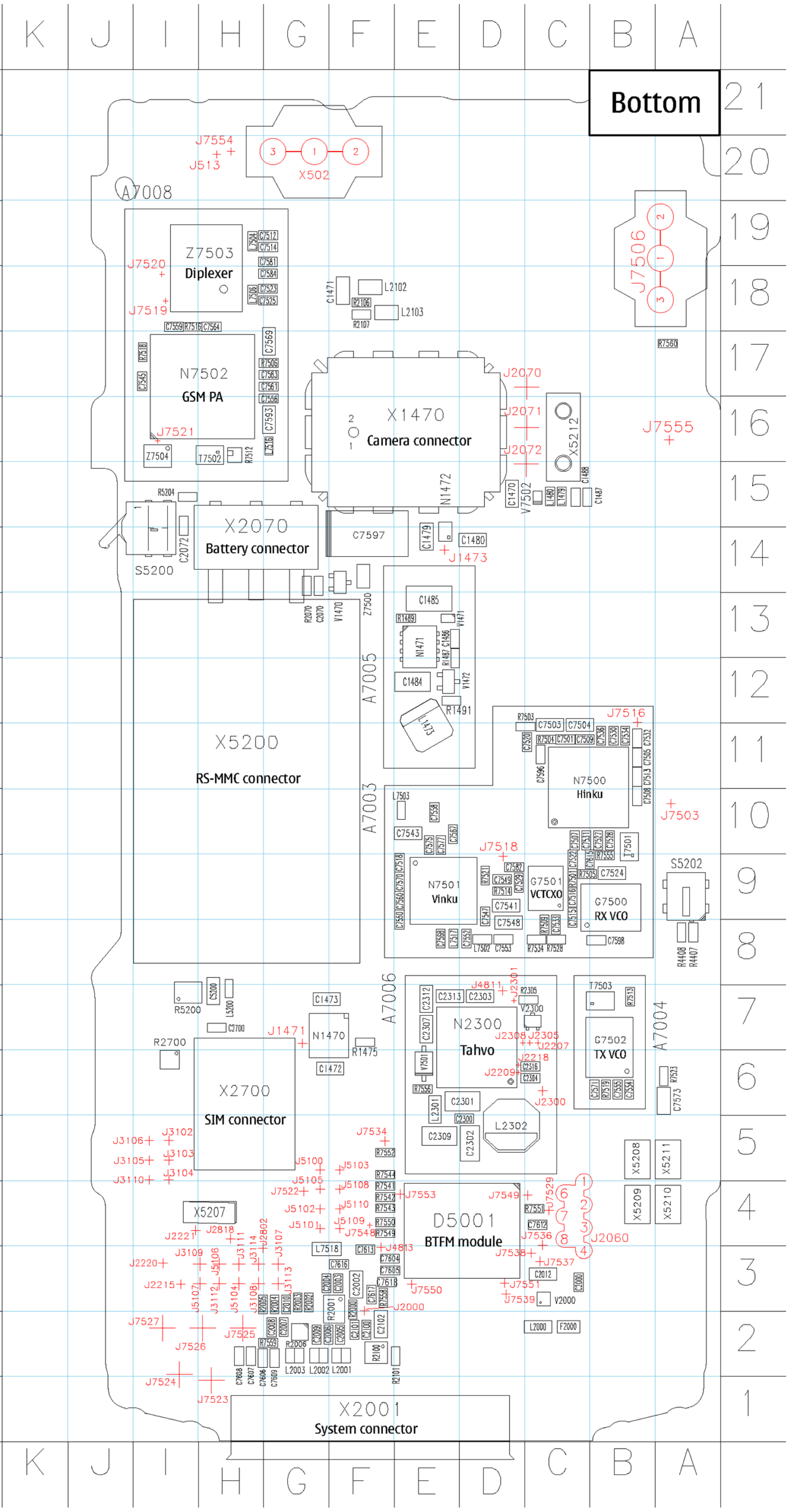

Glossary

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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

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

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

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)