Nokia Customer Care

# *Service Manual*

## RM-208 (Nokia E65)

# Mobile Terminal

*Part No: 9254835 (Issue 1)*

*COMPANY CONFIDENTIAL*

NOKIA

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# Amendment Record Sheet

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### IMPORTANT

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


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# Warnings and cautions

## Warnings

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

## Cautions

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


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## ESD protection

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

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

To replace the covers ESD protection must be applied.

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

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

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

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

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


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## Care and maintenance

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

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

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


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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.


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## Nokia E65 Service Manual Structure




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# 1 — General Information



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## RM-208 product selection

Nokia RM-208 is a WCDMA/GSM quad band handportable phone, supporting WCDMA 2100 (UMTS) , EGSM 850/900/1800/1900 bands and WLAN 802.11g.

The MMS implementation follows the OMA 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-208 uses Symbian 9.1a operating system and supports also MIDP Java 2.0 & CLDC1.1, providing a good platform for 3rd party applications.


**Figure 1 View of RM-208**

## RM-208 product features and sales package

### Bearers & transport

- RM-208 is a 3GPP Release 99 (+ Geran feature pack 1) terminal supporting WCDMA, EGPRS and GPRS data bearers.
- The maximum bit rate for WCDMA is up to 384 kbps for downlink and 384 kbps for uplink with simultaneous CS speech (12.2 (AMR) kbps).
- For GSM networks RM-208 is a class B terminal with EGPRS multislot class 32 (5 Rx, 3 Tx, SUM=6) and GPRS multislot class 32 (5 Rx, 3 Tx, SUM=6).

### Software platform

- SW platform: Nokia Series 60 3rd Edition


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### Connectivity

- Bluetooth 1.2 wireless technology
- IrDA
- Pop-Port™ interface with USB
- 2.0 mm charger connector
- WLAN 802.11g
- Dual transfer mode

### Productivity

- SMS, MMS and email
- MS Word, PowerPoint , Excel and Adobe PDF viewers
- PIM (Calendar & Contacts)
- HTML Nokia and XHTML browser
- Video streaming (3GPP)
- Logs (last calls , timers and history list)
- Instant messaging
- Java™ MIDP 2.0, CLDC 1.13D API, PIM API, File access API
- MP3
- OMA DRM 1.0 with forward lock
- Data Transfer

### Sales package

- Transceiver RM-208
- BL-5F Li-ion Battery Cell
- AC-4 Travel Charger
- All-in-one User Guide (warranty card + accessory info + getting started sheet + invitational module for Club Nokia )
- Headset HS-5
- Connectivity Cable CA-53
- Quickstart guide

## Product and module list

| Module name | Type code | Notes |
|---|---|---|
| System/RF Module | 1YB | Main PWB with components |
| UI flex | 1yc | |
| T9 flex | 1yd | |
| Camera flex | 1ye | |
| SIM card module | 1yf | |


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## Mobile enhancements

**Table 1 Audio**

| Enhancement | Type |
|---|---|
| Headset | HS-5 |
| Bluetooth headset BH 600 | HS-59W |
| Bluetooth headset BH 800 | HS-24W |
| Bluetooth headset BH 900 | HS-25W |

**Table 2 Car**

| Enhancement | Type |
|---|---|
| Advanced car kit | CK-20W |
| Car kit phone | N616 |
| Wireless plug-in car handsfree | HF-6W |
| Mobile charger | DC-4 |
| Mobile holder | CR-39 |
| Headrest handsfree | BHF-3 |
| Plug-in car handsfree | HF-3 |

**Table 3 Data**

| Enhancement | Type |
|---|---|
| Connectivity cable | CA-53 |
| Universal passive desk stand | DT-13 |
| 1GB memorycard | MU-22 |

**Table 4 Imaging**

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

**Table 5 Messaging**

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


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**Table 6 Power**

| Enhancement | Type |
|---|---|
| Battery | BP-5F |
| Travel charger | AC-5 |
| Compact charger | AC-3 |

## Technical specifications

### Transceiver general specifications

| Unit | Dimensions (L x W x T) | Weight (g) | Volume ($cm^3$) |
|---|---|---|---|
| Transceiver with BP-5F 1000mAh li-ion battery back | 105 x 49 x 15.5 mm | 115 (including BP-5L battery) | 74 |

### Main RF characteristics for GSM850/900/1800/1900 and WCDMA1900/2100 phones

| Parameter | Unit |
|---|---|
| Cellular system | GSM850, EGSM900, GSM1800/1900, WCDMA1900 or WCDMA2100 |
| Rx frequency band | GSM850: 869 - 894MHz |
| | EGSM900: 925 - 960 MHz |
| | GSM1800: 1805 - 1880 MHz |
| | GSM1900: 1930 - 1990 MHz |
| | WCDMA1900: 1930-1990MHz |
| | WCDMA2100: 2110 - 2170 MHz |
| Tx frequency band | GSM850: 824 - 849MHz |
| | EGSM900: 880 - 915 MHz |
| | GSM1800: 1710 - 1785 MHz |
| | GSM1900: 1850 - 1910 MHz |
| | WCDMA1900: 1850-1910MHz |
| | WCDMA2100: 1920 - 1980 MHz |
| Output power | GSM850: +5 ...+33dBm/3.2mW ... 2W |
| | GSM900: +5 ... +33dBm/3.2mW ... 2W |
| | GSM1800: +0 ... +30dBm/1.0mW ... 1W |
| | GSM1900: +0 ... +30dBm/1.0mW ... 1W |
| | WCDMA -50 ... 24 dBm |


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| Parameter | Unit |
|---|---|
| Number of RF channels | GSM850: 124 |
| | GSM900: 174 |
| | GSM1800: 374 |
| | GSM1900: 299 |
| Channel spacing | 200 kHz |
| Number of Tx power levels | GSM850: 15 |
| | GSM900: 15 |
| | GSM1800: 16 |
| | GSM1900: 16 |

## Battery endurance

| Battery | Capacity (mAh) | Talk time | Stand-by |
|---|---|---|---|
| BL-5F | 1000 | up to 7 hrs | up to 8 days |

## Charging times

| AC-4 |
|---|
| 1.5 hrs |

## Environmental conditions

| Environmental condition | Ambient temperature | Notes |
|---|---|---|
| Normal operation | -15ºC...+55ºC | Specifications fulfilled |
| Reduced performance | -25ºC...-15ºC<br>+55ºC...+70ºC | Operational for shorts periods only |
| Intermittent operation | -40ºC...-15ºC<br>+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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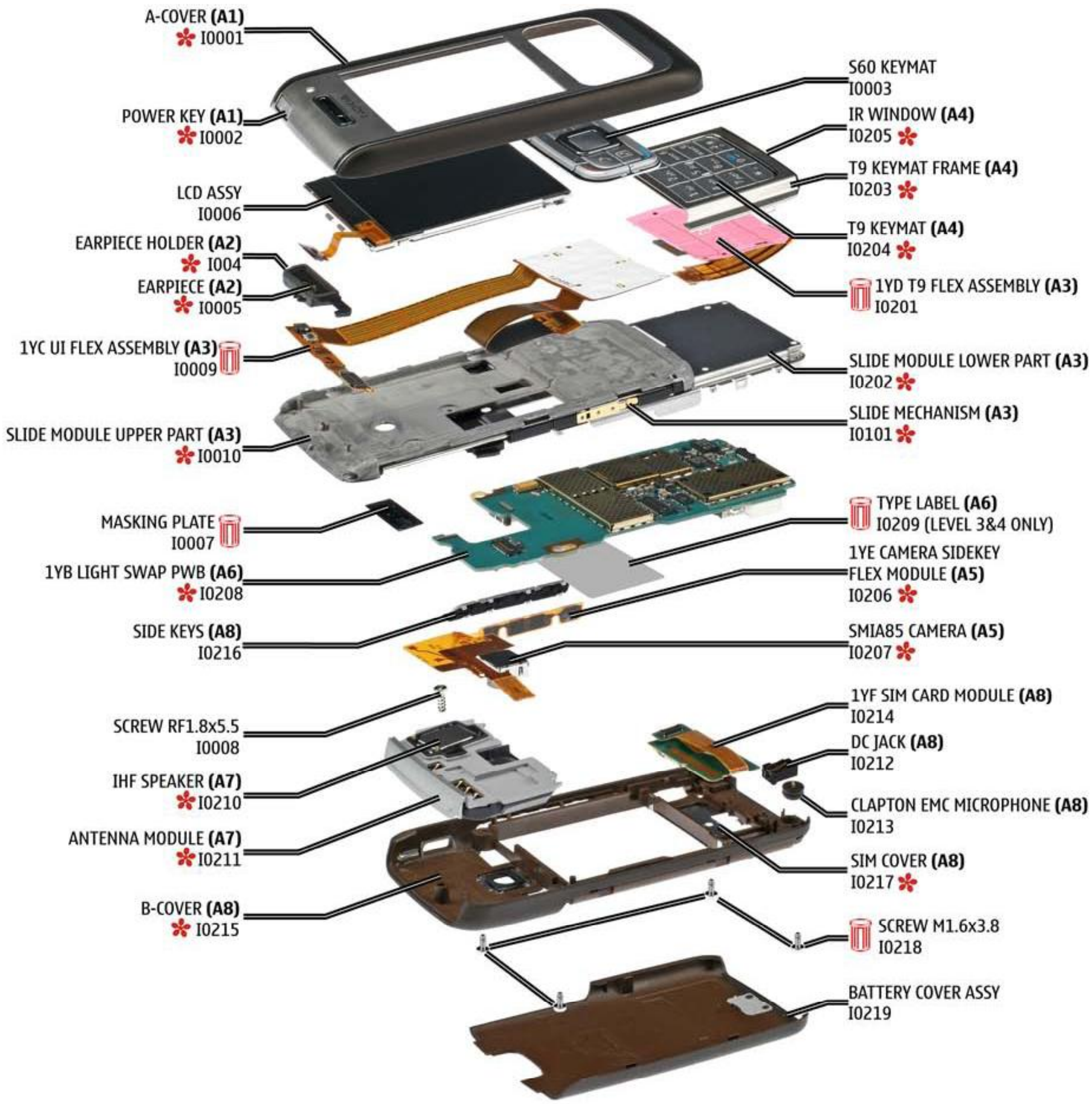
## Exploded view

### Exploded view




= These parts can not be reused after removal.

= only available as assembly

Ver. 0.1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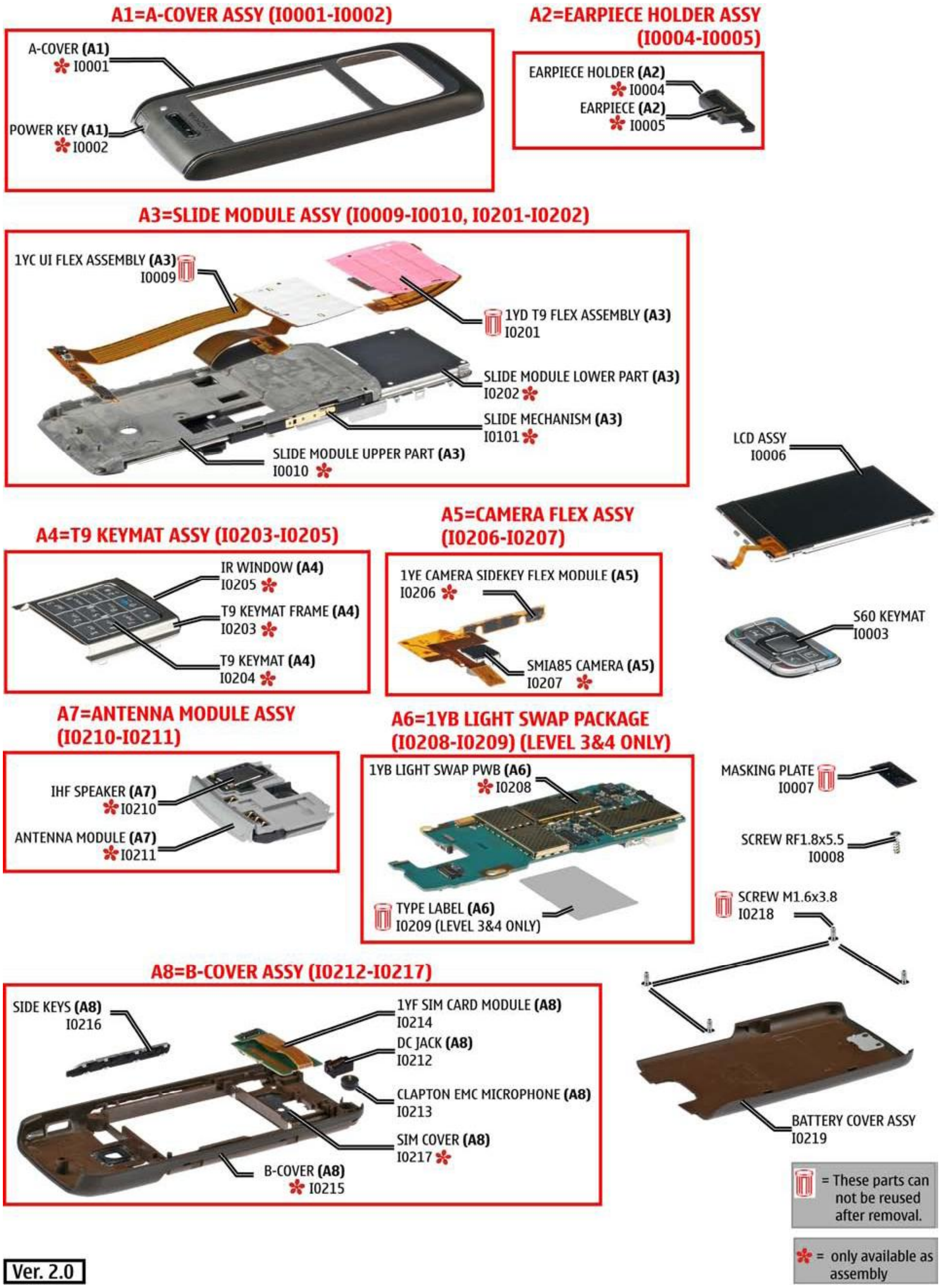
## *Spare parts overview*





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# Parts lists

## Mechanical spare parts list

### RM-208 mechanical parts list

| ITEM/ CIRCUIT REF. | QTY | SPARE PART DESCRIPTION | NOTE | ACT. | LEVEL | NAM | LTA | EU | MEA | APAC | CHINA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | A-COVER ASSY (I0001 - I0002) | | - | 1 | | | | | | |
| I0001 | 1 | A-COVER | | MR | - | | | | | | |
| I0002 | 1 | POWER KEY | | MR | - | | | | | | |
| | | | | | | | | | | | |
| I0003 | 1 | S60 KEYMAT | | MR | 1 | | | | | | |
| | | | | | | | | | | | |
| A2 | 1 | EARPIECE HOLDER ASSY (I0004 - I0005) | | - | 1 | | | | | | |
| I0004 | 1 | EARPIECE HOLDER | | MR | - | | | | | | |
| I0005 | 1 | EARPIECE | | MR | - | | | | | | |
| | | | | | | | | | | | |
| I0006 | 1 | LCD ASSY | | MR | 1 | | | | | | |
| I0007 | 1 | MASKING PLATE | | MR | 1 | | | | | | |
| I0008 | 1 | SCREW RF1.8x5.5 | | MR | 1 | | | | | | |
| | | | | | | | | | | | |
| A3 | 1 | SLIDE MODULE ASSY (I0009-I0010, I0101, I0201-I0202) | | - | 1 | | | | | | |
| I0009 | 1 | 1YC UI FLEX ASSEMBLY | Cannot be reused when removed | MR | 1 | | | | | | |
| I0010 | 1 | SLIDE MODULE UPPER PART | | MR | - | | | | | | |
| I0101 | 1 | SLIDE MECHANISM | | MR | - | | | | | | |


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| ITEM/ CIRCUIT REF. | QTY | SPARE PART DESCRIPTION | NOTE | ACT. | LEVEL | NAM | LTA | EU | MEA | APAC | CHINA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I0201 | 1 | 1YD T9 FLEX ASSEMBLY | Cannot be reused when removed | MR | 1 | | | | | | |
| I0202 | 1 | SLIDE MODULE LOWER PART | | MR | - | | | | | | |
| | | | | | | | | | | | |
| A4 | 1 | T9 KEYMAT ASSY (I0203-I0205) | | - | 1 | | | | | | |
| I0203 | 1 | T9 KEYMAT FRAME | | MR | - | | | | | | |
| I0204 | 1 | T9 KEYMAT | | MR | - | | | | | | |
| I0205 | 1 | IR WINDOW | | MR | - | | | | | | |
| | | | | | | | | | | | |
| A5 | 1 | CAMERA FLEX ASSY (I0206 - I0207) | | - | 1 | | | | | | |
| I0206 | 1 | 1YE CAMERA SIDEKEY FLEX MODULE | | MR | 1 | | | | | | |
| I0207 | 1 | SMIA85 CAMERA | | MR | - | | | | | | |
| | | | | | | | | | | | |
| A6 | 1 | 1YB LIGHT SWAP PACKAGE (I0208-I0209) | | - | 3 | | | | | | |
| I0208 | 1 | 1YB LIGHT SWAP PWB | | MS | - | | | | | | |
| I0209 | 1 | TYPE LABEL | Cannot be reused when removed | MR | 3 | | | | | | |
| | | | | | | | | | | | |
| A7 | 1 | ANTENNA MODULE ASSY (I0210 - I0211) | | - | 1 | | | | | | |
| I0210 | 1 | IHF SPEAKER | | MR | - | | | | | | |
| I0211 | 1 | ANTENNA MODULE | | MR | - | | | | | | |
| | | | | | | | | | | | |


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| ITEM/ CIRCUIT REF. | QTY | SPARE PART DESCRIPTION | NOTE | ACT. | LEVEL | NAM | LTA | EU | MEA | APAC | CHINA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A8 | 1 | B-COVER ASSEMBLY (I0212 - I0217) | | - | 1 | | | | | | |
| I0212 | 1 | DC-JACK | | MR | 1 | | | | | | |
| I0213 | 1 | CLAPTON EMC MICROPHONE | | MR | 1 | | | | | | |
| I0214 | 1 | 1YF SIM CARD MODULE | | MR | 1 | | | | | | |
| I0215 | 1 | B-COVER | | MR | - | | | | | | |
| I0216 | 1 | SIDE KEYS | | MR | - | | | | | | |
| I0217 | 1 | SIM COVER | | MR | - | | | | | | |
| | | | | | | | | | | | |
| I0218 | 4 | SCREW M1.6x3.8 | Cannot be reused when removed | MR | 1 | | | | | | |
| I0219 | 1 | BATTERY COVER ASSY | | MO | 1 | | | | | | |
| | | | | | | | | | | | |

## RM-208 component parts list

### Component parts list (1yb-07a)

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

| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| A1500 | Bottom | B | 18 | SHIELD_CAMERA_ACC | CAMERA ACC SHIELD 040-031706 | ~ |
| A2800 | Top | G | 7 | SHIELD_RAP_3G | RAP 3G SHIELD 040-031712 | ~ |
| A5000 | Top | C | 3 | SHIELD_COMBO | COMBO SHIELD 040-031714 | ~ |
| A6000 | Bottom | E | 4 | SHIELD_BT_WLAN | WLAN BT SHIELD 040-031708 | ~ |
| A7500 | Top | E | 11 | SHIELD_040_022072 | RA-6 RF-SHIELD 040-035290 | ~ |
| B2200 | Top | F | 5 | CRYSTAL_FC_135 | CRYSTAL 32.768KHZ +-20PPM 12.5PF | 32.768 kHz |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C1550 | Bottom | C | 17 | 0402C | Chipcap 5% NP0 | 27p |
| C1554 | Top | C | 17 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C1555 | Top | C | 17 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C1556 | Top | C | 17 | 0402C | Chipcap 5% NP0 | 27p |
| C1557 | Bottom | B | 18 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C1558 | Bottom | B | 18 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C1559 | Bottom | C | 18 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C1563 | Bottom | B | 18 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C1564 | Bottom | B | 18 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| C1566 | Bottom | B | 16 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C1567 | Top | D | 9 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C1568 | Top | E | 9 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C1569 | Top | D | 9 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C1570 | Bottom | C | 16 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C1571 | Bottom | C | 16 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C1575 | Bottom | C | 18 | 0402C | Chipcap 5% NP0 | 27p |
| C2000 | Bottom | E | 2 | 0402C | Chipcap 5% NP0 | 27p |
| C2001 | Bottom | D | 2 | 0603C_H0.95 | CHIPCAP X5R 470N K 25V 0603 | 470n |
| C2005 | Bottom | F | 2 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C2006 | Bottom | G | 2 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C2071 | Top | H | 13 | TANT_C_6.2X3.4_H1 .7 | CHIPTCAP 150U M 10V 6X3.2X1.5 | 150u_1 0V |
| C2201 | Top | G | 5 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C2202 | Top | C | 9 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2203 | Top | C | 9 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2204 | Top | C | 9 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2205 | Top | F | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2211 | Top | H | 5 | 0805C | CHIPCAP X5R 4U7 K 10V 0805 | 4u7 |
| C2213 | Top | F | 5 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2215 | Top | G | 5 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2216 | Top | F | 5 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C2217 | Top | G | 6 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C2220 | Top | H | 6 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2222 | Top | H | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C2225 | Top | E | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C2226 | Top | F | 5 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C2227 | Top | F | 5 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2228 | Top | E | 4 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2231 | Top | H | 6 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| C2232 | Top | H | 5 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2235 | Top | F | 6 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C2236 | Top | F | 6 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C2237 | Top | G | 4 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2238 | Top | H | 9 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2242 | Top | E | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2243 | Top | E | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2244 | Top | E | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2245 | Top | E | 6 | 0402C | Chipcap 5% NP0 | 68p |
| C2246 | Top | E | 6 | 0402C | Chipcap 5% NP0 | 68p |
| C2247 | Bottom | C | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2248 | Top | G | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2249 | Top | G | 6 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C2300 | Top | G | 3 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C2301 | Top | G | 3 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C2302 | Top | H | 4 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C2303 | Top | F | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C2304 | Top | G | 4 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C2307 | Top | F | 3 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C2309 | Top | G | 3 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C2312 | Top | F | 3 | 0405_DUAL | CHIPCAP NETWORK X5R 2X1U5 K 6V3 0405 | 2x1u5 |
| C2314 | Top | D | 7 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 |
| C2315 | Top | C | 7 | 0805C | CHIPCAP X5R 4U7 M 25V 0805 | 4u7 |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C2316 | Top | F | 4 | 0402C | Chipcap 5% NP0 | 100p |
| C2317 | Top | F | 4 | 0402C | Chipcap 5% NP0 | 100p |
| C2800 | Top | G | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2801 | Top | F | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2802 | Top | F | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2803 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2804 | Top | H | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2805 | Top | H | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2806 | Top | G | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2807 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2808 | Top | G | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2809 | Top | G | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2810 | Top | F | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2811 | Top | F | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2812 | Top | G | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2813 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2814 | Top | H | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2815 | Top | F | 9 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2816 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2817 | Top | H | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2818 | Top | F | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C2819 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2820 | Top | H | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2821 | Top | F | 7 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C2822 | Top | F | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4200 | Top | E | 8 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C4201 | Top | E | 8 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C4202 | Top | E | 8 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C4400 | Top | C | 8 | 0402C | Chipcap 5% NP0 | 27p |
| C4401 | Top | G | 2 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4402 | Top | D | 8 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4403 | Top | B | 9 | 0402C | Chipcap 5% NP0 | 27p |
| C4404 | Top | E | 9 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C4405 | Top | E | 9 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C4406 | Top | F | 2 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C4407 | Top | F | 1 | 0402C | Chipcap 5% NP0 | 27p |
| C4408 | Top | F | 1 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4409 | Top | C | 6 | 0402C | Chipcap 5% NP0 | 27p |
| C4410 | Top | C | 7 | 0402C | Chipcap 5% NP0 | 27p |
| C4411 | Top | A | 9 | 0402C | Chipcap 5% NP0 | 27p |
| C4800 | Top | A | 5 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4801 | Top | D | 6 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C4802 | Top | A | 6 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4803 | Top | D | 5 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C4804 | Top | C | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4805 | Top | D | 4 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4806 | Top | C | 6 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4807 | Top | A | 4 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4808 | Top | D | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4809 | Top | A | 6 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4810 | Top | D | 5 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4811 | Top | B | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4812 | Top | A | 4 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C4813 | Top | D | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C5000 | Top | C | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5001 | Top | E | 2 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5002 | Top | A | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5003 | Top | D | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5004 | Top | A | 2 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5005 | Top | A | 2 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5006 | Top | D | 4 | 0603C | CHIPCAP X5R 1U K 6V3 0603 | 1u0 |
| C5201 | Bottom | I | 3 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C5202 | Bottom | H | 2 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C5203 | Bottom | H | 2 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C5204 | Bottom | I | 3 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C5205 | Top | E | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C5206 | Top | E | 5 | 0402C | Chipcap X7R 10% 50V 0402 | 1n0 |
| C6030 | Bottom | G | 3 | 0402C | Chipcap 5% NP0 | 100p |
| C6031 | Bottom | F | 3 | 0402C | Chipcap 5% NP0 | 15p |
| C6033 | Bottom | G | 3 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C6036 | Bottom | G | 4 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C6037 | Bottom | G | 4 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |
| C6038 | Bottom | G | 4 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |
| C6039 | Bottom | G | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6040 | Bottom | G | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6041 | Bottom | H | 3 | 0402C | CHIPCAP X5R 0U47 K 6.3V 0402 | 0u47 |
| C6042 | Bottom | G | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |
| C6043 | Bottom | G | 4 | 0402C | CHIPCAP X5R 0U47 K 6.3V 0402 | 0u47 |
| C6044 | Bottom | F | 5 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |
| C6045 | Bottom | G | 5 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |
| C6051 | Bottom | G | 5 | 0402C | Chipcap 5% NP0 | 10p |
| C6300 | Bottom | E | 5 | 0805C | CHIPCAP X5R 22U M 6V3 0805 | 22u |
| C6301 | Bottom | E | 5 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C6303 | Bottom | E | 5 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C6305 | Bottom | A | 4 | 0402C | CHIPCAP NP0 0P5 C 50V 0402 | 0p5 |
| C6307 | Bottom | E | 3 | 0402C | CHIPCAP X5R 1U K 6V3 0402 | 1u0 |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C6308 | Bottom | D | 3 | 0402C | Chipcap +-0.25pF NP0 | 6p8 |
| C6328 | Bottom | C | 5 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6329 | Bottom | C | 5 | 0402C | Chipcap 5% NP0 | 12p |
| C6330 | Bottom | D | 5 | 0603C | CHIPCAP X5R 2U2 K 6V3 0603 | 2u2 |
| C6331 | Bottom | E | 5 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C6335 | Bottom | D | 5 | 0402C | CHIPCAP NP0 220P J 25V 0402 | 220p |
| C6338 | Bottom | C | 5 | 0402C | Chipcap 5% NP0 | 47p |
| C6350 | Bottom | F | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6351 | Bottom | F | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6352 | Bottom | F | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6353 | Bottom | F | 4 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6354 | Bottom | E | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6360 | Bottom | D | 3 | 0402C | CHIPCAP X5R 100N K 10V 0402 | 100n |
| C6396 | Bottom | C | 4 | 0402C | Chipcap +-0.25pF NP0 | 6p8 |
| C6397 | Bottom | C | 4 | 0402C | Chipcap +-0.25pF NP0 | 6p8 |
| C6398 | Bottom | D | 4 | 0402C | Chipcap +-0.25pF NP0 | 6p8 |
| C6399 | Bottom | D | 4 | 0402C | Chipcap +-0.25pF NP0 | 6p8 |
| C7500 | Top | H | 11 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| C7507 | Top | G | 11 | 0402C | Chipcap X7R 10% 16V 0402 | 10n |
| C7513 | Top | H | 11 | 0402C | Chipcap X7R 10% 25V 0402 | 4n7 |
| C7518 | Top | G | 10 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C7519 | Top | H | 10 | 0402C | CHIPCAP X5R 1U5 K 4V 0402 | 1u5 |
| C7520 | Top | H | 10 | 0402C | Chipcap 5% X7R | 1n0 |
| C7521 | Top | D | 10 | 0402C | Chipcap +-0.25pF NP0 | 3p3 |
| C7523 | Top | D | 12 | 0402C | Chipcap +-0.25pF NP0 | 3p3 |
| C7524 | Top | E | 10 | 0402C | Chipcap 5% NP0 | 27p |
| C7525 | Top | E | 10 | 0402C | Chipcap 5% NP0 | 10p |
| C7531 | Bottom | E | 19 | 0402C | Chipcap +-0.25pF NP0 | 8p2 |
| C7532 | Bottom | E | 19 | 0402C | Chipcap +-0.25pF NP0 | 1p8 |
| C7533 | Bottom | D | 19 | 0402C | Chipcap 5% NP0 | 100p |
| C7536 | Bottom | C | 16 | 0402C | Chipcap 5% NP0 | 12p |
| C7537 | Bottom | C | 16 | 0402C | Chipcap 5% NP0 | 12p |
| C7543 | Top | C | 11 | 0603C | CHIPCAP X5R 4U7 K 6V3 0603 | 4u7 |
| C7544 | Top | B | 11 | 0402C | CERCAP X7R 22N K 16V 0402 | 22n |
| C7545 | Top | B | 11 | 0402C | Chipcap 5% NP0 | 10p |
| C7547 | Top | B | 10 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| C7548 | Top | B | 11 | 0402C | Chipcap X7R 10% 16V 0402 | 8n2 |
| C7549 | Top | C | 11 | 0402C | Chipcap X7R 10% 16V 0402 | 8n2 |
| C7550 | Top | B | 10 | 0402C | Chipcap 5% X7R | 1n0 |
| C7553 | Top | C | 11 | 0402C | Chipcap 5% X7R | 1n0 |
| C7580 | Top | H | 10 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C7581 | Top | H | 10 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C7582 | Top | H | 10 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C7583 | Top | H | 10 | 0402C_H0.6 | CHIPCAP X5R 100N K 16V 0402 | 100n |
| C7586 | Top | F | 10 | 0402C | Chipcap 5% NP0 | 10p |
| C7587 | Top | F | 10 | 0402C | Chipcap 5% NP0 | 10p |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| C7590 | Top | F | 12 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| C7591 | Top | F | 11 | 0603C | CHIPCAP X5R 10UF 6V3 0603 | 10u |
| D1550 | Bottom | B | 17 | TFBGA84 | HW ACCELERATOR STV0984N | ~ |
| D2800 | Top | G | 8 | VFBGA343 | RAP3GS V2.0E-PA VFBGA | ~ |
| D2801 | Top | G | 8 | FBGA128_EMPTY | COMBO 128M NOR +128M DDR DRAM FBGA128 | 8Mx16 / 8Mx16 |
| D4400 | Top | D | 8 | XBGA_N5_H0.625 | 1X1-IN AND 1.8V 74AUC1G08 WCSP-5 | ~ |
| D4800 | Top | C | 5 | uBGA_289 | HELEN3 PS2.0 N3 F761909 C27 UBGA289 | ~ |
| D5000 | Top | C | 2 | FBGA133_11.6X13.1 | COMBO 512 DDR + 1G NAND FBGA133 PBFREE | 32Mx16/128Mx8 |
| D6030 | Bottom | G | 4 | XBGA_N5_H0.625 | OR-GATE 2INPUT 74LVC1G32YZTR WCSP-5 | ~ |
| E1500 | Top | G | 15 | SMT_EMI_GASKET_13 | 25SMT-3645-13 T and R330MM | ~ |
| E1501 | Top | E | 19 | SMT_EMI_GASKET_13 | 25SMT-3645-13 T and R330MM | ~ |
| E1502 | Bottom | B | 5 | SMT_EMI_GASKET_41 | 25SMT-3645-41 T and R330MM | ~ |
| E1503 | Bottom | H | 5 | SMT_EMI_GASKET_41 | 25SMT-3645-41 T and R330MM | ~ |
| E7500 | Bottom | B | 20 | SK200400122 | SM CONN SPACER PAD 2.0X2.0 | ~ |
| E7501 | Bottom | B | 20 | CONTACT_PAD_2.95X1.95 | SM CONN VIBRA SPACER PAD 2.8X1.8 | ~ |
| E7502 | Bottom | C | 20 | CONTACT_PAD_2.95X1.95 | SM CONN VIBRA SPACER PAD 2.8X1.8 | ~ |
| E7531 | Bottom | E | 20 | SK200400122 | SM CONN SPACER PAD 2.0X2.0 | ~ |
| F2000 | Bottom | C | 2 | 0603_FUSE_AVX2MATS | SM FUSE F 2.0A 32V | 2A |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| G2200 | Top | E | 3 | BATTER_EECEP | RTC BACUP CAPAC 311 SIZE FOR 2.6V 4UAH | 2.6V |
| G6030 | Bottom | G | 5 | VCTCXO_3.4X2.7_4P 2_H1.0 | TCXO 38.4MHZ +-10PPM 2.78V | 38.4M Hz |
| G7501 | Top | H | 12 | NKG3176B_H1.0 | VCTCXO 38.4MHZ 2.5V 2MA | 38.4M Hz |
| L1553 | Bottom | C | 18 | CHOKE_SER300 | CHOKE 1U 0R1 1.5A 3.0X3.0X1.0 | 1uH |
| L2000 | Bottom | D | 2 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2001 | Bottom | F | 2 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x100 0R/ 100MH z |
| L2002 | Bottom | G | 2 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x100 0R/ 100MH z |
| L2003 | Bottom | G | 2 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x100 0R/ 100MH z |
| L2202 | Top | E | 4 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2205 | Top | H | 6 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2206 | Top | B | 7 | 0405_2_H1.0 | CHIP BEAD ARRAY 2X1000R 0405 | 2x100 0R/ 100MH z |
| L2207 | Top | F | 6 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2208 | Top | F | 6 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2209 | Top | H | 6 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/ 100MH z |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| L2210 | Top | H | 6 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/ 100MH z |
| L2301 | Top | G | 3 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L2302 | Top | G | 4 | CHOKE_SER400_H1. 2 | INDUCT WW 10UH 0A65 0R35 4X4X1.2 | 10uH |
| L2304 | Top | D | 7 | CHOKE_SER300_H1. 5 | CHOKE 22U M 0R7 0.35A 3.0x3.0x1.5 | 22uH |
| L4200 | Top | E | 7 | CHOKE_SER400_H1. 2 | INDUCT WW 10UH 0A65 0R35 4X4X1.2 | 10uH |
| L4201 | Top | E | 9 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L4400 | Top | F | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MH z |
| L4401 | Top | C | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MH z |
| L4402 | Top | B | 9 | 0603_BLM | FERRITE BEAD 0R5 600R/100MHZ 0603 | 600R/ 100MH z |
| L4403 | Top | C | 8 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/ 100MH z |
| L6030 | Bottom | F | 3 | 0402L | CHIP COIL 22N J Q28/800M 0402 | 22nH |
| L6306 | Bottom | B | 3 | 0402L | CHIP COIL 3N9 +-0N3 Q28/800M 0402 | 3n9H |
| L7500 | Top | G | 10 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH |
| L7501 | Top | F | 11 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH |
| L7502 | Top | G | 12 | 0603_BLM | FERR.BEAD 220R/ 100M 2A 0R05 0603 | 220R/ 100MH z |
| L7503 | Top | G | 10 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/ 100MH z |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| L7506 | Top | H | 12 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/100MHz |
| L7510 | Top | D | 12 | FERRITE_FBMJ1608 | FERRITE BEAD 0R01 28R/100MHZ 0603 | 28R/100MHz |
| L7526 | Top | F | 10 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/100MHz |
| L7530 | Bottom | E | 19 | 0402L | CHIP COIL 6N8 J Q27/800M 0402 | 6n8H |
| L7540 | Top | C | 10 | CHOKE_SER300_H1.5 | CHOKE 3U3 1.2A 0R096 3X3X1.5 | 3u3H |
| L7550 | Top | B | 10 | 0402L | FERR.BEAD 240R7100M 0.4A 0R4 0402 | 240R/100MHz |
| L7588 | Top | G | 11 | 0402L | CHIP COIL 12N J Q31/800M 0402 | 12nH |
| L7589 | Top | G | 12 | 0402L | CHIP COIL 6N8 J Q27/800M 0402 | 6n8H |
| L7590 | Top | F | 12 | INDUCTOR_MDT2520 | INDUCT ML CHIP PWR 3U3 M 0R15 0.2A | 3u3H |
| L7591 | Top | B | 10 | FERRITE_FBMJ1608 | FERRITE BEAD 0R01 28R/100MHZ 0603 | 28R/100MHz |
| L7592 | Top | F | 11 | FERRITE_FBMJ1608 | FERRITE BEAD 0R01 28R/100MHZ 0603 | 28R/100MHz |
| M2200 | Bottom | B | 4 | VIBRA_M_KHN4NX1RA | SMD VIBRA MOTOR 1.3V 80MA 9000RPM | ~ |
| N1551 | Top | D | 9 | USMD5_1.47X1.04_H0.675 | VREG LP3985ITLX-2.8 NOPB USMD5 | ~ |
| N1552 | Bottom | B | 18 | USMD5_1.518X1.137 | DC/DC CONV 1.8V 600MA 3MHZ WLCSP5 | ~ |
| N2200 | Top | G | 6 | TFBGA_105 | AVILMA 1.05C BB MODULE TFBGA105 | ~ |
| N2300 | Top | F | 3 | TFBGA64_H1.2 | BETTY V2.1 & V2.2 LFA TFBGA64 | ~ |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| N2301 | Top | D | 7 | USMD8_1.69X1.69 | WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8 | ~ |
| N4200 | Top | E | 8 | USMD_10_2.458X1.899 | DC/DC CONV LM3661-1.40V/ 1.05V NOPB | ~ |
| N4400 | Top | G | 2 | SOT_666 | TRX2+RX4 PEMD9 N &P 10K/47K 0W12 SOT666 | ~ |
| N4401 | Top | H | 2 | D381A | POWER IC D381A 5X7 QFN | ~ |
| N4402 | Top | E | 9 | SH248CSP | HALL IC SWITCH SH248CSP VCC | ~ |
| N4403 | Top | F | 1 | IRDA_TFBS_GP2W_CIM | IRDA MIR XSMALL | ~ |
| N4404 | Top | B | 9 | CSP_8_2.118X1.118 | IC ANALOG SWITCH SPDT LOW THRESHOLD CSP8 | ~ |
| N5200 | Bottom | H | 3 | BGA24_2.58X2.58_P0.4 | LEVEL SHIFTER SD/ MMC 24BGA | ~ |
| N6030 | Bottom | G | 3 | uBGA63_4.6X4.6 | BRF6150 | ~ |
| N6031 | Bottom | G | 5 | FC_4_0.99X0.99 | LI VREG TK63128B 2.8V WLCSP4 | ~ |
| N6300 | Bottom | E | 4 | LFBGA240 | WLAN MCM STLC4550 LFBGA240 | ~ |
| N6301 | Bottom | D | 4 | RF5924 | WLAN RF5924 ES3.5 | ~ |
| N7505 | Top | G | 11 | TFBGA144 | AHNEUS204A TFBGA144 | ~ |
| N7520 | Top | D | 11 | RF9283E1.2 | PW AMP GSM/EDGE 850/900/1800/1900 | ~ |
| N7530 | Bottom | D | 19 | SC70_6_FAIR | HIGH POWER SPDT RF SW SC70 | ~ |
| N7540 | Top | B | 11 | PW_AMP_RF3278E4.1 | PW AMP WCDMA 824-915/1710-1980MHZ | ~ |
| N7541 | Top | B | 10 | USMD8_1.85X1.70 | DC/DC CONV LMX3206TLX uSMD8 | ~ |
| N7590 | Top | F | 12 | uBGA8_1.849X1.696 | DC CONV LM3202TLX NOPB REVB USMD8 | ~ |
| R1500 | Top | D | 5 | 0402R | CHIPRES 0W06 10K F 0402 | 10k |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| R1550 | Top | B | 17 | 0402R | Resistor 5% 63mW | 4k7 |
| R1551 | Top | B | 17 | 0402R | Resistor 5% 63mW | 4k7 |
| R1555 | Top | C | 6 | 0402R | Resistor 5% 63mW | 100R |
| R1556 | Top | B | 6 | 0402R | Resistor 5% 63mW | 100R |
| R1557 | Bottom | C | 16 | 0402R | Resistor 5% 63mW | 100R |
| R1558 | Bottom | C | 17 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| R1561 | Bottom | B | 16 | 0402R | Resistor 5% 63mW | 100R |
| R1567 | Bottom | C | 17 | 0402R | Resistor 5% 63mW | 4k7 |
| R1573 | Bottom | C | 17 | 0402R | Resistor 5% 63mW | 4k7 |
| R1574 | Bottom | B | 16 | 0402R | Resistor 5% 63mW | 4k7 |
| R1575 | Bottom | B | 18 | 0402R | Resistor 5% 63mW | 220k |
| R1578 | Top | D | 9 | 0603R | CHIPRES JUMPER 0603 | 0R |
| R2000 | Bottom | G | 2 | 0402R | Resistor 5% 63mW | 10R |
| R2001 | Bottom | F | 2 | 0402R | Resistor 5% 63mW | 10R |
| R2002 | Bottom | F | 2 | 0402_VAR | CHIP VARISTOR VWM5.6V VC15.5 0402 | 5.6V/ 15V/ 0.05J |
| R2003 | Bottom | F | 2 | 0402_VAR | CHIP VARISTOR VWM5.6V VC15.5 0402 | 5.6V/ 15V/ 0.05J |
| R2004 | Bottom | E | 2 | 0402R | Resistor 5% 63mW | 100R |
| R2006 | Bottom | H | 2 | BGA11 | ASIP 4 LINES AUDIO FILTER BGA11 | ~ |
| R2007 | Bottom | F | 2 | uBGA11_1.6X2.15 | ASIP SILIC USB OTG / ESD BGA11 | ~ |
| R2010 | Bottom | E | 2 | 0402R | Resistor 5% 63mW | 220k |
| R2015 | Bottom | D | 2 | BGA_4 | ASIP TVS BGA4 | ~ |
| R2070 | Bottom | G | 15 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/ 50V |
| R2071 | Bottom | H | 5 | 0402_NTH5 | NTC RES 47K J B=4050+-3% 0402 | 47k |
| R2200 | Top | G | 6 | 0402R | Resistor 5% 63mW | 1k0 |
| R2201 | Top | G | 6 | 0402R | Chipres 0W06 jumper 0402 | 0R |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| R2202 | Top | C | 9 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/ 50V |
| R2203 | Top | C | 9 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/ 50V |
| R2204 | Top | C | 17 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/ 50V |
| R2205 | Top | C | 17 | 0402_VAR | CHIP VARISTOR VWM14V VC50V 0402 | 14V/ 50V |
| R2206 | Top | F | 6 | 0402R | Resistor 5% 63mW | 27k |
| R2300 | Top | H | 12 | CURRENT_SEN_0R01_D1J | CHIPRES 0W1 0R01 J 0603 | 0R01 |
| R2302 | Top | H | 4 | 0402R | Resistor 5% 63mW | 100R |
| R2303 | Top | D | 8 | 0402R | Resistor 5% 63mW | 33R |
| R2800 | Top | G | 7 | 0402R | Resistor 5% 63mW | 10R |
| R2801 | Top | F | 9 | 0402R | Resistor 5% 63mW | 4k7 |
| R2802 | Top | F | 7 | 0402R | Resistor 5% 63mW | 4k7 |
| R2803 | Top | H | 7 | 0402R | Resistor 5% 63mW | 4k7 |
| R4400 | Top | F | 2 | 0402R | Resistor 5% 63mW | 220k |
| R4401 | Top | E | 9 | 0402R | Resistor 5% 63mW | 100k |
| R4402 | Top | G | 2 | 0402R | Resistor 5% 63mW | 27k |
| R4403 | Top | E | 2 | 0805R_THERM1 | CHIPRES 0W125 4R7 J 0805 | 4R7 |
| R4404 | Top | D | 9 | 0402R | Resistor 5% 63mW | 100R |
| R4405 | Top | D | 9 | 0402R | Resistor 5% 63mW | 470R |
| R4410 | Top | C | 6 | 0402R | Resistor 5% 63mW | 4k7 |
| R4413 | Top | H | 1 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| R4800 | Top | A | 5 | 0402R | Resistor 5% 63mW | 10R |
| R4801 | Bottom | F | 5 | 0402R | Resistor 5% 63mW | 47R |
| R4802 | Bottom | F | 5 | 0402R | Resistor 5% 63mW | 47R |
| R4809 | Top | E | 5 | 0402R | Resistor 5% 63mW | 1k0 |
| R5206 | Bottom | I | 2 | 0402R | Resistor 5% 63mW | 100k |
| R6054 | Bottom | F | 4 | 0402R | Resistor 5% 63mW | 100k |
| R6055 | Bottom | F | 5 | 0402R | Resistor 5% 63mW | 100k |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| R6065 | Bottom | H | 4 | 0402R | Resistor 5% 63mW | 10k |
| R6300 | Bottom | E | 3 | 0402R | CHIPRES 0W06 1M F 100PPM 0402 | 1M0 |
| R6301 | Bottom | E | 3 | 0402R | Resistor 5% 63mW | 10k |
| R6350 | Bottom | F | 3 | 0402R | Resistor 5% 63mW | 100R |
| R6356 | Bottom | F | 4 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| R7501 | Top | H | 11 | 0402R | Resistor 5% 63mW | 10R |
| R7502 | Top | H | 10 | 0402R | CHIPRES 0W06 10K F 0402 | 10k |
| R7503 | Top | G | 10 | 0402R | Resistor 5% 63mW | 4k7 |
| R7509 | Top | H | 11 | 0402R | Resistor 5% 63mW | 22k |
| R7521 | Top | E | 10 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| R7522 | Top | G | 11 | 0402R | Resistor 5% 63mW | 18k |
| R7528 | Top | E | 12 | 0402R | Resistor 5% 63mW | 10R |
| R7529 | Top | D | 12 | 0402R | Resistor 5% 63mW | 470R |
| R7530 | Top | D | 12 | 0402R | Resistor 5% 63mW | 470R |
| R7532 | Bottom | C | 16 | 0402R | Resistor 5% 63mW | 470R |
| R7533 | Bottom | C | 16 | 0402R | Resistor 5% 63mW | 470R |
| R7541 | Top | B | 10 | 0402R | CHIPRES 0W06 1K2 F 250PPM 0402 | 1k2 |
| R7543 | Top | B | 11 | 0402R | Resistor 5% 63mW | 10k |
| R7544 | Top | B | 10 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| R7560 | Top | C | 10 | 0402R | Chipres 0W06 jumper 0402 | 0R |
| T6030 | Bottom | F | 3 | TRANS_LDB10 | BALUN 2450 +-50MHZ 1DB 1.7X0.9 | ~ |
| T7502 | Top | E | 12 | TRANS_HHM1726N 1 | TRANSF BALUN 1700-1900MHZ 0603 | ~ |
| T7580 | Top | F | 10 | TRANS_HHM1726N 1 | TRANSF BALUN 2.1GHZ 1.6X0.8MM | ~ |
| V2303 | Top | H | 3 | SOD323F | SCH DI 30V 2A SOD323F | ~ |
| V4400 | Top | D | 8 | SOT_666 | TRX2+RX4 PEMD9 N & P 10K/47K 0W12 SOT666 | ~ |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| V4406 | Top | D | 9 | VMT3 | TR 2SC5658QRS N 50V 0A1 0W15 VMT3 | ~ |
| W6300 | Bottom | A | 3 | ANTENNA_NAN68_PC0400C | ANTENNA INT WLAN P2636 (3-PAD) | ~ |
| X1550 | Top | B | 17 | JST_CN3_00514_200 | CONN BTB 2X15 F P0.4 30V 0.2A | ~ |
| X2001 | Bottom | F | 1 | SYSCON_MQ202_NK_14R3 | SM SYSTEM CONNECTOR 14POL | ~ |
| X2070 | Bottom | G | 15 | TYCO_0_1857071_1_V1 | CONN BATT 3.5V 2A P3.7 H2.7MM | ~ |
| X2420 | Bottom | I | 4 | MOLEX_51338_2274 | CONN BTB F 2X11 P0.4 | ~ |
| X4400 | Top | C | 9 | MOLEX_SD_51338_0409 | SM CONN B2B 2X20 F P0.4 | ~ |
| X4401 | Top | C | 7 | MOLEX_51338_9974 | CONN BTB REC F P0.4 5.5x3.3x1.34 | ~ |
| X4402 | Top | G | 1 | SPRING_040_012210 | SPRING CONTACT 012210 P2465 | ~ |
| X4403 | Top | G | 1 | SPRING_040_012210 | SPRING CONTACT 012210 P2465 | ~ |
| X6300 | Bottom | A | 5 | COAX_MM8430 | CONN SM COAX+ SW F 50R 250V 6GHZ | ~ |
| Z1550 | Top | B | 17 | BGA11 | ASIP 4 LINES AUDIO FILTER BGA11 | ~ |
| Z2000 | Bottom | E | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz |
| Z2001 | Bottom | E | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz |
| Z2003 | Bottom | E | 2 | FERRITE_0402 | FERRITE BEAD 0.6R 600R/100MHZ 0402 | 600R/100MHz |
| Z4400 | Top | C | 8 | BGA24_P0.4_H0.67 | ASIP 10-CH LCD FILTER W/ESD BGA24 | ~ |
| Z4401 | Top | B | 8 | BGA24_P0.4_H0.67 | ASIP 10-CH LCD FILTER W/ESD BGA24 | ~ |
| Z4402 | Top | B | 8 | BGA24_P0.4_H0.67 | ASIP 10-CH LCD FILTER W/ESD BGA24 | ~ |


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| Item | Side | Grid ref. | | Description and value | | |
|---|---|---|---|---|---|---|
| Z6300 | Bottom | D | 3 | LFB2H2G45SGFB868 | CER FILT 2450 +-50MHZ 2.5X2.0 | 2450MHz |
| Z7501 | Top | F | 10 | FILTER_2.1X1.7_10P_H0.6 | DUAL RX SAW FILTER 1800/1900MHZ 2016 | 1800/1900MHz |
| Z7503 | Top | F | 11 | FILTER_SAW_LMSM32AA_422 | TX SAW MODULE GSM 850/900MHZ | 850/900MHz |
| Z7504 | Top | F | 11 | EPCOS_LN82B_H0.45 | SAW FILT 942.5 +-17.5/2.6 1.4X1.1X0.4MM | 942.5 MHz |
| Z7521 | Top | E | 12 | FILTER_LFTC10N | CER FILT LFL181699TC1 2400-2483MHZ 1.6 | 2400-2483MHz |
| Z7540 | Top | C | 12 | DUPLEXER_3.2X2.7_H1.2 | DUPL SAW 824-849/869-894MHZ 3.0X2.5X1.2 | 824-849/869-894MHz |
| Z7541 | Top | C | 11 | DUPLEXER_3.2X2.7_H1.1 | DUPL SAW 1920-1980/2110-2170 3.0X2.5X1.1 | 1920-1980/2110-2170MHz |
| Z7580 | Top | F | 10 | FILTER_SXR967B3 | SAW FILT 2140 +-30MHZ 1.4X1.1X0.5 | 2140MHz |
| Z7582 | Top | G | 12 | FILTER_QCS10I_H0.78 | SAW FILT DUAL 836.5/1950MHZ 3.0X1.6X0.68 | 836.5/1950MHz |


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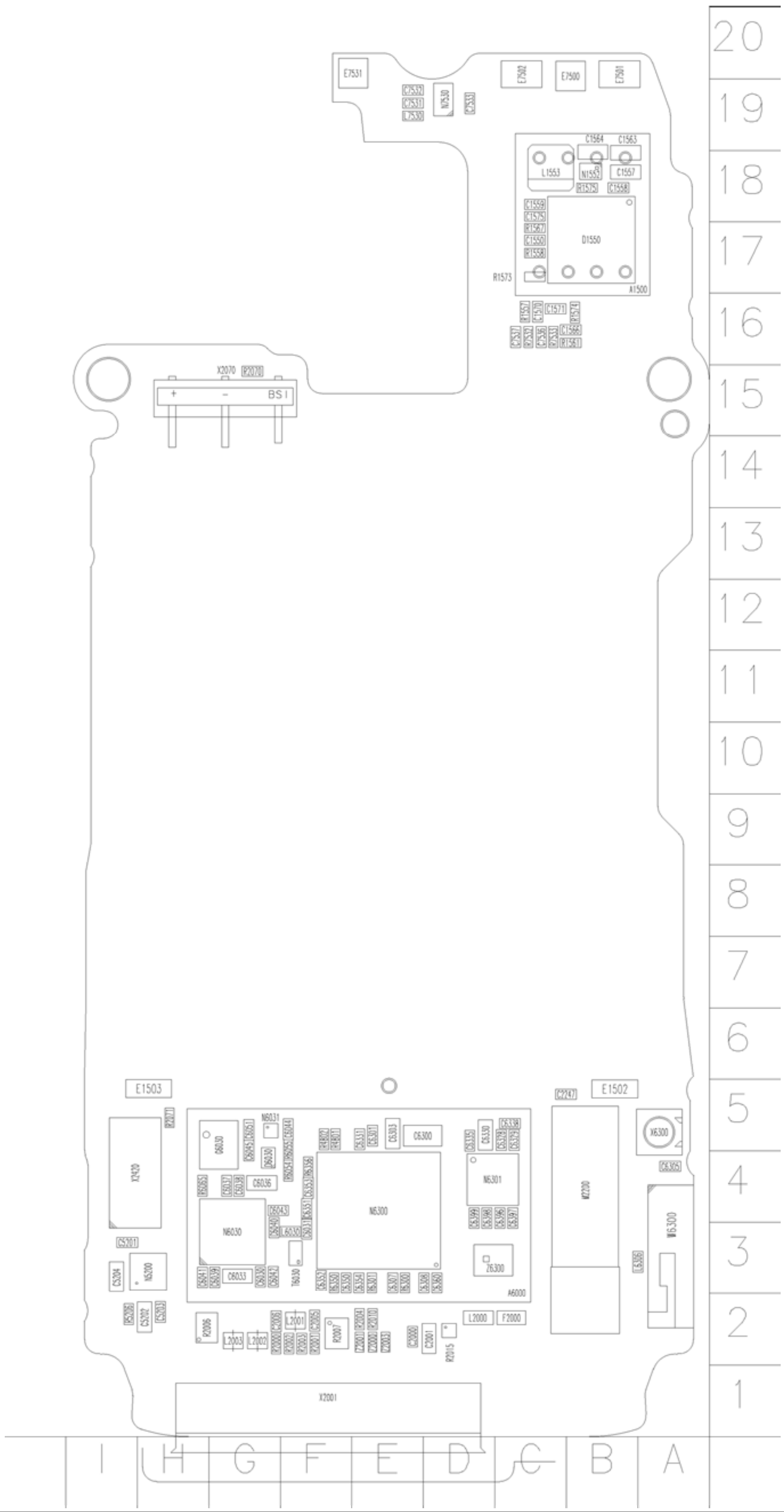
## Component layouts

### Component layout - bottom (1yb-07a)





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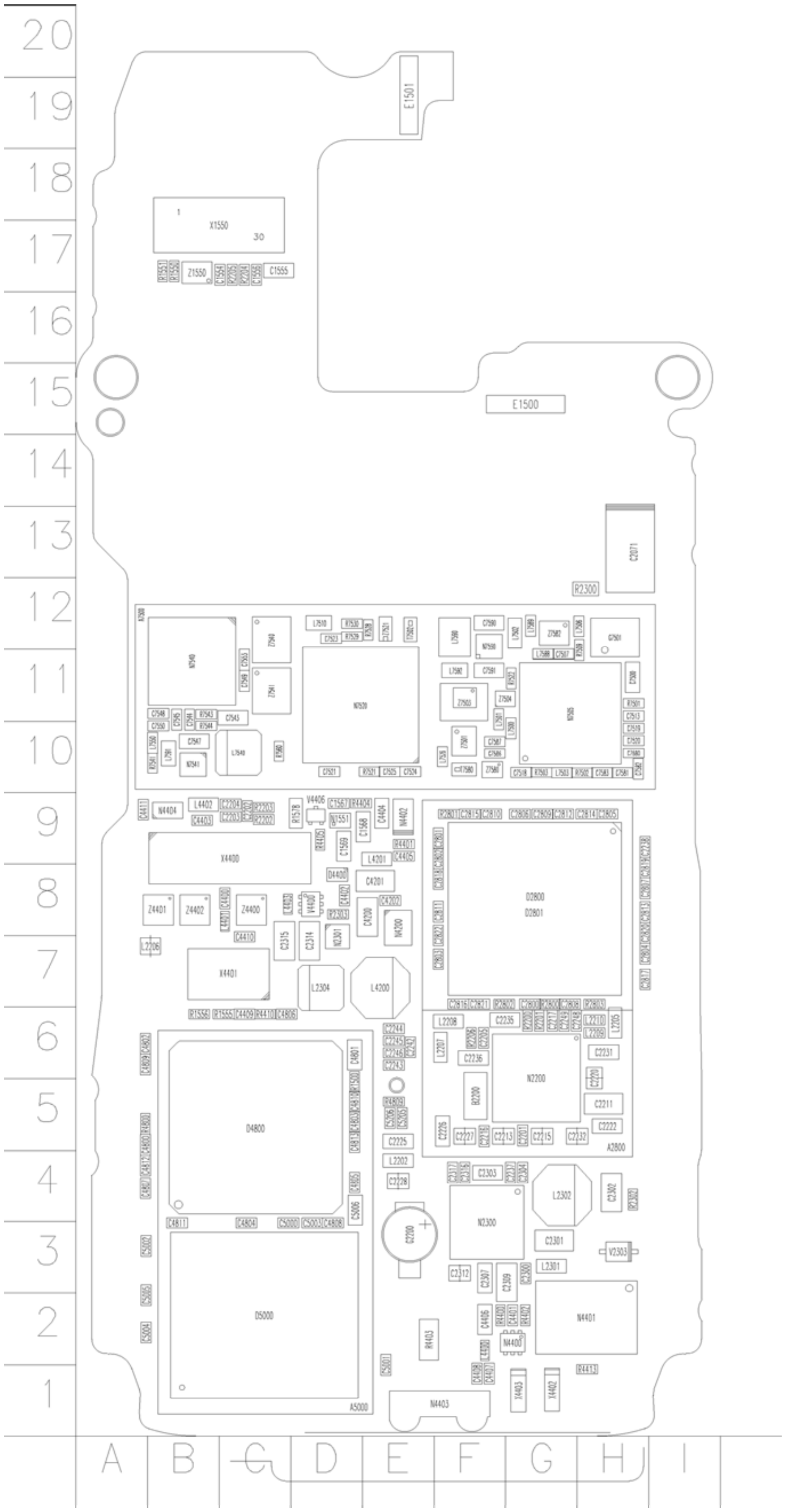
## Component layout - top (1yb-07a)



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# 3 — Service Software Instructions


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## *Phoenix* installation steps in brief

### Prerequisites

Recommended hardware requirements:

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

Supported operating systems:

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

### Context

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

*Phoenix* installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - PKD-1 (DK2) dongle
  - DKU-2 or CA-53 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.


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5. Manage connection settings (depends on the tools you are using).

| | |
|---|---|
| If you use FPS-10: | • Update FPS-10 software<br>**Note:** There is no need to activate FPS-10.<br>• Activate SX-4 smart card, if you need tuning and testing functions.<br>**Note:** When FPS-10 is used only for product software updates, SX-4 smart card is not needed. |

## Results

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

# Installing *Phoenix*

## Prerequisites

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

## Context

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

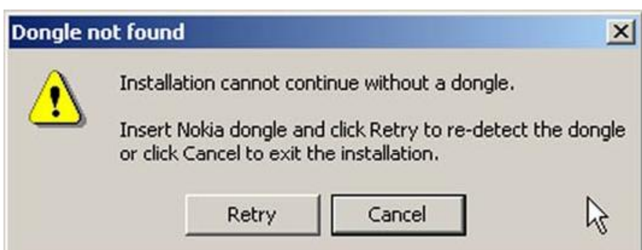


**Figure 2 Dongle not found**

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

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

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

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

## Steps

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


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

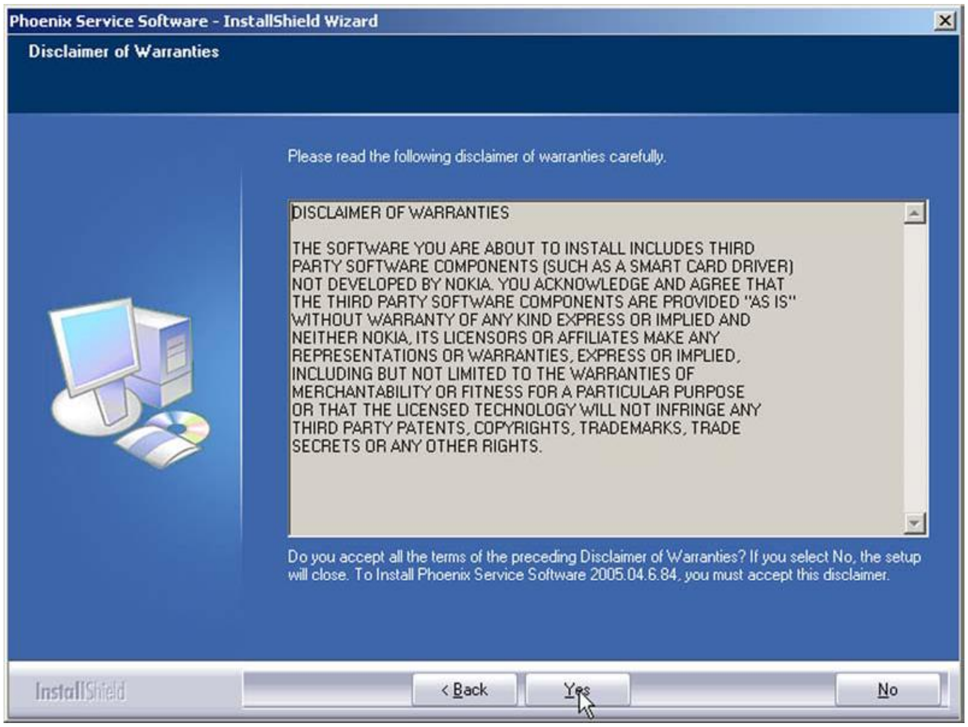


**Figure 3 Disclaimer text**

4. Choose the destination folder.
   The default folder *C:\ProgramFiles\Nokia\Phoenix* is recommended.
5. To continue, click **Next.**
   To choose another location, click **Browse** (not recommended).
6. Wait for the components to be copied.
   The progress of the installation is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.
   The process may take several minutes to complete.
   If the operating system does not require rebooting, the PC components are registered right away.
   If the operating system requires restarting your computer, the Install Shield Wizard will notifies about it.
   Select **Yes...** to reboot the PC immediately or **No...** to reboot the PC manually afterwards.
   After the reboot, all components are registered.

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


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

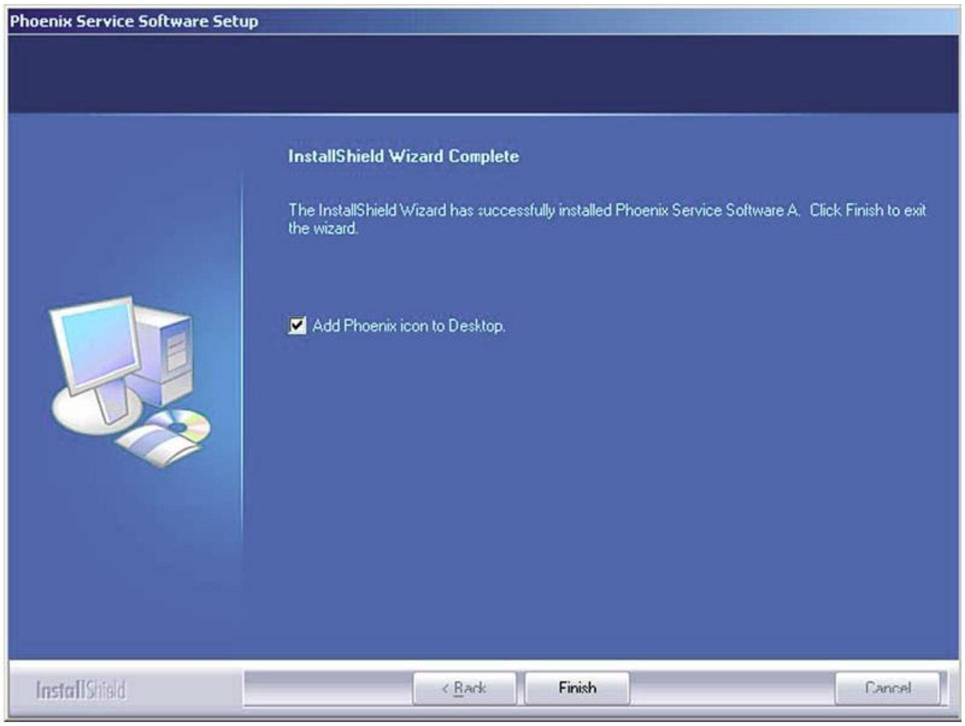


**Figure 4 InstallShield Wizard Complete**

## Next actions

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

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

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

## Updating *Phoenix* installation

## Context

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


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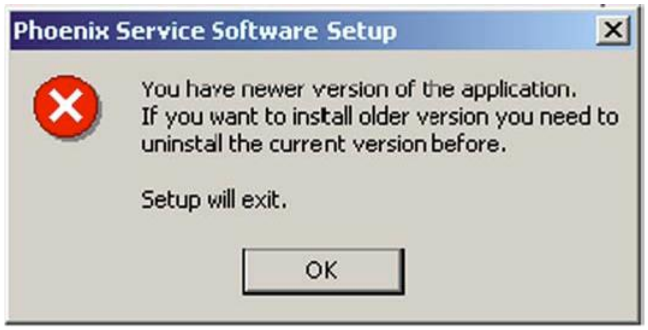


**Figure 5 Installation interrupted**

- Always follow the instructions on the screen.

### Steps

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

### Results

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

## Uninstalling *Phoenix*

### Context

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

### Steps

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


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

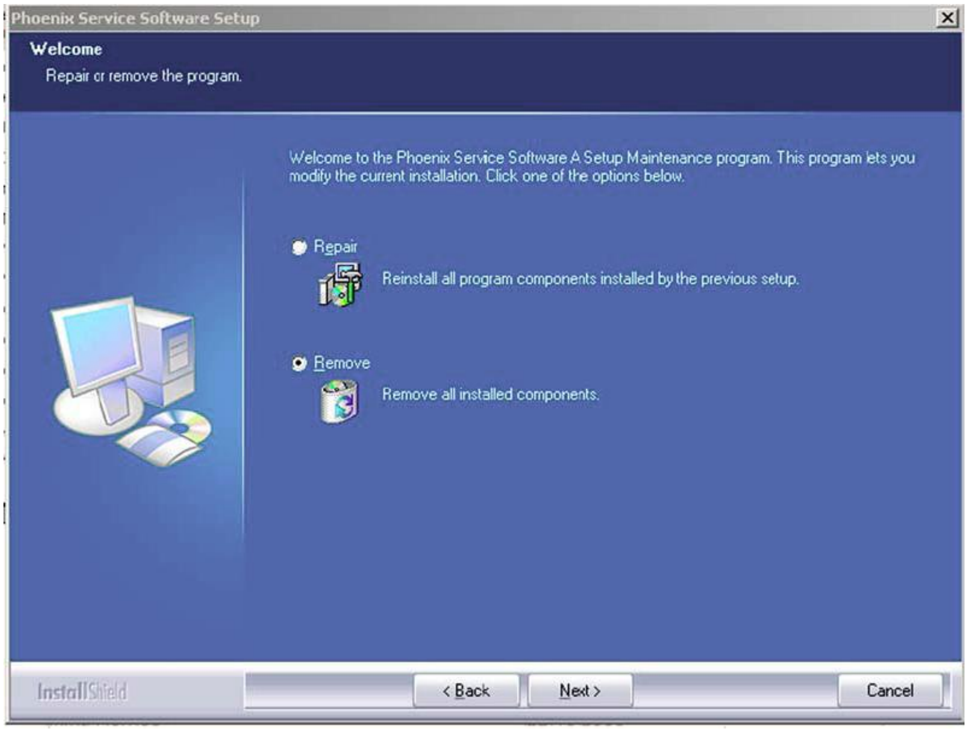


**Figure 6 Remove program**

The progress of the uninstallation is shown.

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

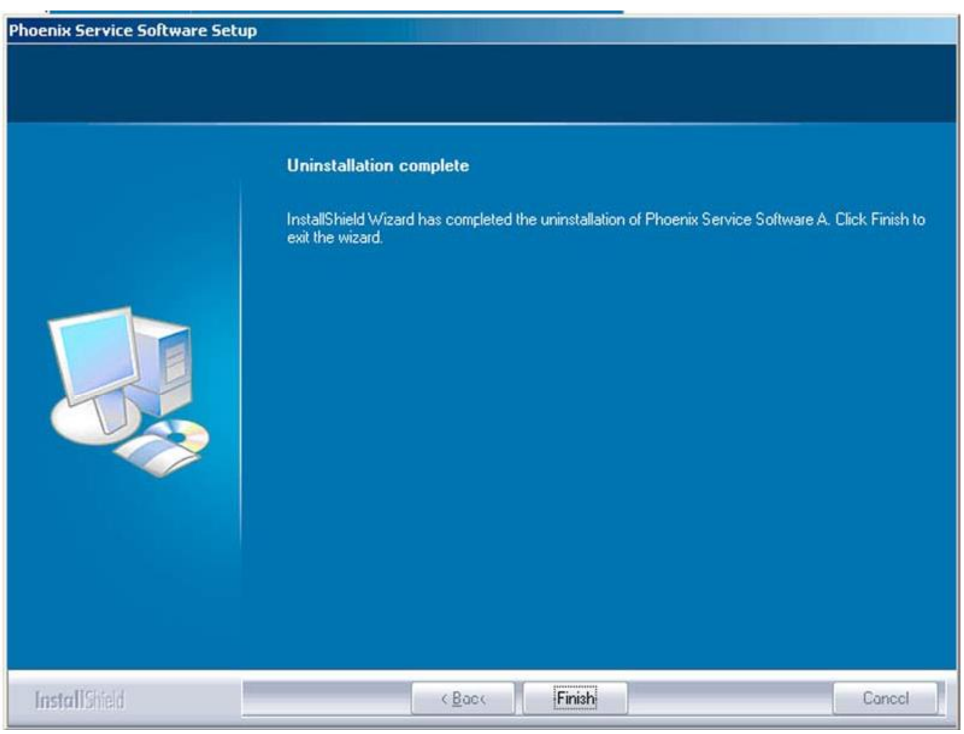


**Figure 7 Finish uninstallation**


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

## Repairing *Phoenix* installation

### Context

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

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

### Steps

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

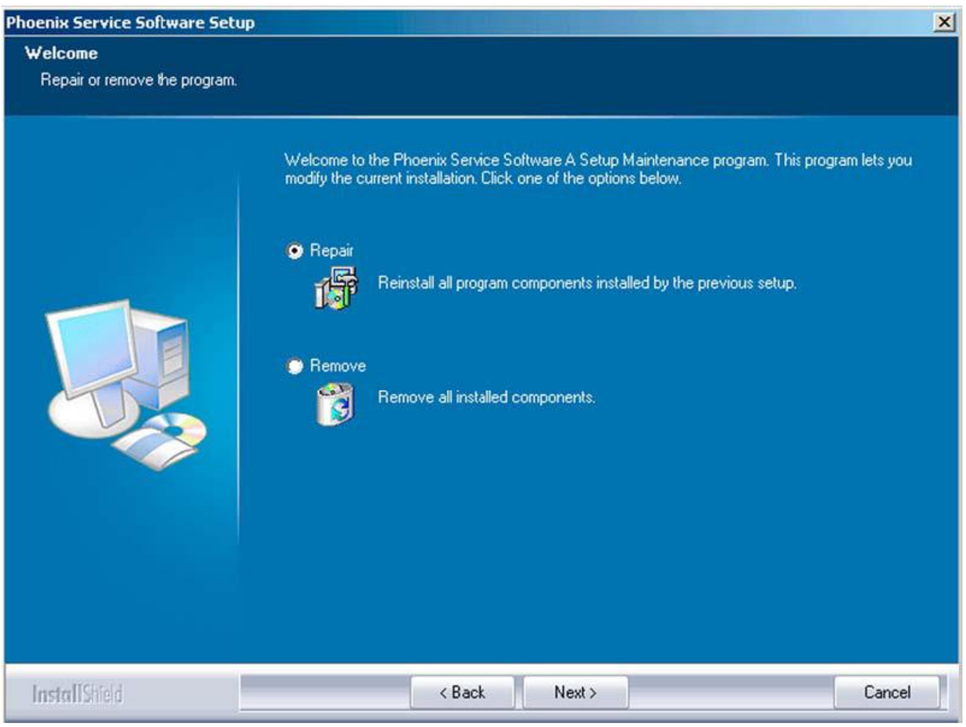


**Figure 8 Repair program**

*Phoenix* reinstalls components and registers them.

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

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

## 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.


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- 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.

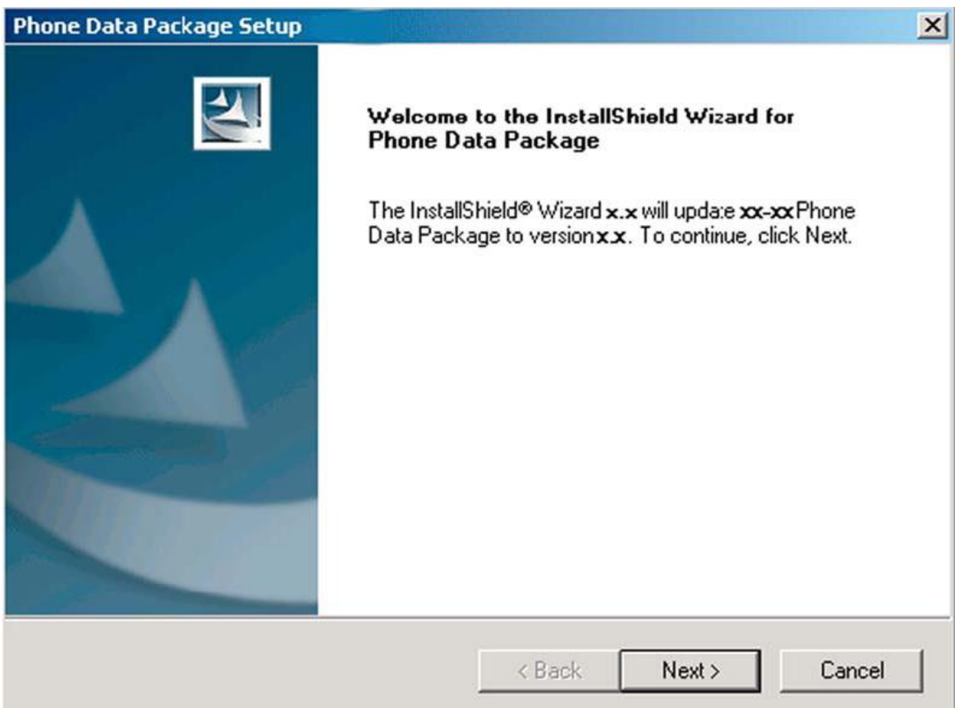
> **Note:** Often *Phoenix* and the phone-specific data package come in pairs, meaning that a certain version of *Phoenix* can only be used with a certain version of a data package. Always use the latest available versions of both. Instructions can be found in phone-specific Technical Bulletins and *readme.txt*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





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

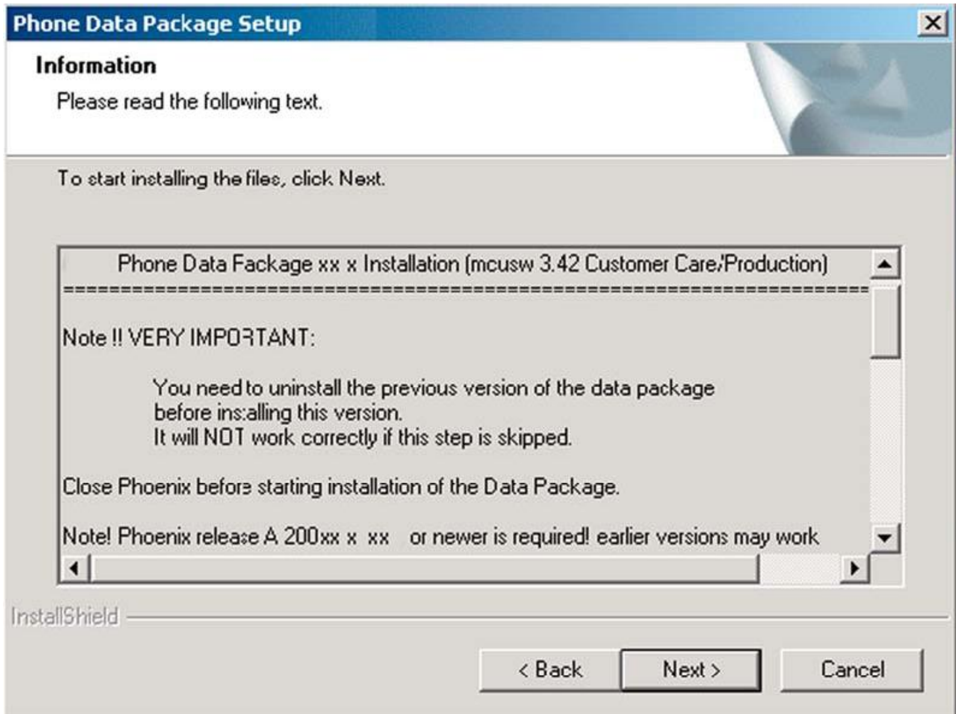


**Figure 9 Data package setup information**

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

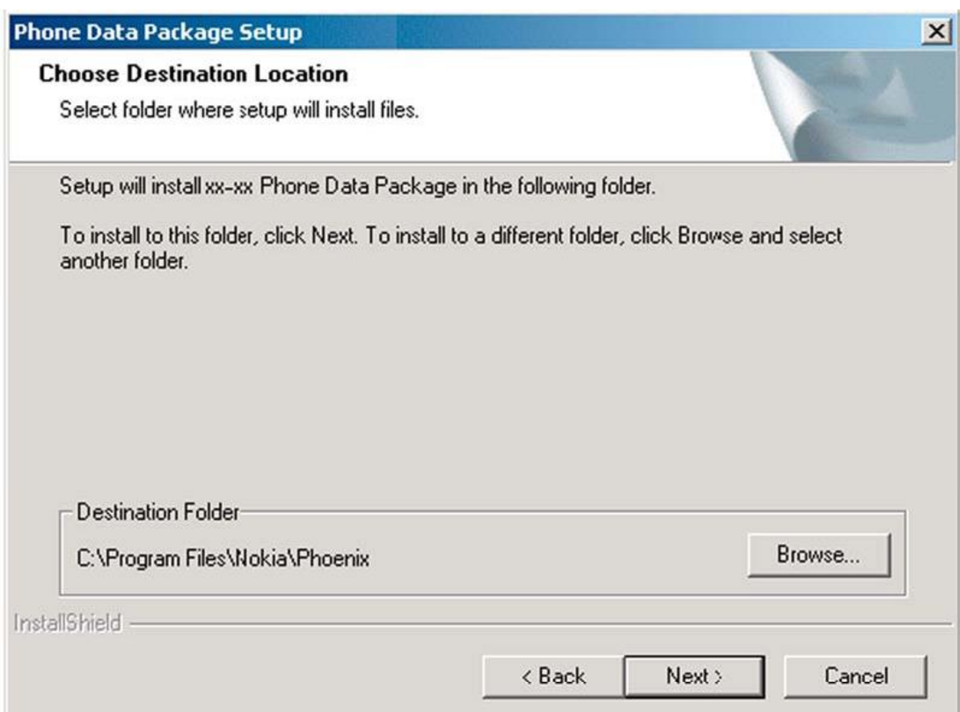


**Figure 10 Data package destination folder**


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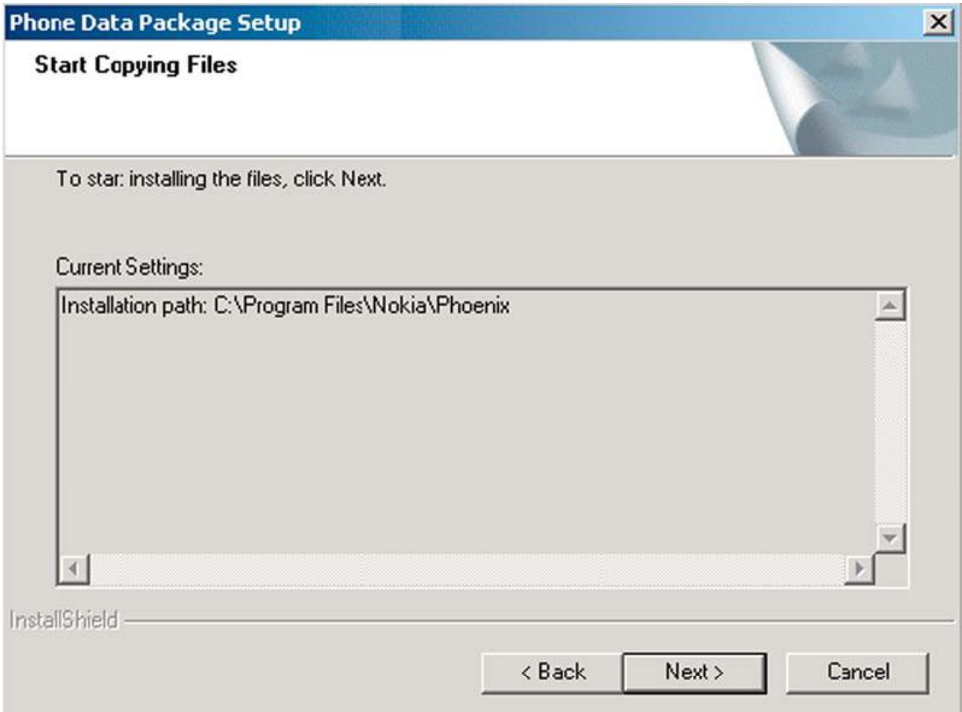
The InstallShield Wizard checks where *Phoenix* is installed, and the directory is shown.

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




Phone model specific files are installed. Please wait.

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

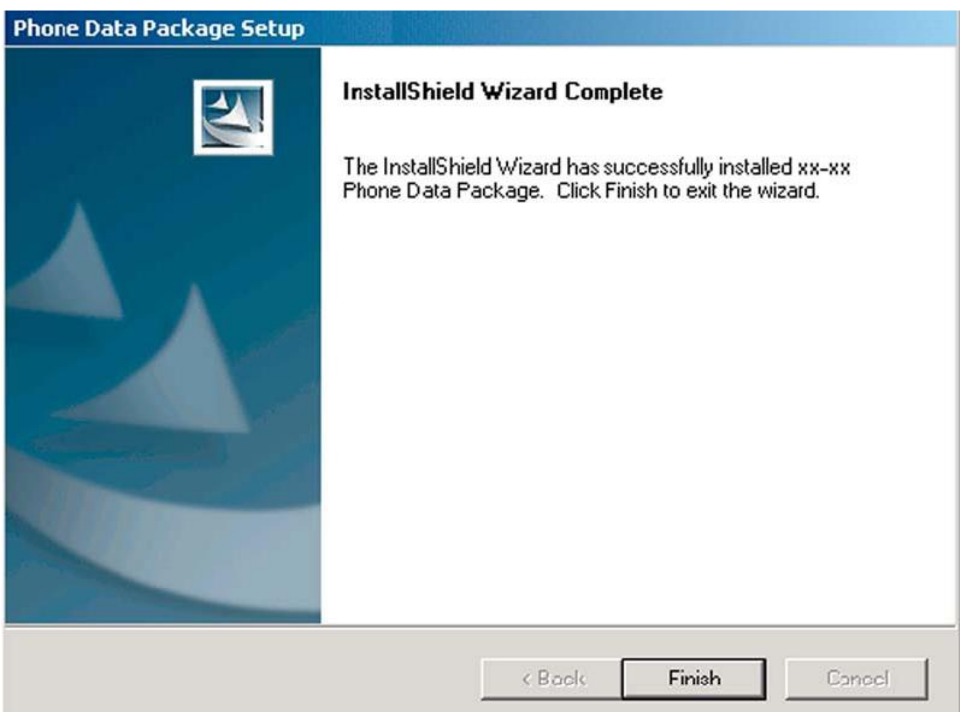



**Figure 11 InstallShield Wizard Complete**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## Next actions

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

- Configuring users
- Managing connections

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

# Uninstalling phone data package

## Context

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

Please read all related documents carefully.

## Steps

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

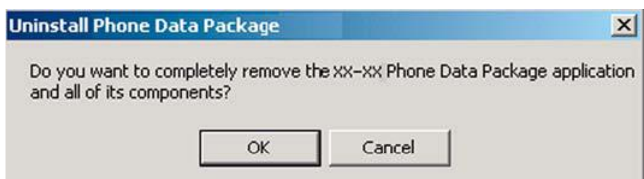


**Figure 12 Uninstalling phone data package**


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

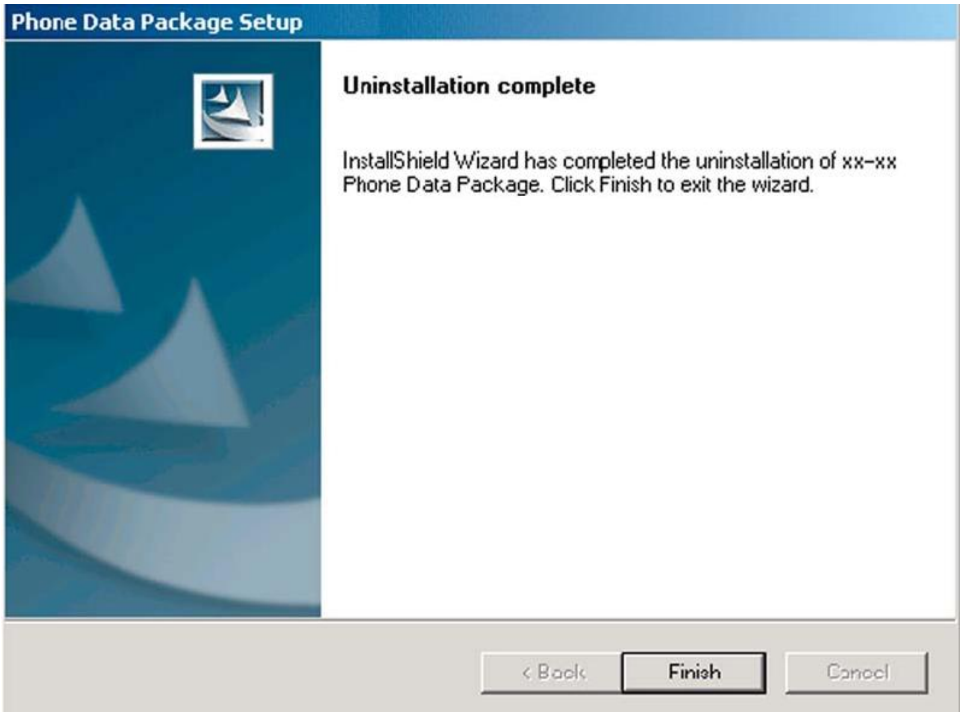


**Figure 13 Finishing data package uninstallation**

## Alternative steps

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

## Configuring users in *Phoenix*

## Steps

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

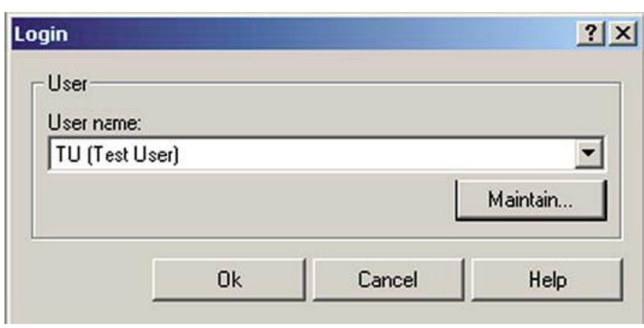


**Figure 14 Phoenix login**

   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**.


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4. Type in the name and initials of the user, and click **OK**.

   The user is added to the user name list.

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

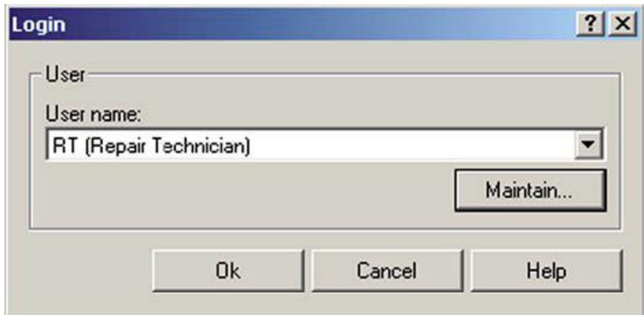



**Figure 15 New user configured**

## Managing connections in *Phoenix*

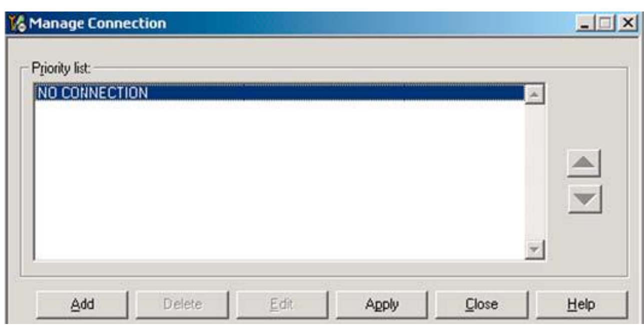
### Context

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.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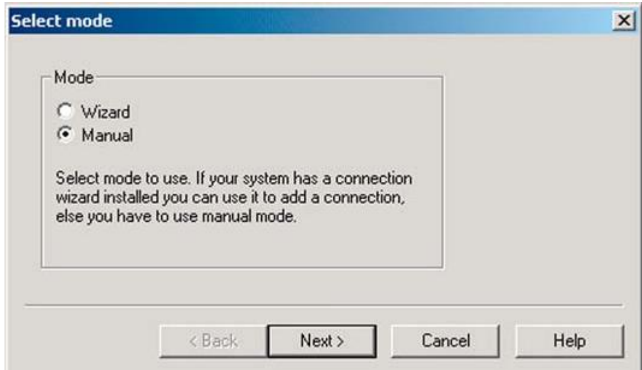


**Figure 16 Select mode: Manual**

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:
- Media: **FPS-10 USB**
- DEVICE_INDEX: **0**
- SERIAL_NUM: See Serial No from the label attached to the bottom of FPS-10
- ACTIVE_MEDIA: **USB**

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:
- Media: **FPS-10 TCP/IP**
- NET_SERV_NAME: Click **Scan...**. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- PORT_NUM: Use the default value, and click **Next**.
- PROTOCOL_FAMILY: Use the default value, and click **Next**.
- SOCKET TYPE: Use the default value, and click **Next**.
- TX_BUFFER_SIZE: Use the default value, and click **Next**.
- RX_BUFFER_SIZE: Use the default value, and click **Next**.

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

**Note:** First connect the DKU-2 or CA-53 USB cable between the PC USB port and phone.
- Media: USB

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

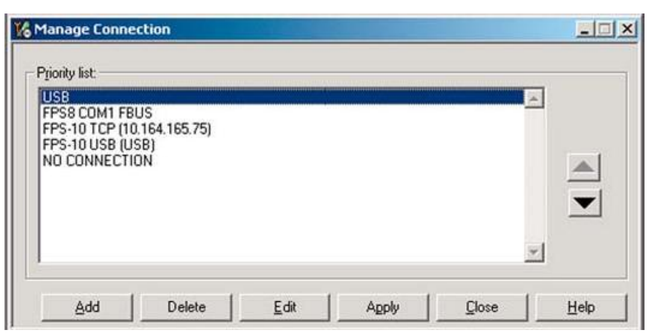


**Figure 17 Connections list**

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.


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**Figure 18 Connection information**

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

### Results

The product support module information appears in the status bar:


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

## Installing flash support files for 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-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-10 flash prommer software" (page 3–22) after installing a new phone data package.


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## Steps

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

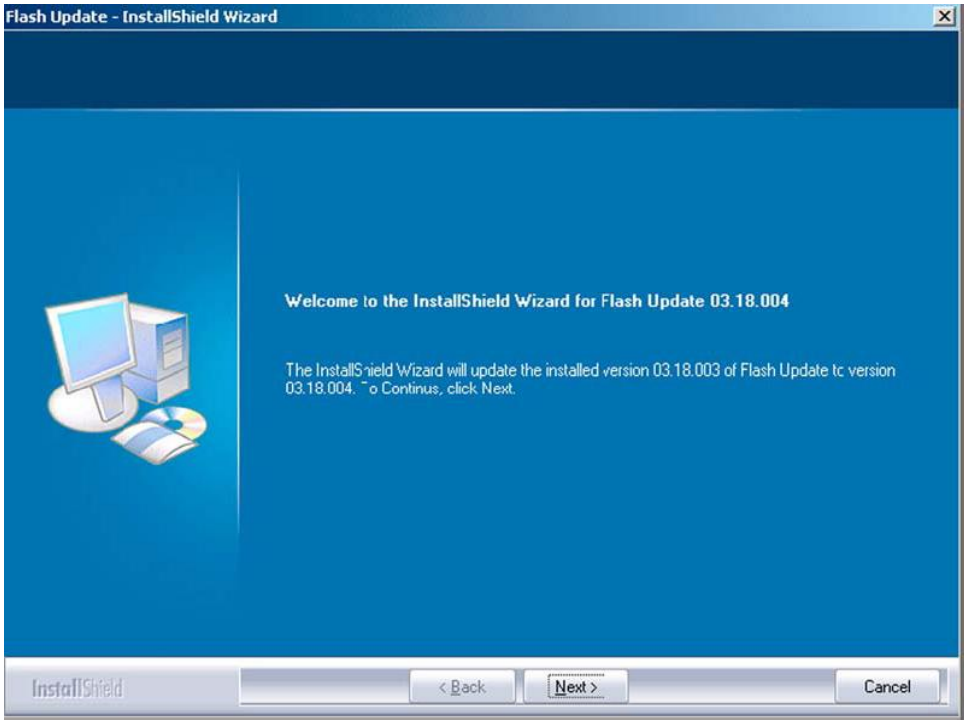


**Figure 20 Flash update welcome dialog**

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

Restart installation again after the uninstallation.

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


**Figure 21 Flash installation interrupted**

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


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

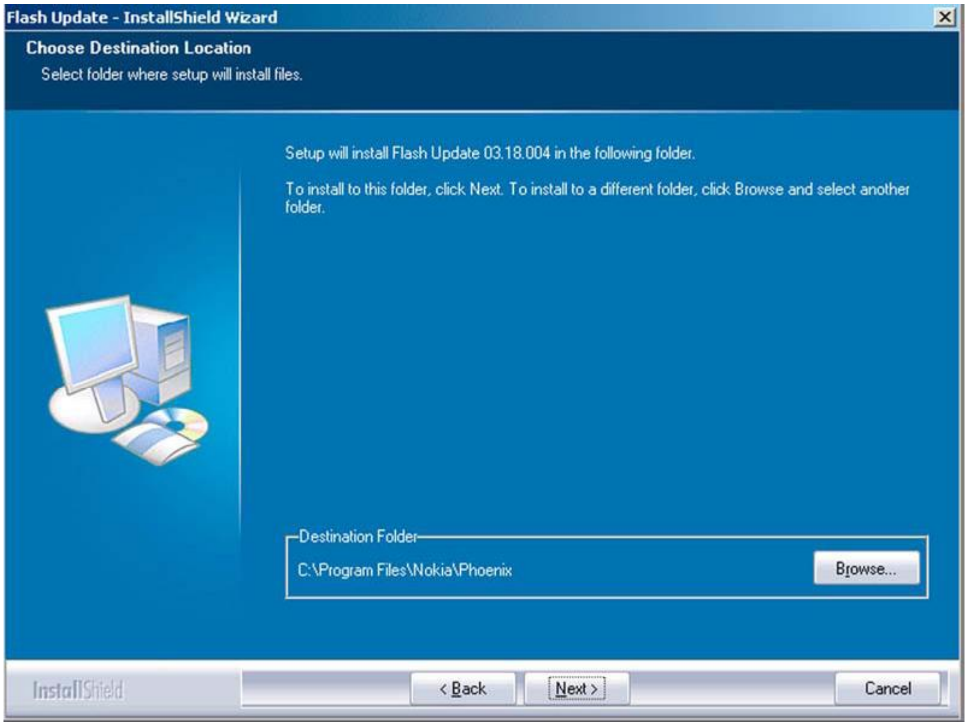


**Figure 22 Flash destination folder**

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


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

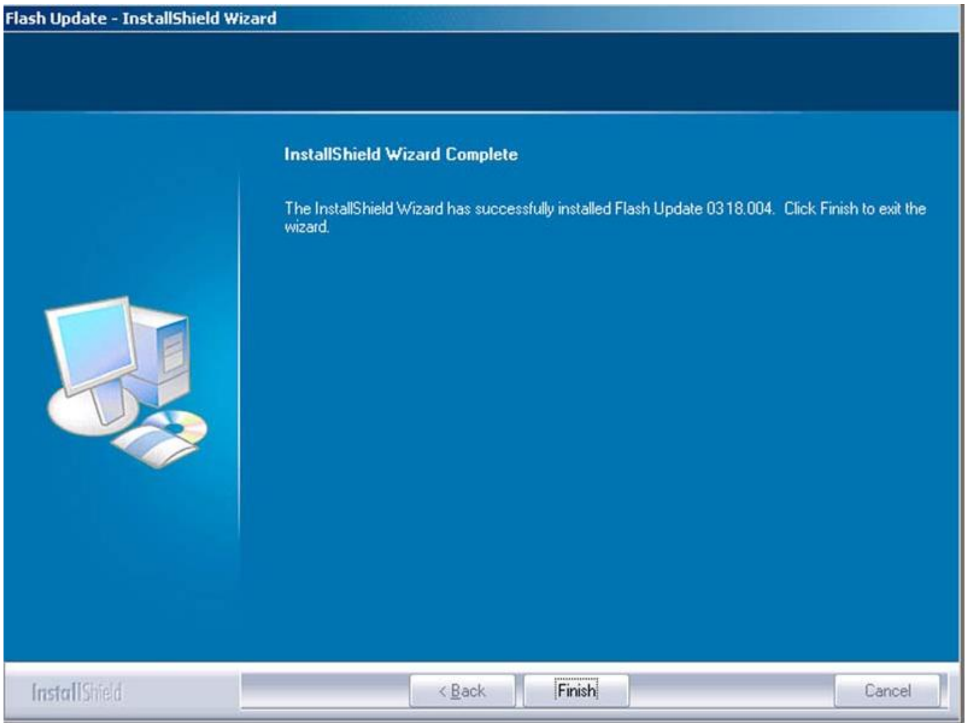


**Figure 23 Finish flash update**

## Next actions

FPS-10 flash prommer must be updated using *Phoenix*.

## Updating 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-10** software, click **Update**, and select the appropriate file or *fpsxupd.ini* (for FPS-10) from *C:\Program Files\Nokia\Phoenix\Flash*.

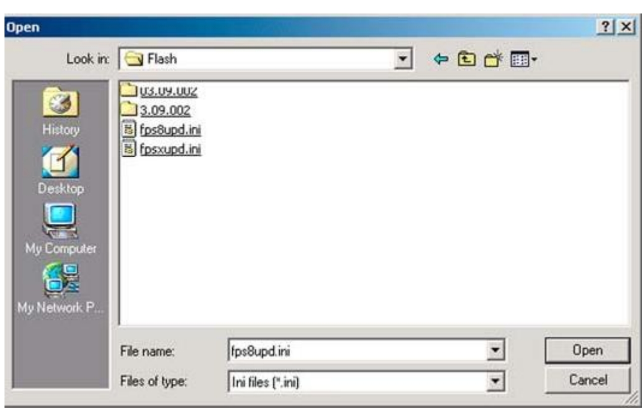


**Figure 24 Flash directory window**


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

5. Click **OK**.

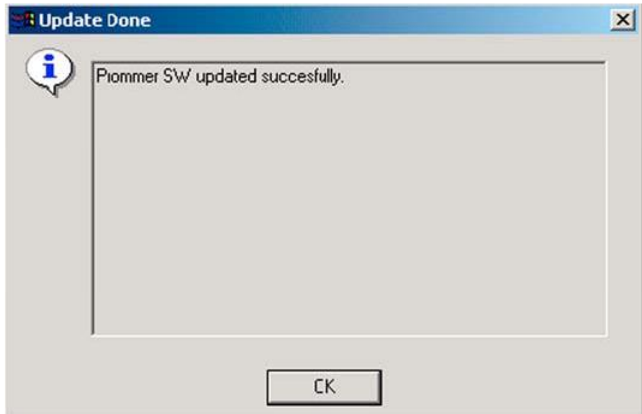


**Figure 25 Prommer software update finished**

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

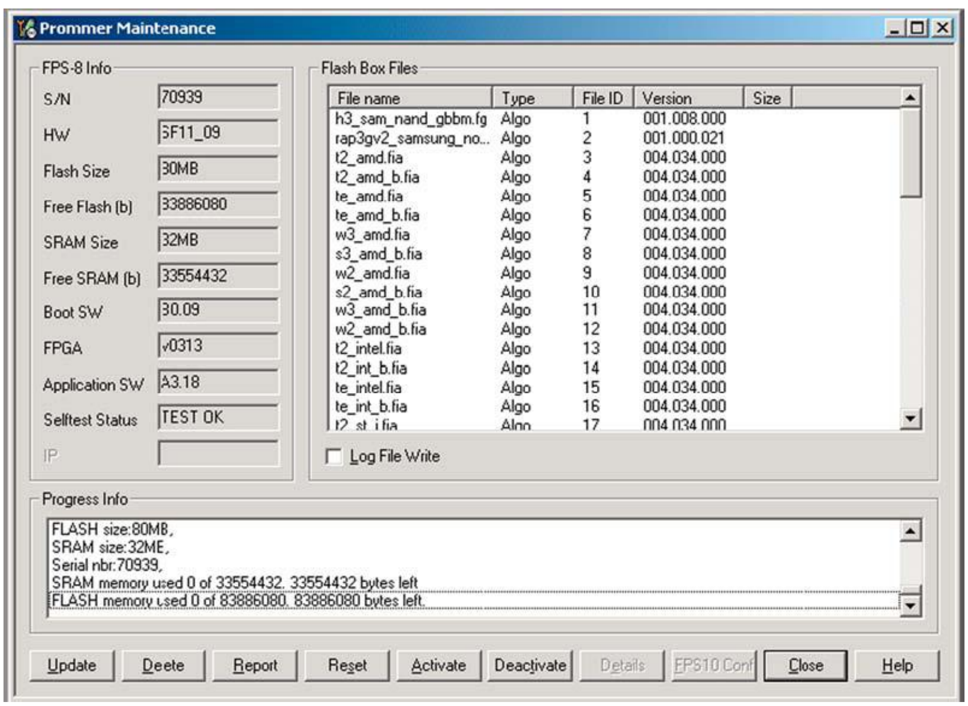


**Figure 26** ***Prommer Maintenance*** **window**


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# 4 — Service Tools and Service Concepts


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## Table of Contents



**List of Tables**



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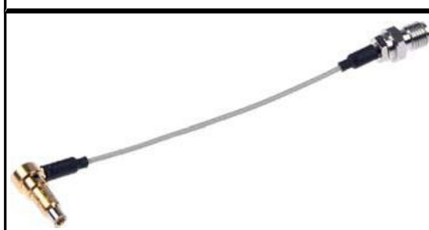
## Service tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-208, refer to various concepts.

| | | | |
|---|---|---|---|
|  | AC-33 | Power supply | |
| | Universal power supply for FPS-10; included in the FPS-10 sales package. | | |
|  | 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-53 | USB connectivity cable | |
| | USB to system connector cable. | | |
|  | CA-56RS | RF cable | |
| | Small RF cable that is used for RF tuning with MJ-120 module jig for BT and WLAN measurements. | | |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| CU-4 | Control unit | |
|---|---|---|

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

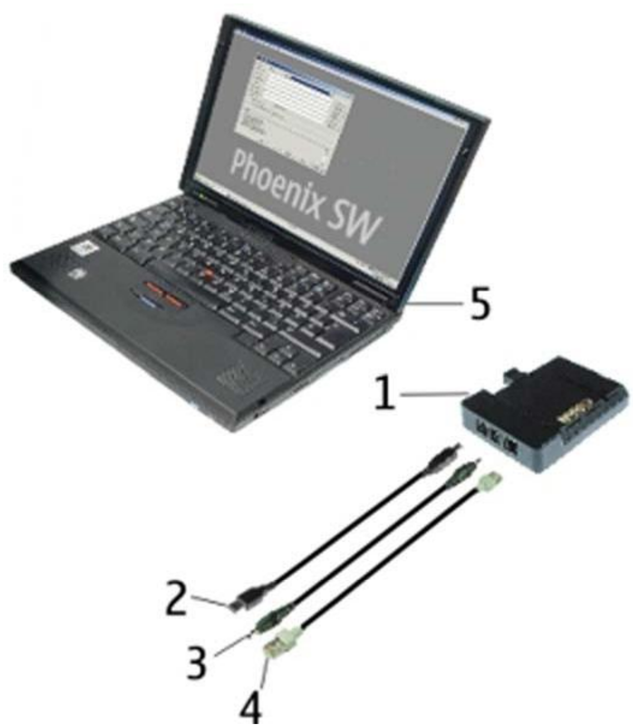
The unit has the following features:

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

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

### Instructions

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




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

Reconnecting the power supply requires a Phoenix restart.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<table>
<tr><td rowspan="2"></td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"></td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:<ul><li>PC</li><li>Control unit</li><li>Flash adapter</li><li>Smart card</li></ul>FPS-10 flash prommer features:<ul><li>Flash functionality for BB5 and DCT-4 terminals</li><li>Smart Card reader for SX-2 or SX-4</li><li>USB traffic forwarding</li><li>USB to FBUS/Flashbus conversion</li><li>LAN to FBUS/Flashbus and USB conversion</li><li>Vusb output switchable by PC command</li></ul>FPS-10 sales package includes:<ul><li>FPS-10 prommer</li><li>Power Supply with 5 country specific cords</li><li>USB cable</li></ul></td></tr>
<tr><td rowspan="2"></td><td>FS-45</td><td>Product specific adapter</td><td></td></tr>
<tr><td colspan="3">RM-208 specific adapter.</td></tr>
</table>


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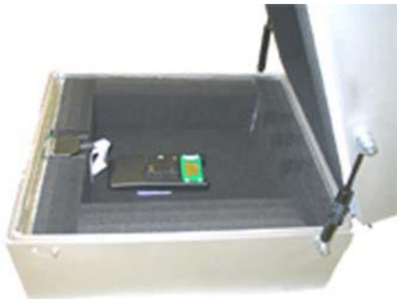
| | | | |
|---|---|---|---|
|  | JXS-1 | RF shield box | |
| | Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal.<br>The shield box is not an active device, it contains only passive filtering components for RF attenuation. | | |
|  | MJ-120 | Module jig | |
| | RM-208 specific module jig. | | |
|  | RJ-142 | Soldering jig | |
| | RM-208 specific soldering jig. | | |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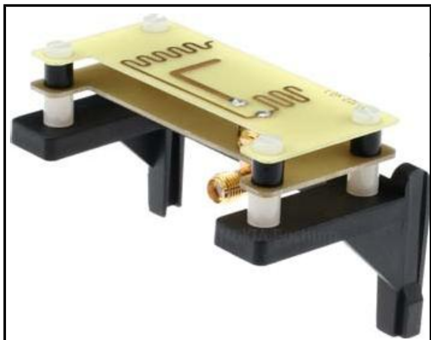

| SA-122 | GSM&WCDMA coupler | |
|---|---|---|

RM-208 specific GSM&WCDMA coupler.

- Flash adapter antenna coupler SA-122 attenuation table for NOKIA E65, measured with Universal Radio Communication Tester CMU-200.

**Note:** Attach the phone carefully when the RF coupler is fixed to SS-62.

**Note:** Attenuation tolerance is +/- 1.0 dB

**Table 7 Attenuation values**

| System | Channel | Tx-att. (dB) | Rx-att.(dB) |
|---|---|---|---|
| **GSM 850** | 128 | 5.0 | 4 |
| | 190 | 4.6 | 5 |
| | 251 | 4.1 | 5 |
| **EGSM 900** | 975 | 4.8 | 5 |
| | 38 | 3.9 | 5 |
| | 124 | 4.0 | 4 |
| **GSM 1800** | 512 | 6.4 | 6 |
| | 698 | 5.8 | 7 |
| | 885 | 5.7 | 8 |
| **GSM 1900** | 512 | 7.7 | 8 |
| | 661 | 7.4 | 8 |
| | 810 | 7.7 | 8 |
| | Tx / Rx | | |
| **WCDMA** | 9612 / 10562 | 8.3 | 9 |
| | 9750 / 10700 | 8.5 | 9 |
| | 9888 / 10838 | 8.7 | 10 |


| SB-6 | Bluetooth test and interface box (sales package) | |
|---|---|---|

The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .

Sales package includes:

- SB-6 test box
- Installation and warranty information


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<table>
<tr><td rowspan="2"></td><td>SB-7</td><td>WLAN test box</td><td></td></tr>
<tr><td colspan="3">WLAN test requires defined position for the device.</td></tr>
<tr><td rowspan="2"></td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers and B-to-B connectors.</td></tr>
<tr><td rowspan="2"></td><td>SS-110</td><td>Domesheet alignment jig</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"></td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
</table>


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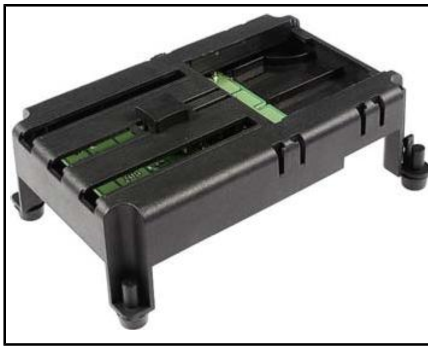
| | | | |
|---|---|---|---|
|  | SS-62 | Generic flash adapter base for BB5 | |
| | • generic base for flash adapters and couplers<br>• SS-62 equipped with a clip interlock system<br>• provides standardised interface towards Control Unit<br>• provides RF connection using galvanic connector or coupler<br>• multiplexing between USB and FBUS media, controlled by VUSB | | |

## Service concepts

### POS (Point of Sale) flash concept

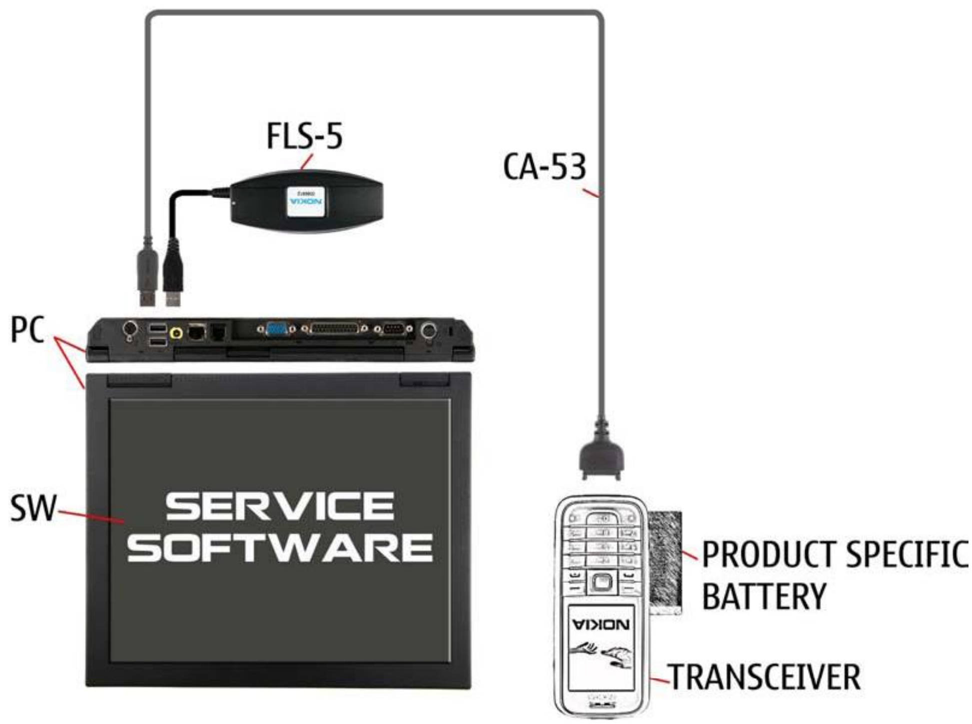



**Figure 27 POS flash concept**

| Type | Description |
|---|---|
| **Product specific tools** | |
| | Battery |
| **Other tools** | |
| FLS-5 | POS flash dongle |
| | PC with Phoenix service software |
| **Cables** | |
| CA-53 | USB connectivity cable |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## Module jig service concept

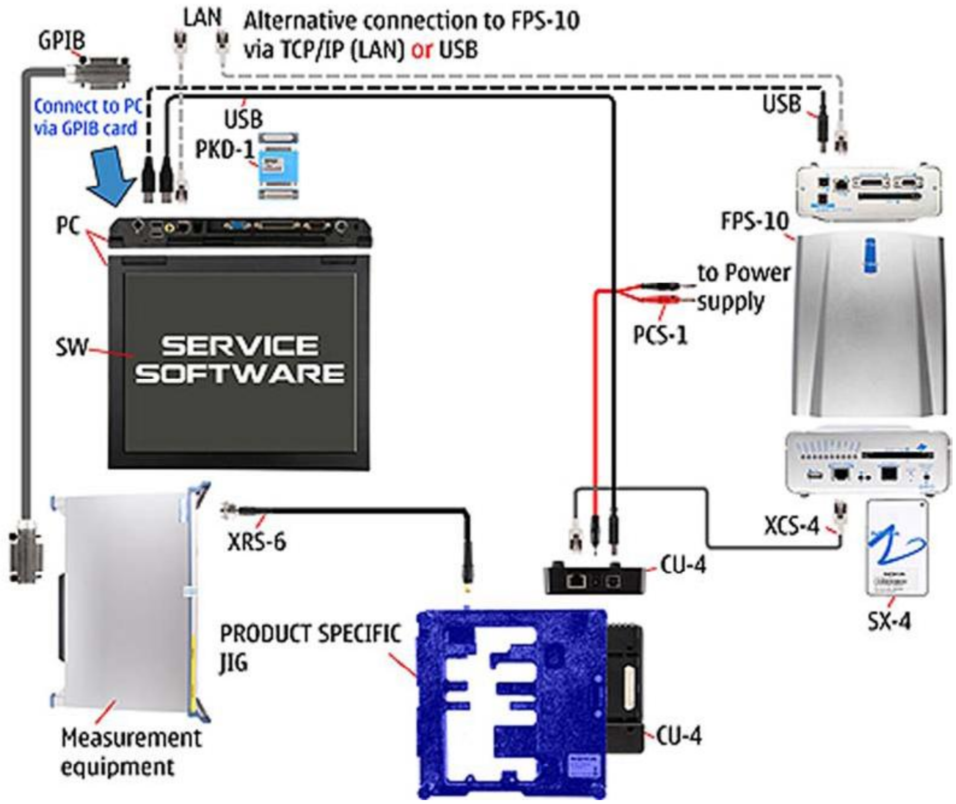


**Figure 28 Module jig service concept**

| Type | Description |
|---|---|
| **Phone specific tools** | |
| MJ-120 | Module jig |
| **Other tools** | |
| CU-4 | Control unit |
| FPS-10 | Flash prommer box |
| PKD-1/PK-1 | SW security device |
| SX-4 | Smart card |
| | PC with Phoenix service software |
| | Measurement equipment |
| **Cables** | |
| PCS-1 | DC power cable |
| XCS-4 | Modular cable |
| XRS-6 | RF cable |
| | USB cable |


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| Type | Description |
|---|---|
| | GPIB control cable |

## Service concept for RF testing and RF/BB tuning

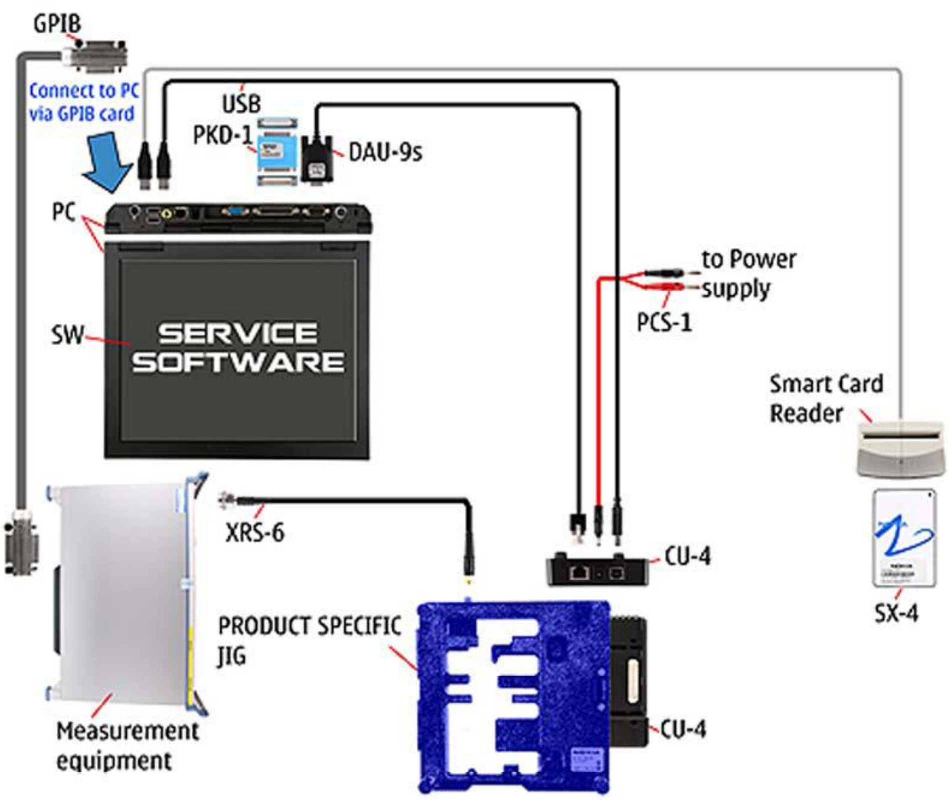


**Figure 29 Service concept for RF testing and RF/BB tuning**

| Type | Description |
|---|---|
| **Product specific tools** | |
| MJ-120 | Module jig |
| **Other tools** | |
| CU-4 | Control unit |
| SX-4 | Smart card |
| | Measurement equipment |
| | Smart card reader |
| | PC with Phoenix service software |
| **Cables** | |
| DAU-9s | MBUS cable |
| PCS-1 | DC power cable |
| PKD-1/PK-1 | SW security device |


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| Type | Description |
|---|---|
| XRS-6 | RF cable |
| | GPIB control cable |
| | USB cable |

## Flash concept with FPS-10

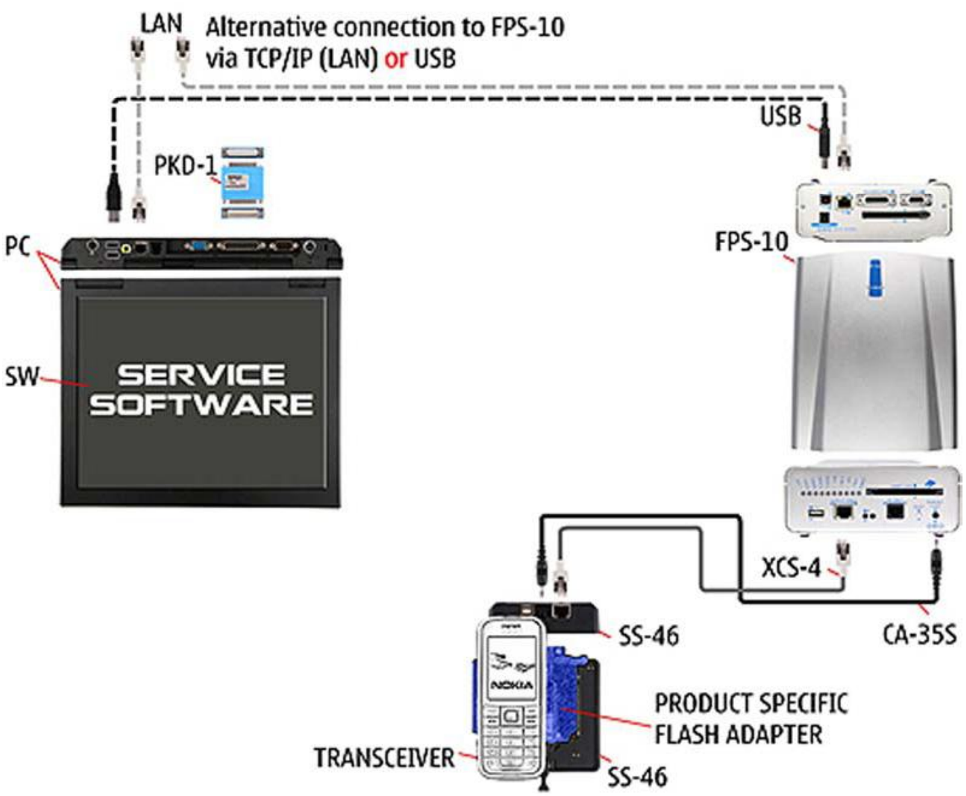


**Figure 30 Basic flash concept with FPS-10**

| Type | Description |
|---|---|
| **Product specific tools** | |
| FS-45 | Flash adapter |
| **Other tools** | |
| FPS-10 | Flash prommer box |
| PKD-1/PK-1 | SW security device |
| SS-46 | Interface adapter |
| | PC with Phoenix service software |
| **Cables** | |
| XCS-4 | Modular cable |
| CA-35S | Power cable |


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| Type | Description |
|---|---|
| | USB cable |

## RF testing concept with RF coupler

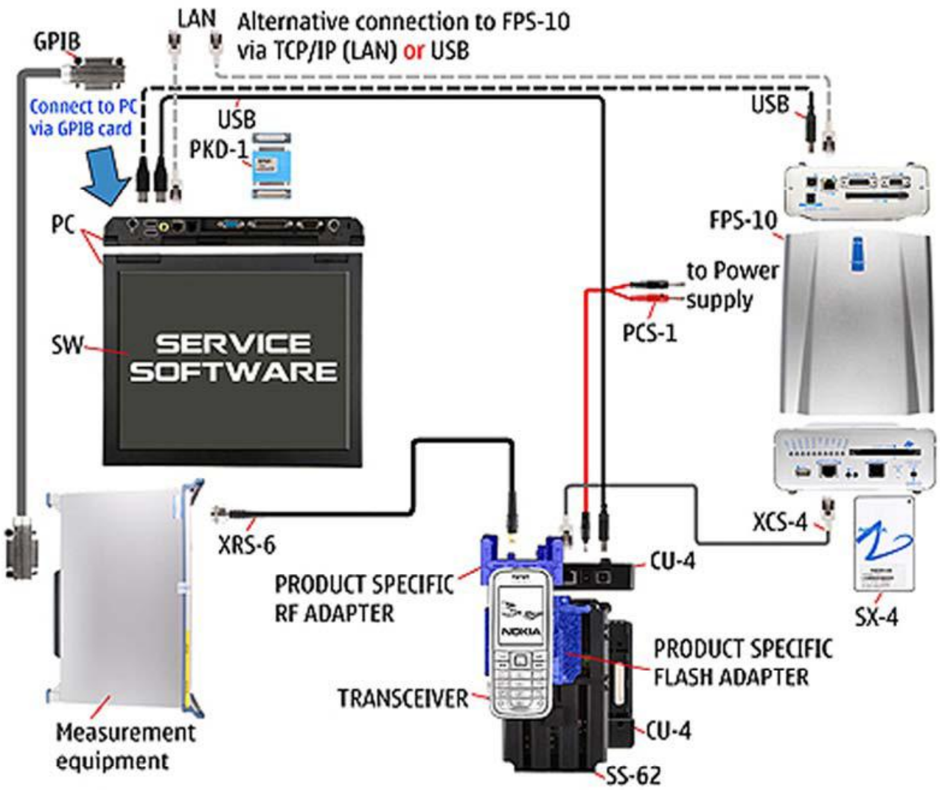


**Figure 31 RF testing concept with RF coupler**

| Type | Description |
|---|---|
| **Product specific tools** | |
| FS-45 | Flash adapter |
| | RF coupler |
| **Other tools** | |
| CU-4 | Control unit |
| SX-4 | Smart card |
| FPS-10 | Flash prommer box |
| PKD-1/PK-1 | SW security device |
| SS-62 | Flash adapter base |
| | Measurement equipment |
| | PC with Phoenix service software |
| **Cables** | |
| PCS-1 | Power cable |


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

## CU-4 flash concept with FPS-10

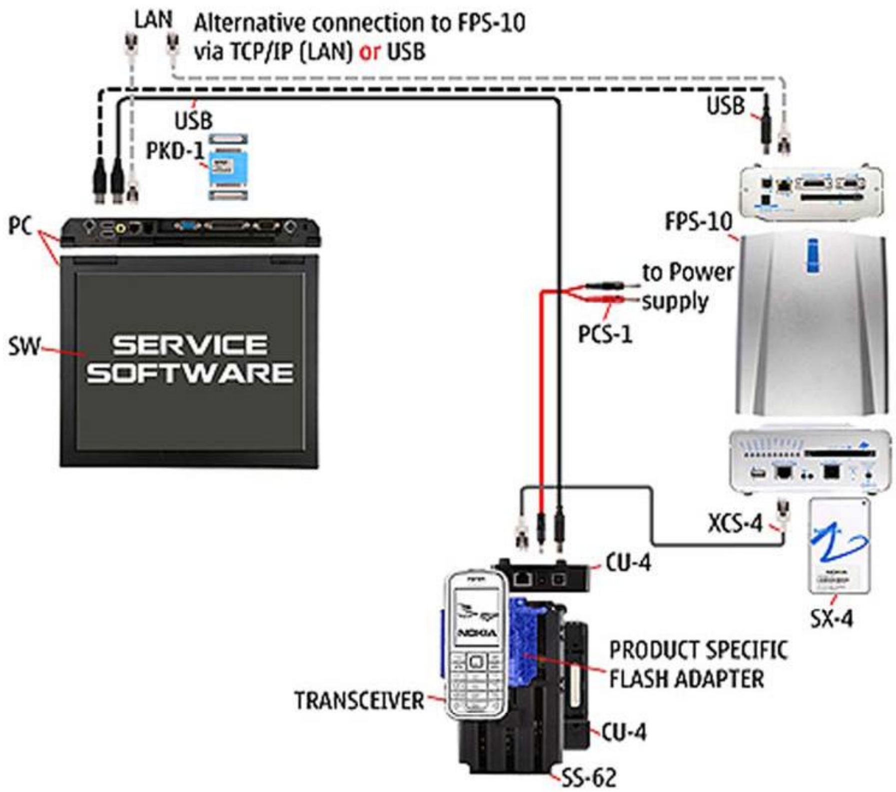


Figure 32 CU-4 flash concept with FPS-10

| Type | Description |
|---|---|
| **Product specific tools** | |
| FS-45 | Flash adapter |
| **Other tools** | |
| CU-4 | Control unit |
| FPS-10 | Flash prommer box |
| PKD-1/PK-1 | SW security device |
| SS-62 | Flash adapter base |
| SX-4 | Smart card |
| | PC with Phoenix service software |
| **Cables** | |


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| Type | Description |
|---|---|
| PCS-1 | Power cable |
| XCS-4 | Modular cable |
| | Standard USB cable |
| | USB cable |


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# 5 — Disassembly / Reassembly Instructions


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## Disassembly/reassembly instructions

### Prerequisites

- Reassembly takes place in the reverse order.


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## Steps

### 1. DISASSEMBLY INSTRUCTION

1. Needed tools: The SS-93, the SRT-6, metal tweezers, the dental pick, a bit holder with a Torx Plus size 6 bit and a dc plug.

2. Always cover the windows with a protective film.

3. Unlock and remove the BATTERY COVER.

4. Shift open the assembly. Carefully pry open the clips of the A-COVER with the SS-93...

5. ...on both sides.

6. Lift up the whole assembly.


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7. Remove the S60 KEYMAT.

8. Protect the window from inner side.

9. Shift together the assembly.

10. Carefully bend open the metal snaps of the DISPLAY HOLDER ASSEMBLY.

11. ...on both sides.

12. Cover the LCD with a protective film.


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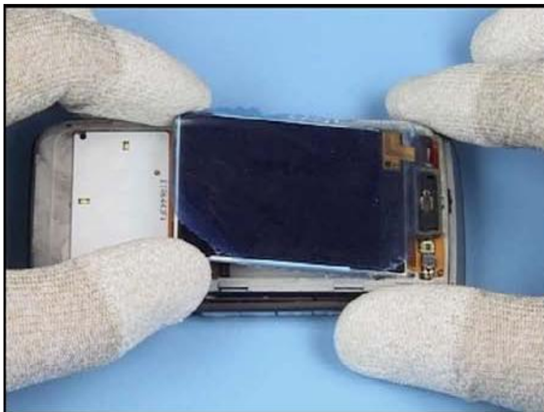
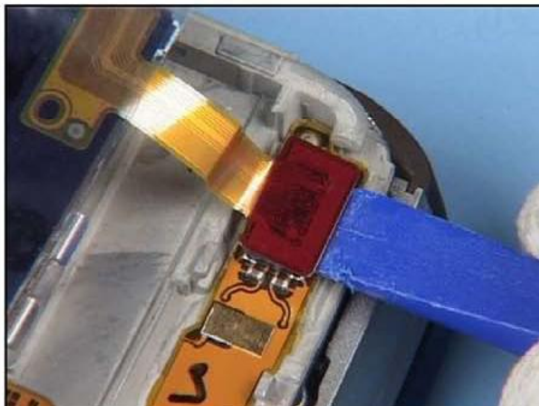


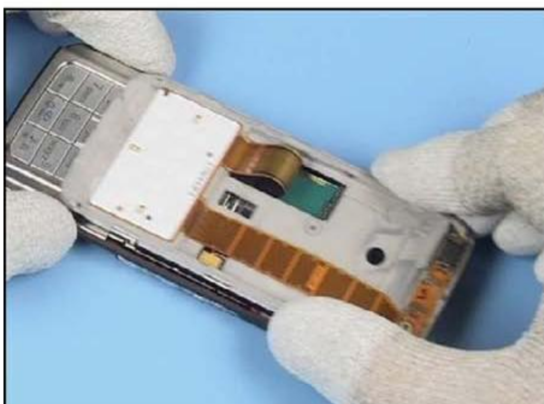
13. Lift up the whole display assembly.

14. Carefully bring it into position shown to gain the maximum flex foil lengths.

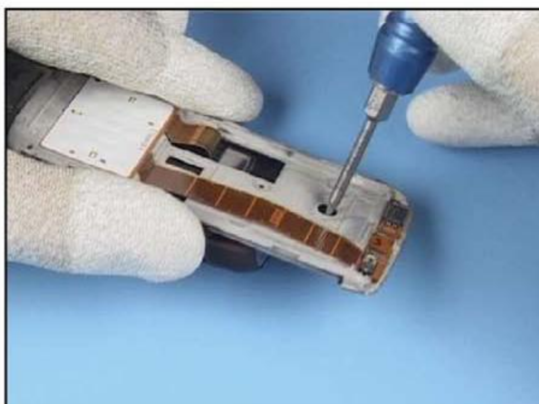
15. Lever out the EARPIECE HOLDER ASSEMBLY.



16. Open the flex connector of the display.



17. Shift open the assembly.



18. Push out the glued in MASKING PLATE and discard it.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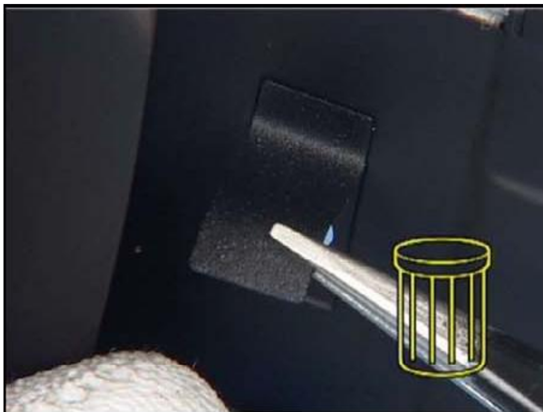
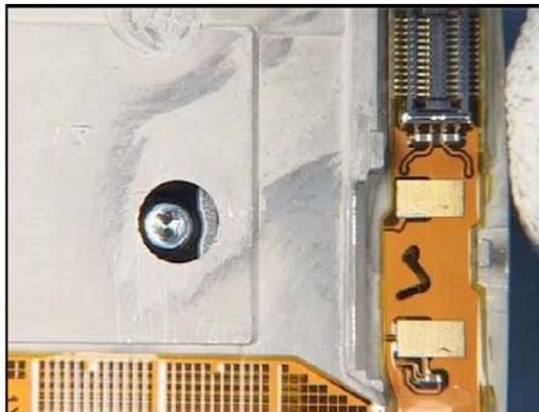


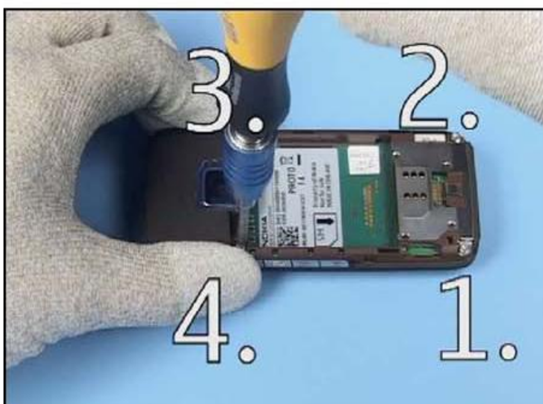
19. It can't be used again.



20. Align the recess of the slider to reach the screw and keep it into position.

21. Unscrew this screw and remove it before continue.

22. Close the assembly.




23. Unscrew these 4 screws in the order shown.

24. Shift open the assembly. Gently pry open these clips of the B-COVER with the SRT-6 in order to reach the clips of the T9 KEYMAT.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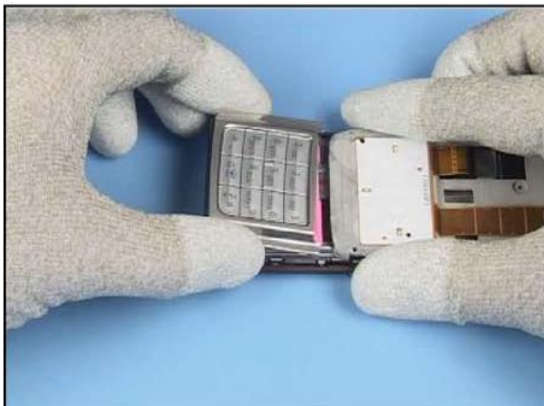
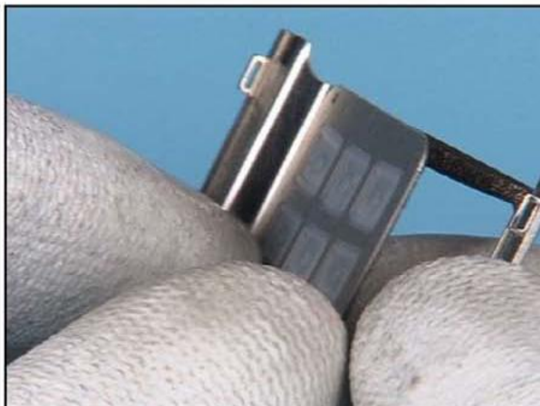
25. Now unlock the metal latches of the KEYMAT...

26. ... on both sides.



27. Carefully remove the SHEET METAL ASSEMBLY.



28. Remove the glued in T9 KEYMAT.

29. Unlock the snaps...

30. ... on both sides.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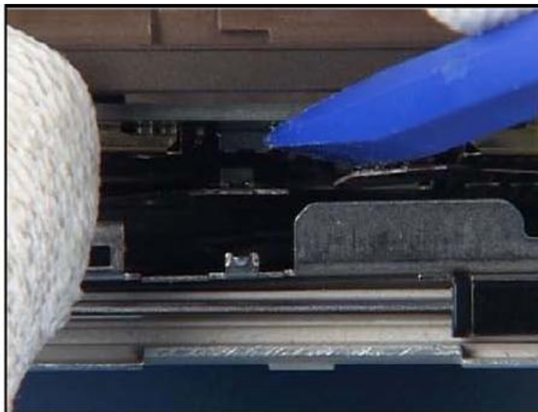
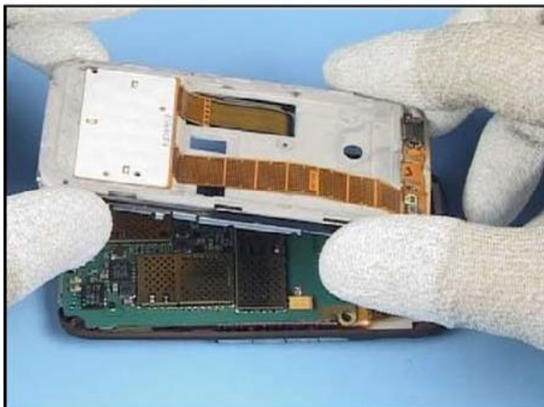
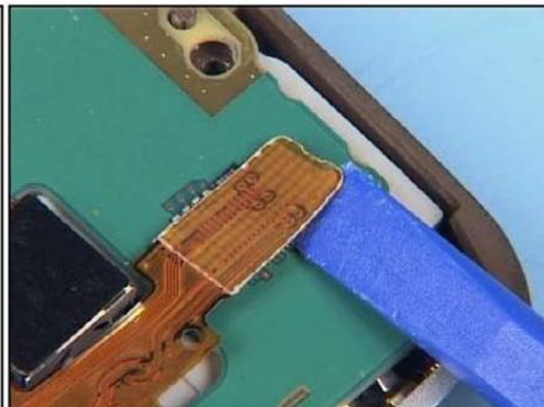
31. Separate the cover slightly. Keep in mind that flex foils are still connected.



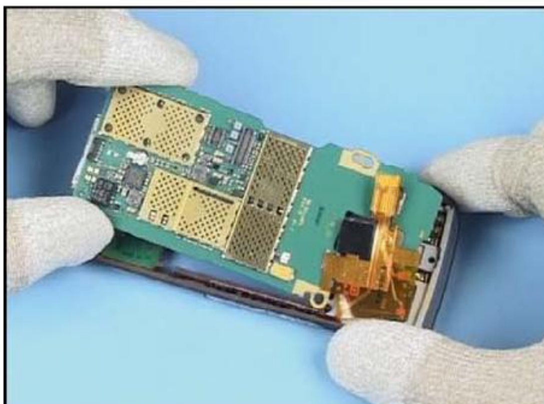
32. Open these 2 connectors with the SS-93 carefully.



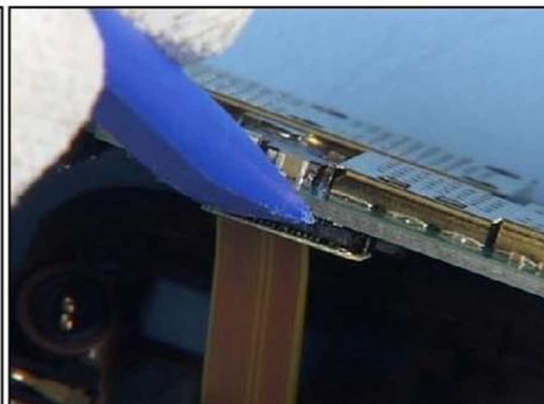
33. Now the SLIDE MODULE ASSEMBLY can be removed.



34. Disconnect the camera connector.



35. Lift up the ENGINE MODULE. Keep in mind that the flex foil is still connected.



36. Disconnect the flex foil.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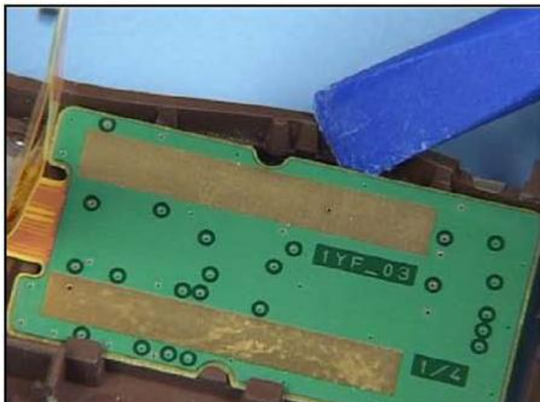
37. Lift out the ANTENNA MODULE ASSEMBLY.

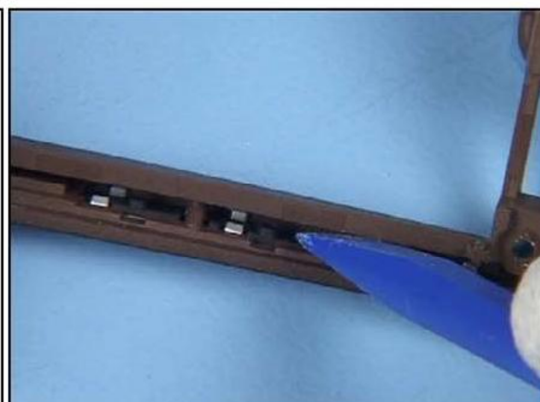
38. Remove the MICROPHONE and the DC JACK. The MICROPHONE will be destroyed surely and must be renewed when reassemble.




39. Gently pry out the 1YF SIM CARD MODULE and remove it.

40. Carefully release the glued in CAMERA FLEX ASSEMBLY.

41. Now it can be removed easily.



42. Unlock all clips of the SIDE KEYS. Note that these clips are very delicate and can break easily.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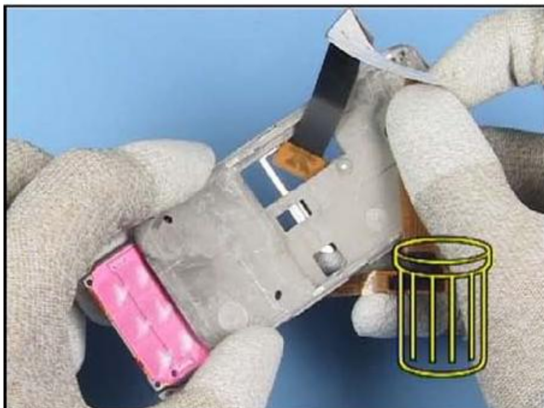
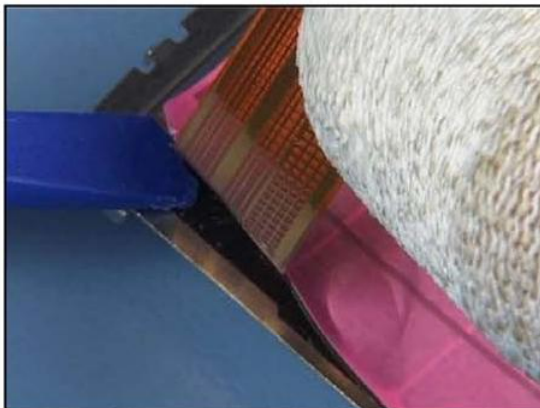
43. Lift up the 1YC UI FLEX ASSEMBLY.

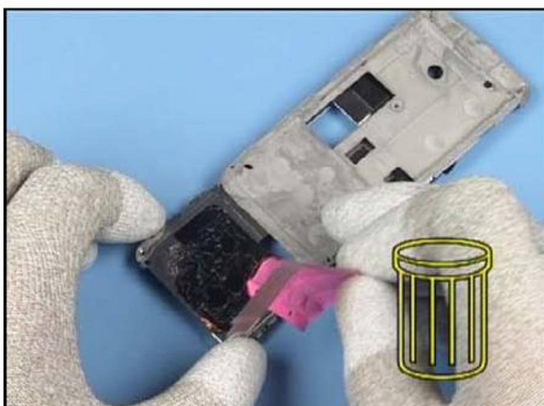
44. Peel it up completely.



45. It can't be used again. Remove all adhesive residues before reassemble.



46. Peel up the T9 FLEX ASSEMBLY, beginning from the connector side.



47. It can't be used again.

48. Remove any adhesive residues before reassemble.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49. The disassembly procedure is now complete.


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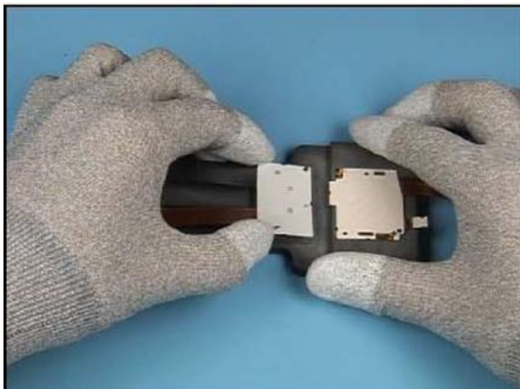
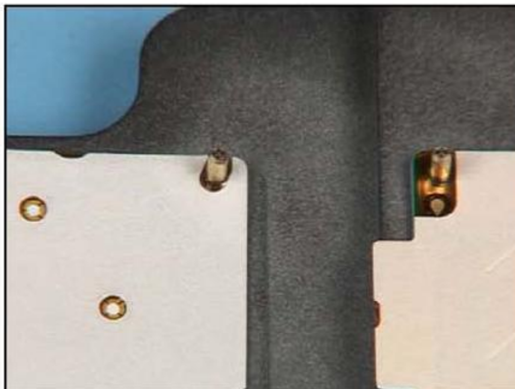
## ASSEMBLY INSTRUCTION

1. Needed tools: The SS-93, metal tweezers, a torque driver with a Torx Plus size 6 bit and a DC plug.

2. The SS-110 Alignment tool is also needed for correct placement of the flex foils.



3. Place the flex foil assemblies.



4. Mind the guide.

5. Remove all protective films.

6. Bring the slider into position shown.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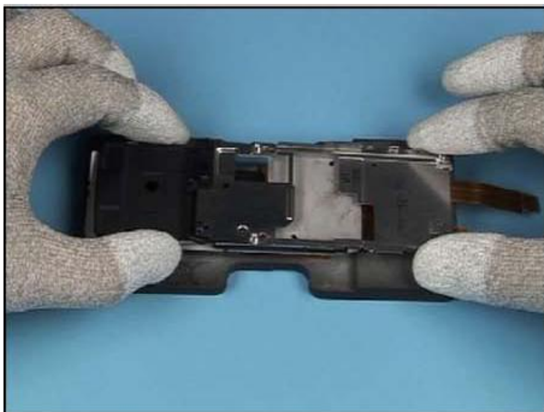
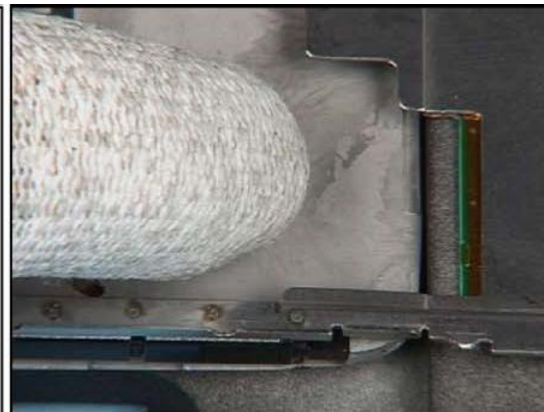
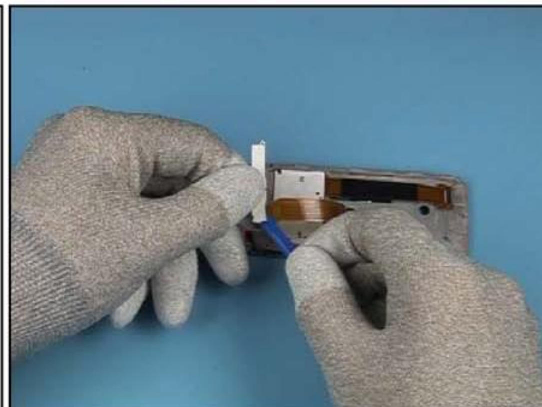


7. Position it over the flex foil assemblies, mind the guides.



8. Push it down slightly.

9. Bend over this contact foil and fix it.



10. Lift up the SLIDE MODULE ASSEMBLY and turn it. Remove this protecting film.

11. Position it as shown, smooth it down evenly.

12. Mind the alignment tabs.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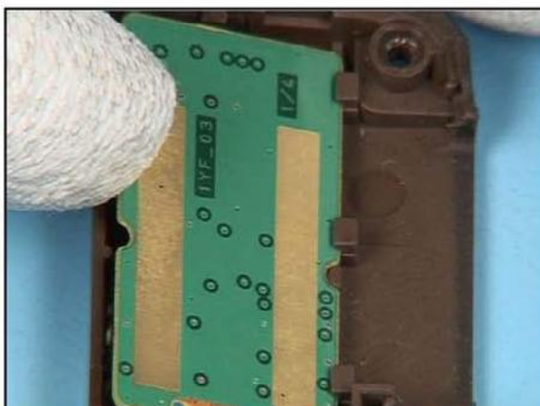
13. Insert the SIDE KEYS.

14. Push it down slightly, click all snaps into their places.

15. Position them with the SS-93.

16. Insert the CAMERA FLEX ASSEMBLY.

17. Check the correct positioning before continue.



18. Insert the SIM CARD MODULE and click it into its place.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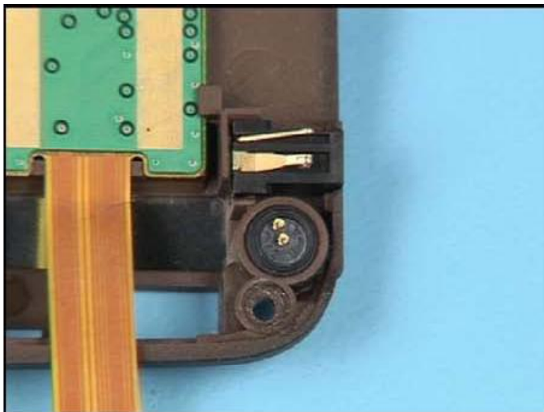
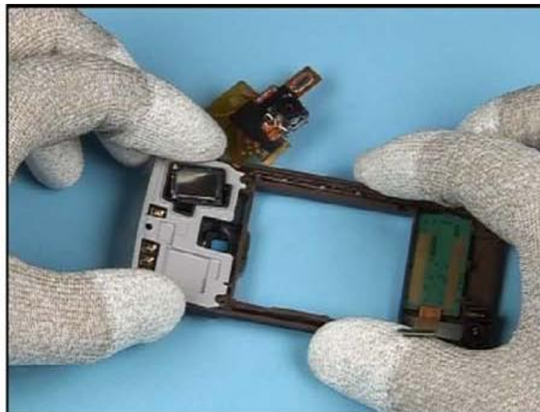
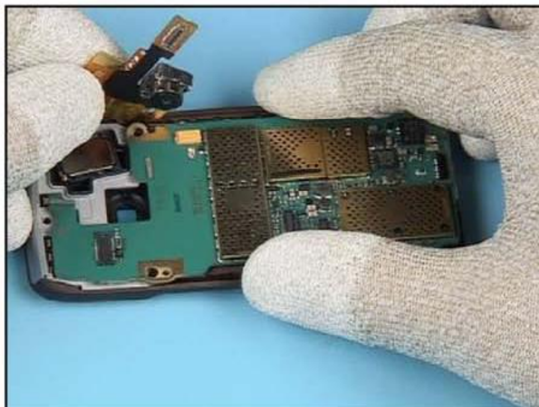


19. Insert the MICROPHONE and CD JACK.

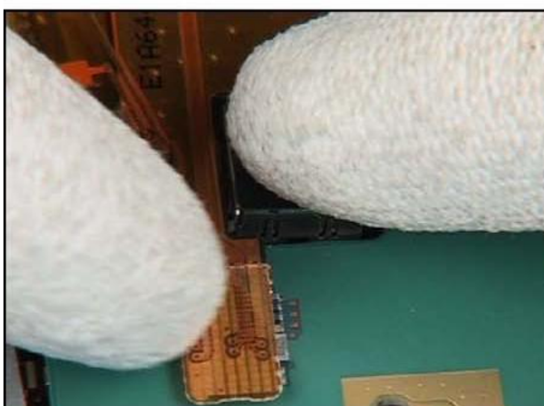


20. Insert the ANTENNA MODULE ASSEMBLY.

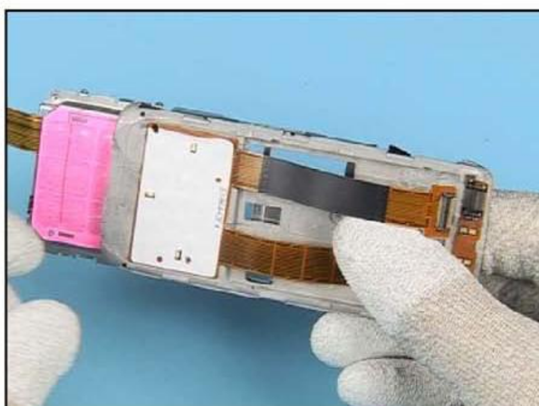
21. Close the connector of the SIM CARD MODULE.



22. Position the ENGINE MODULE into the B-COVER ASSEMBLY.



23. Close the connector of the CAMERA FLEX ASSEMBLY.



24. Bring the SLIDE MODULE ASSEMBLY into position shown.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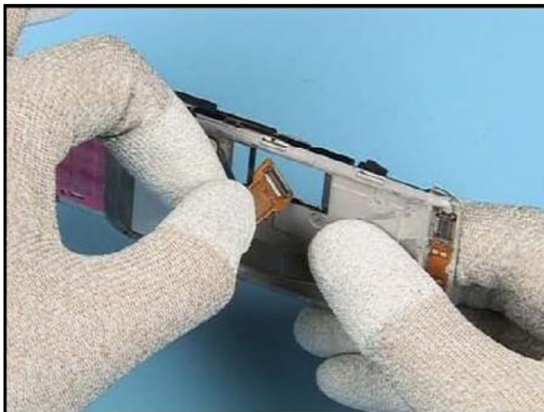
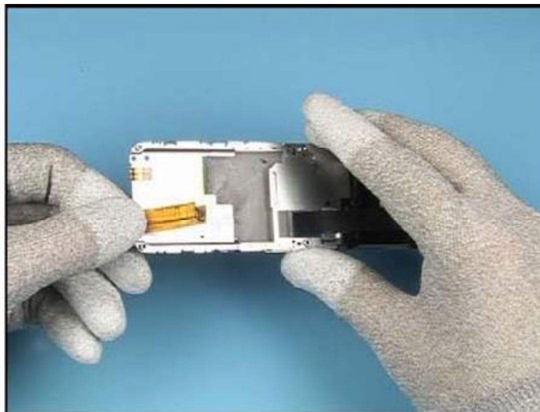
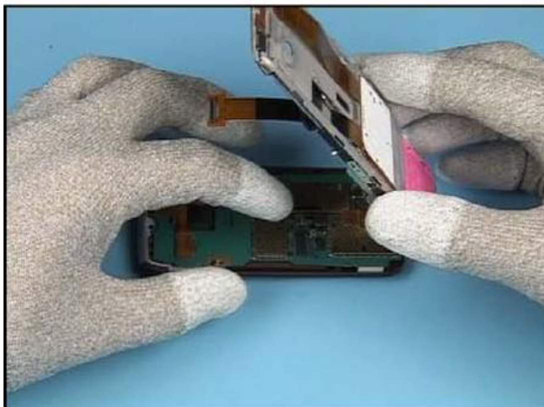


25. Slot the connector through the recess as shown.

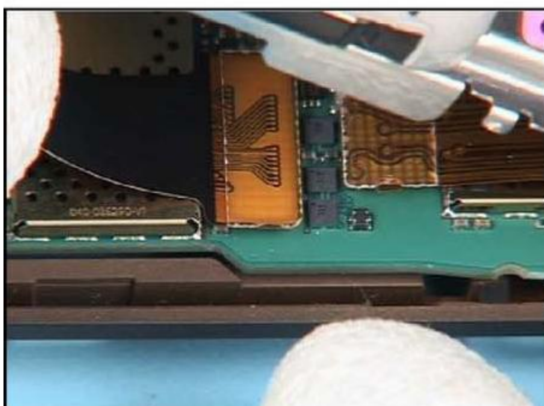


26. Bend over the 2nd flex foil as shown.

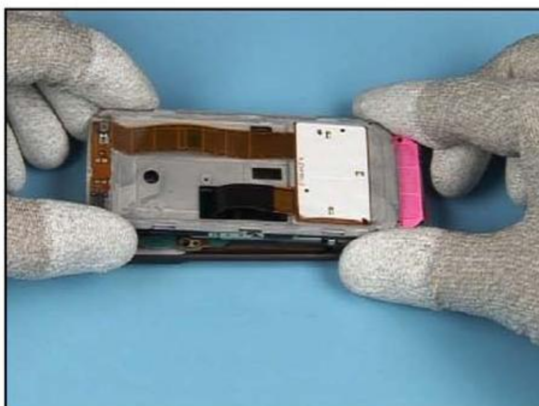


27. Now position the SLIDE MODULE ASSEMBLY over the B-COVER ASSEMBLY.

28. Close this connector first.



29. Move the SLIDE MODULE ASSEMBLY down and close the 2nd connector.



30. Now close the slider slowly and align it to the B-COVER ASSEMBLY.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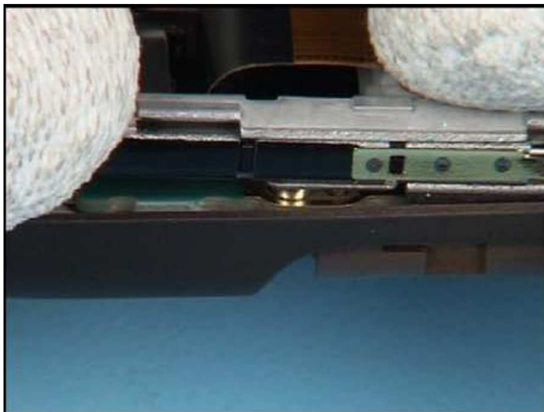
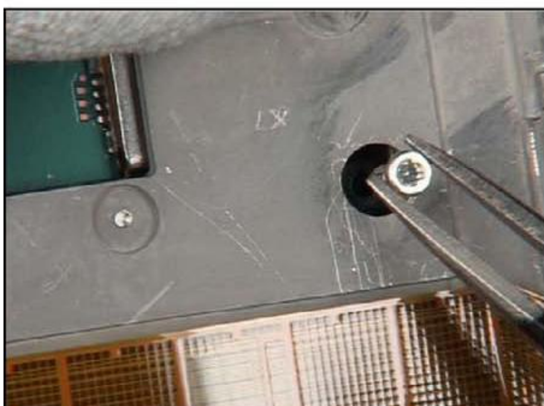


31. Mind this guide.

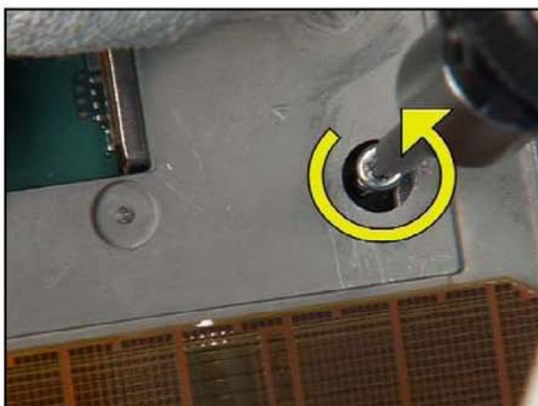
32. Click these 2 top snaps into their places.


33. Set the correct torque for the single screw.

34. Bring the SLIDE MODULE ASSEMBLY into position shown to reach the hidden thread.



35. Hold the slider into position. Insert the screw.



36. To prevent destroying the plastic thread, turn the screw to the left first.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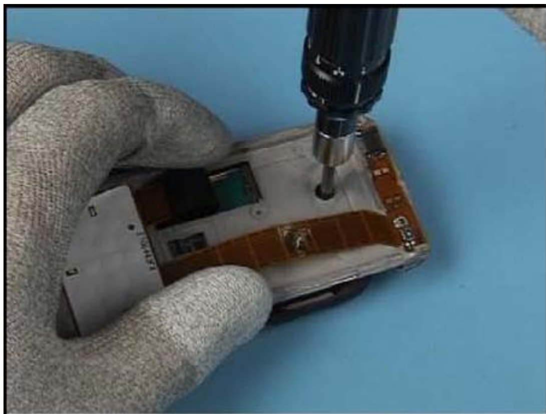
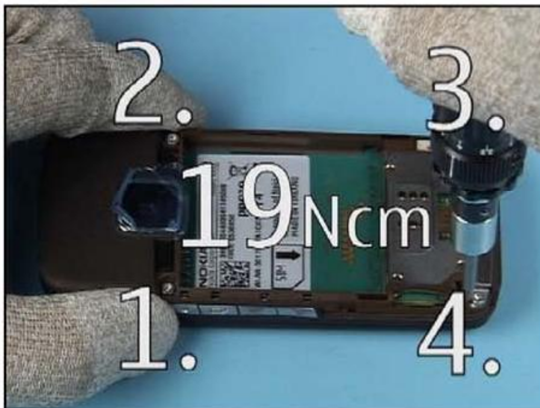


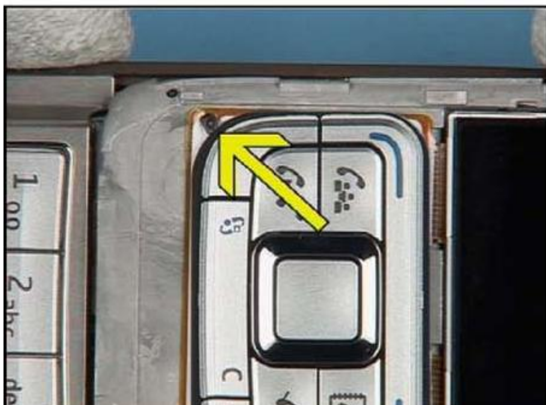
37. Then tighten it to the correct torque.

38. Mind the correct placement of the EARPIECE HOLDER ASSEMBLY.

39. Check that the SHEET METAL ASSEMBLY was positioned correctly to ensure the correct functionality of the slider.




40. Tighten the 4 screws in the order shown.



41. Insert the S60 KEYMAT first before placing the A-COVER ASSEMBLY. Mind the guide.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# 6 — BB Troubleshooting and Manual Tuning Guide


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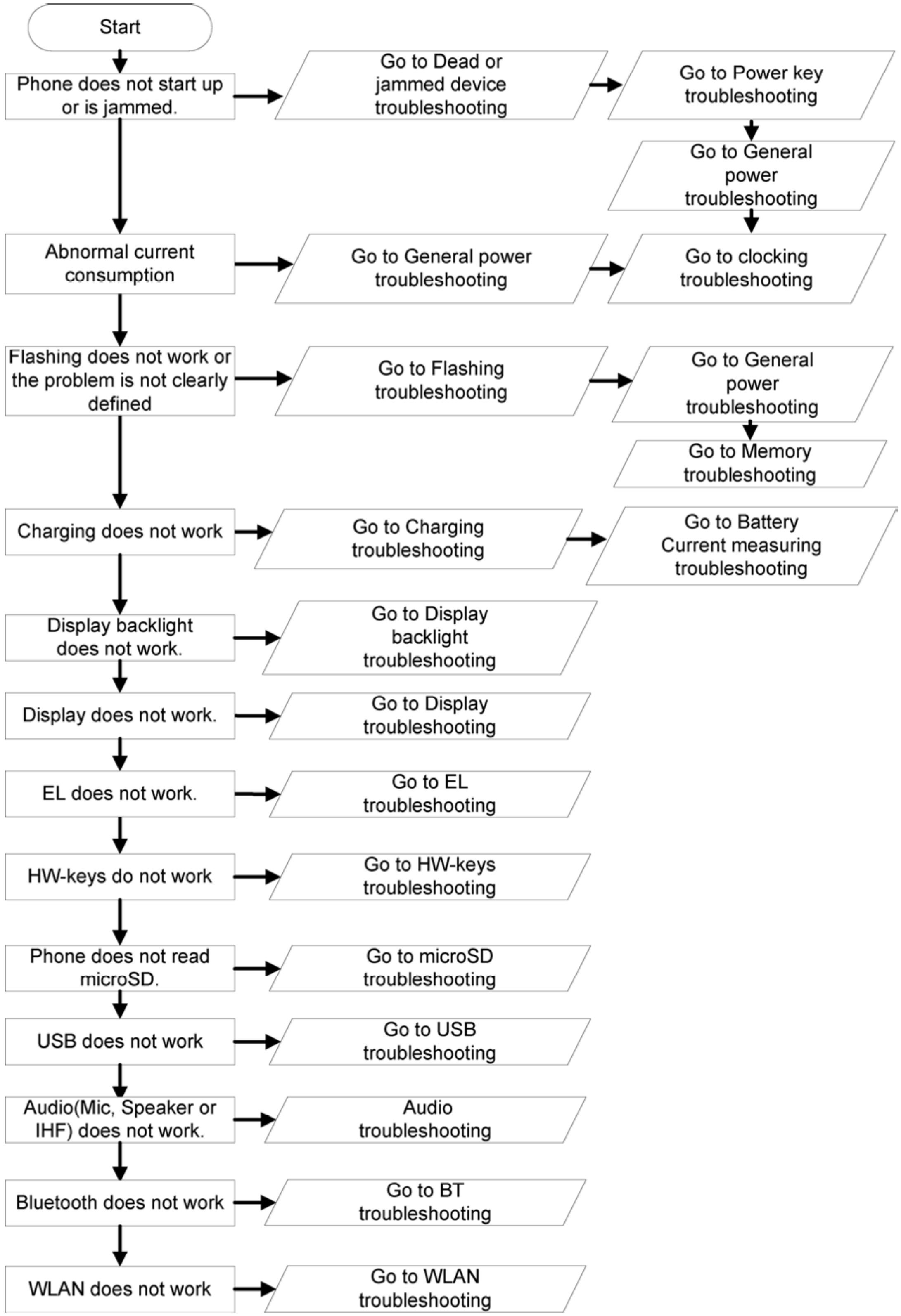
## Baseband main troubleshooting

### Troubleshooting flow





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## Dead or jammed device troubleshooting

### Troubleshooting flow



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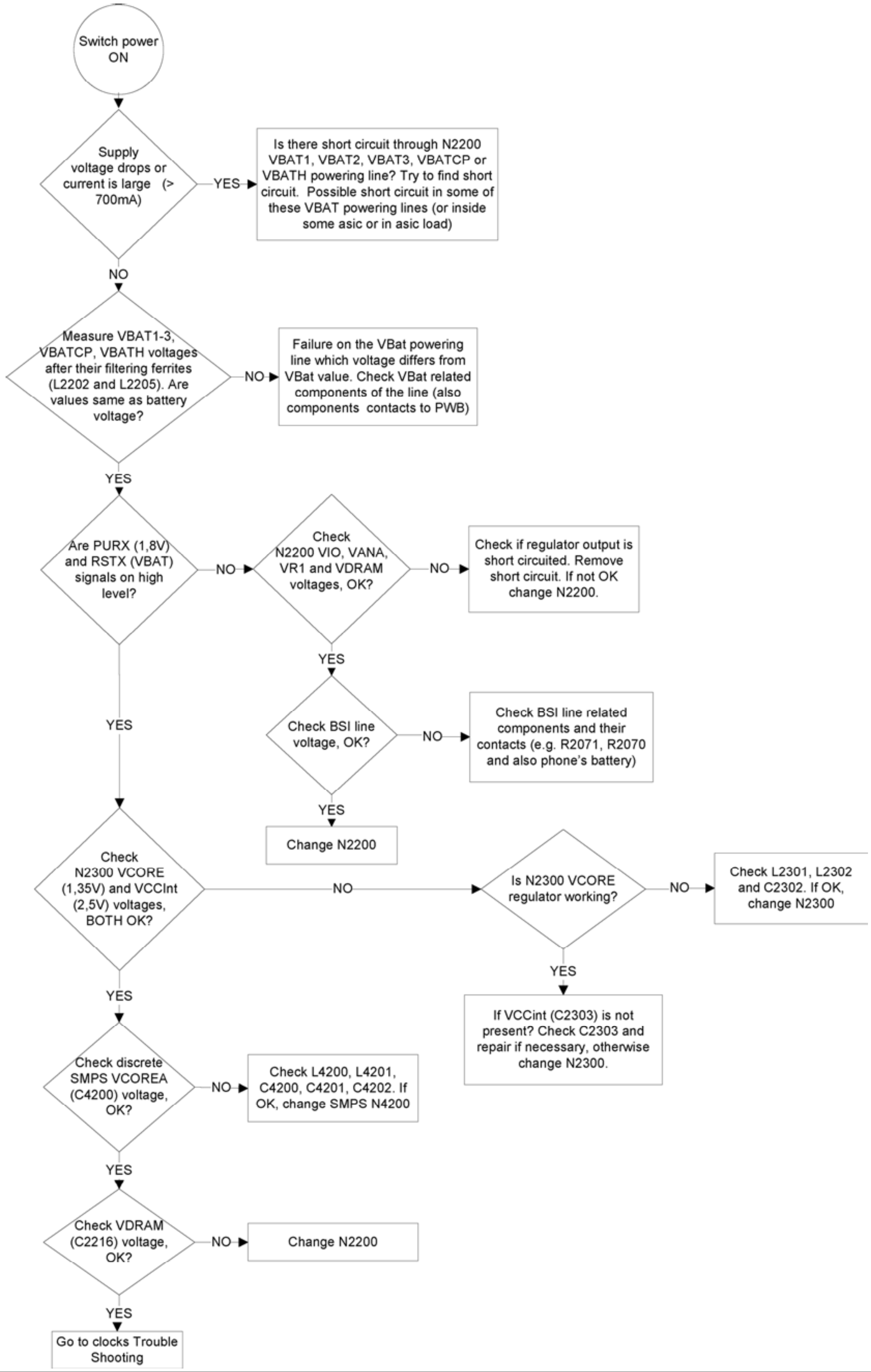
## General power checking troubleshooting

### Troubleshooting flow





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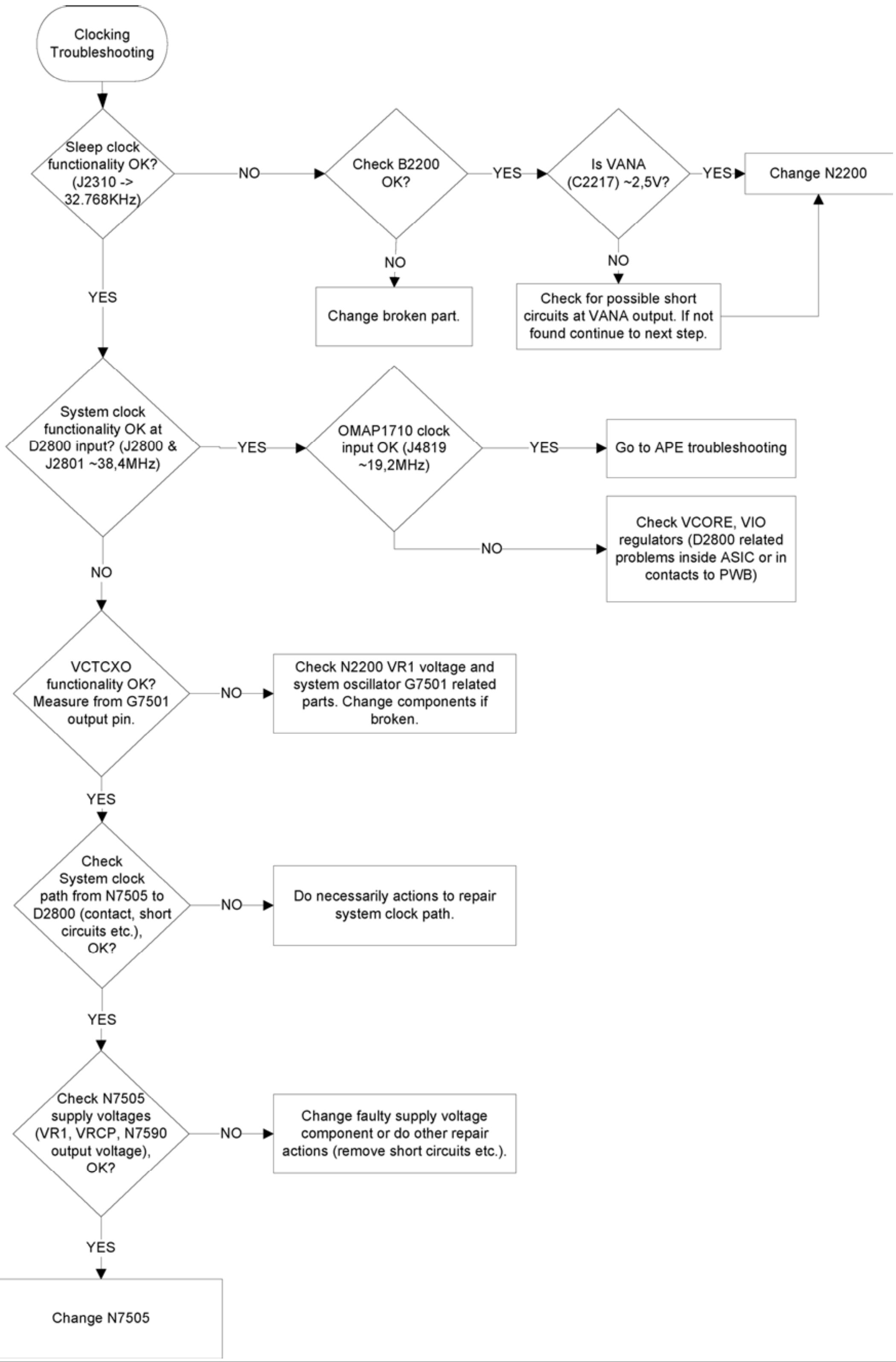
## CMT clocking troubleshooting

### Troubleshooting flow





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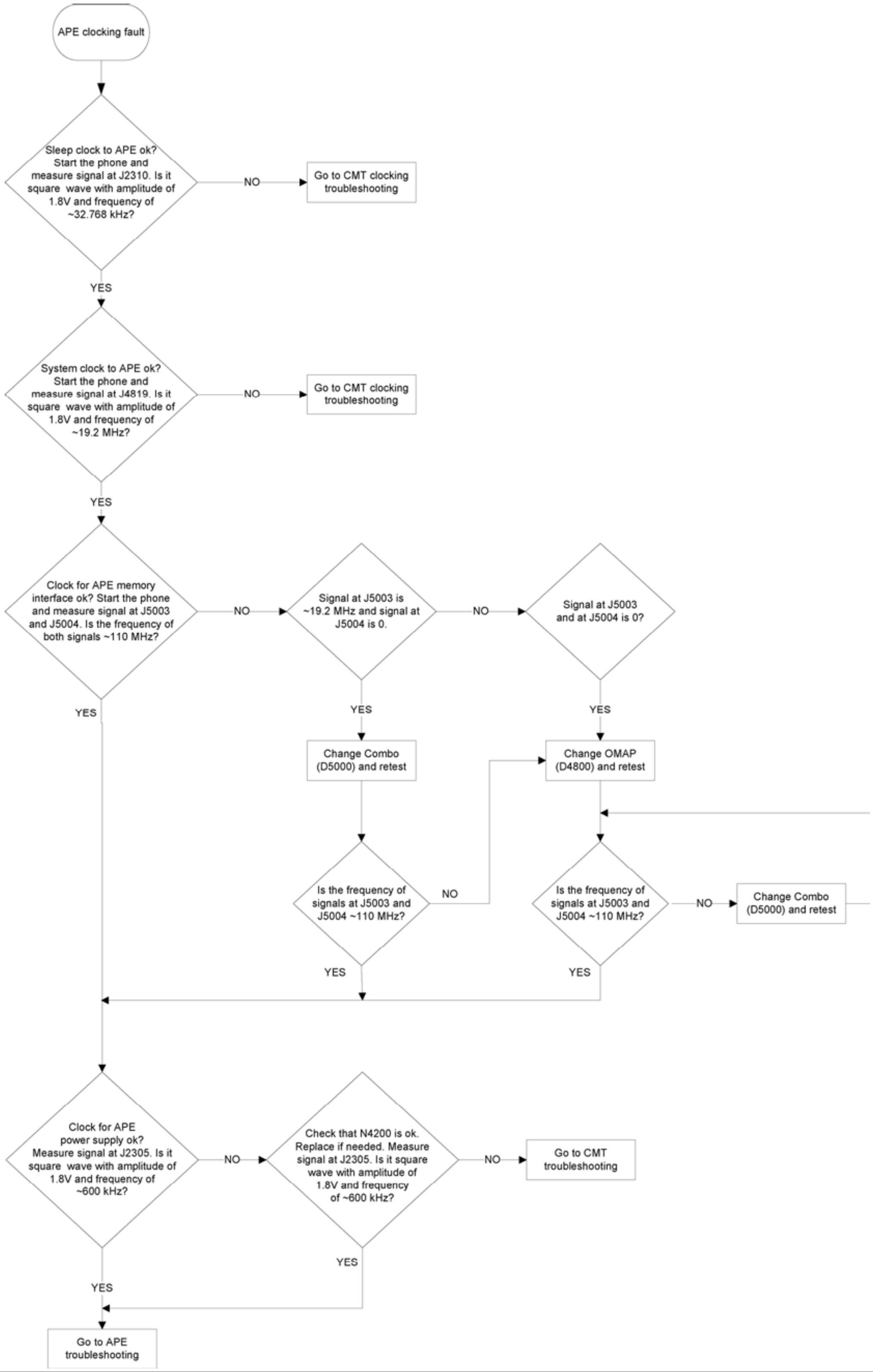
## APE clocking troubleshooting

### Troubleshooting flow





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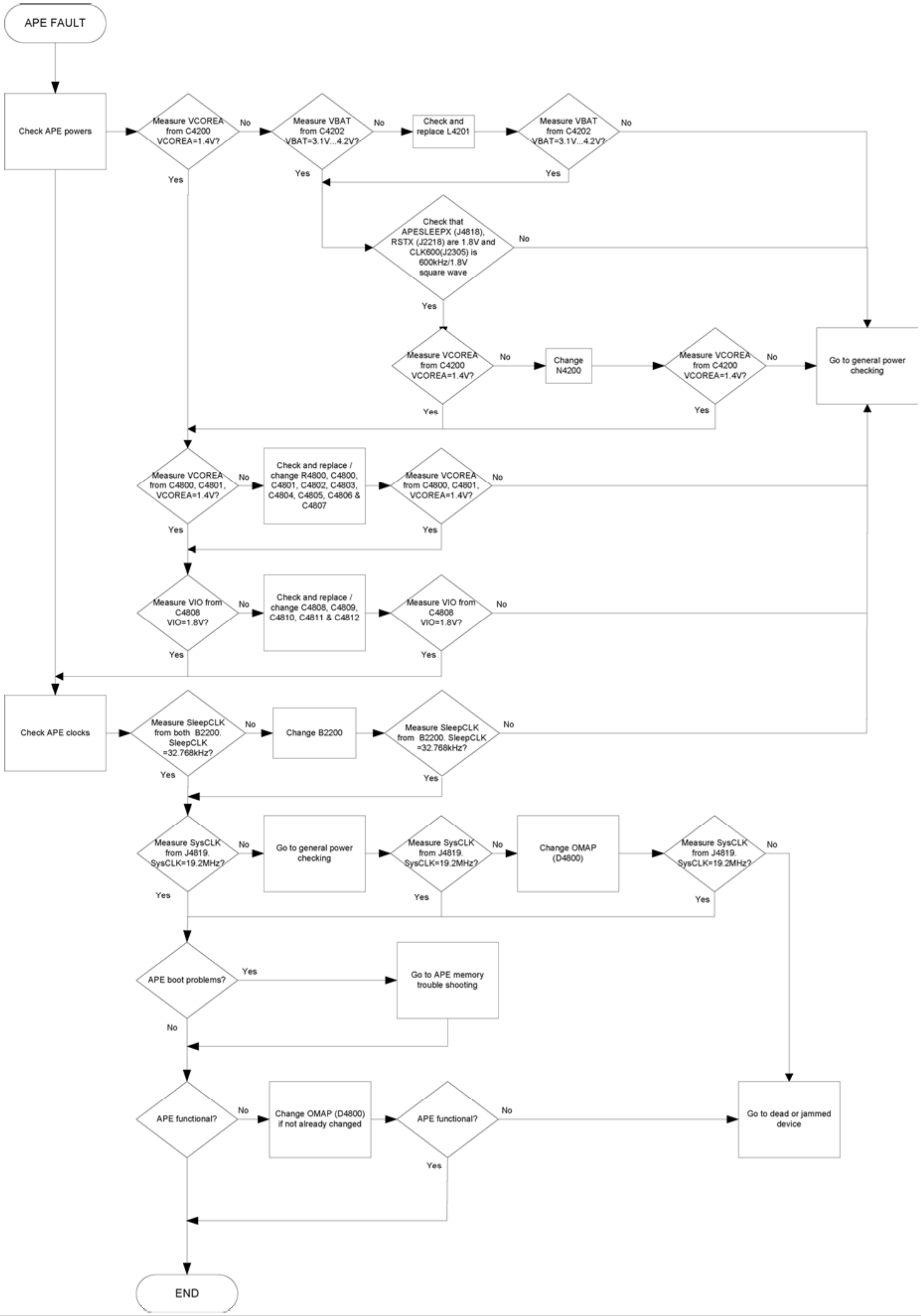
# APE troubleshooting

## Troubleshooting flow

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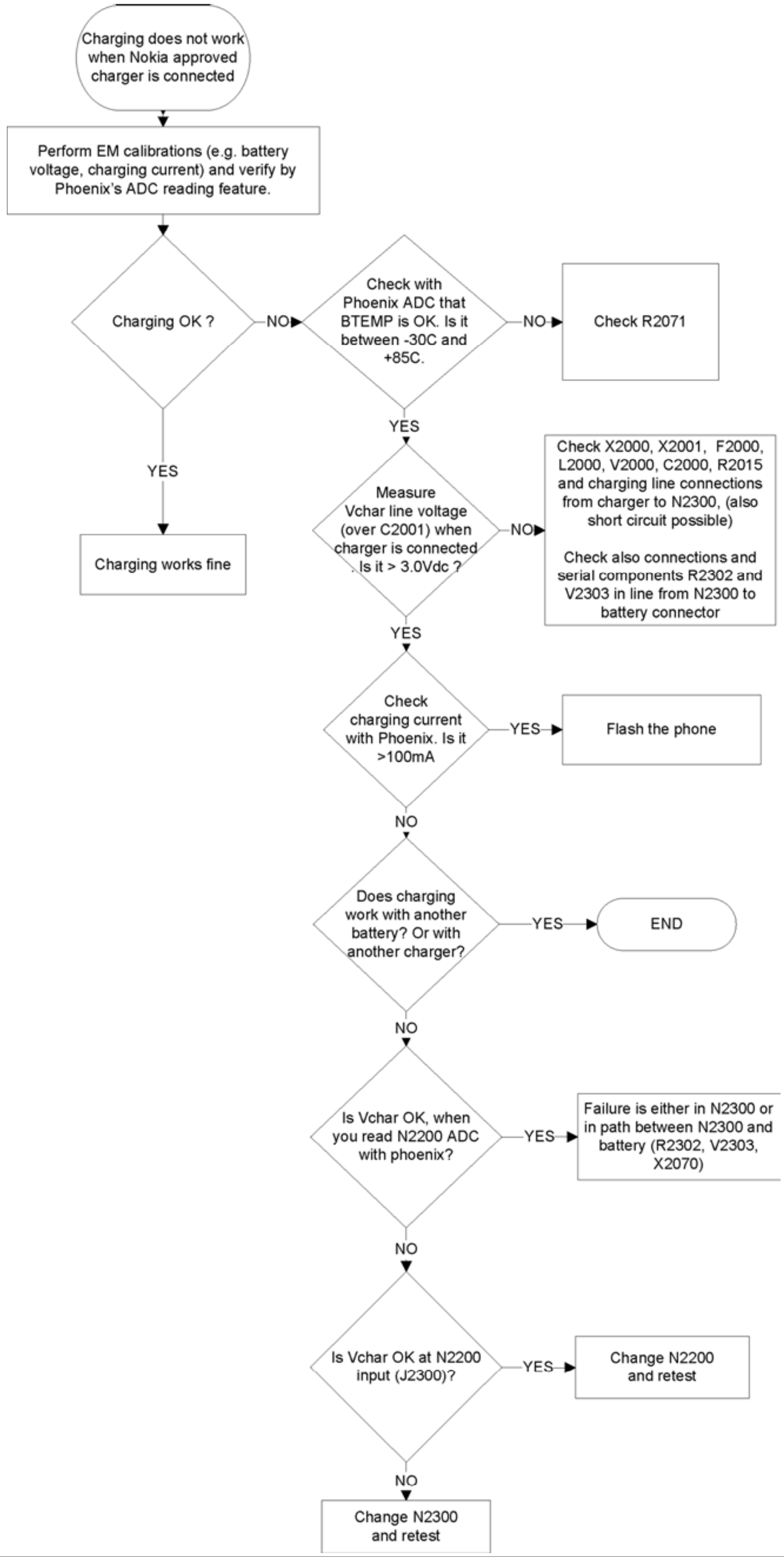
## Charging troubleshooting

### Troubleshooting flow





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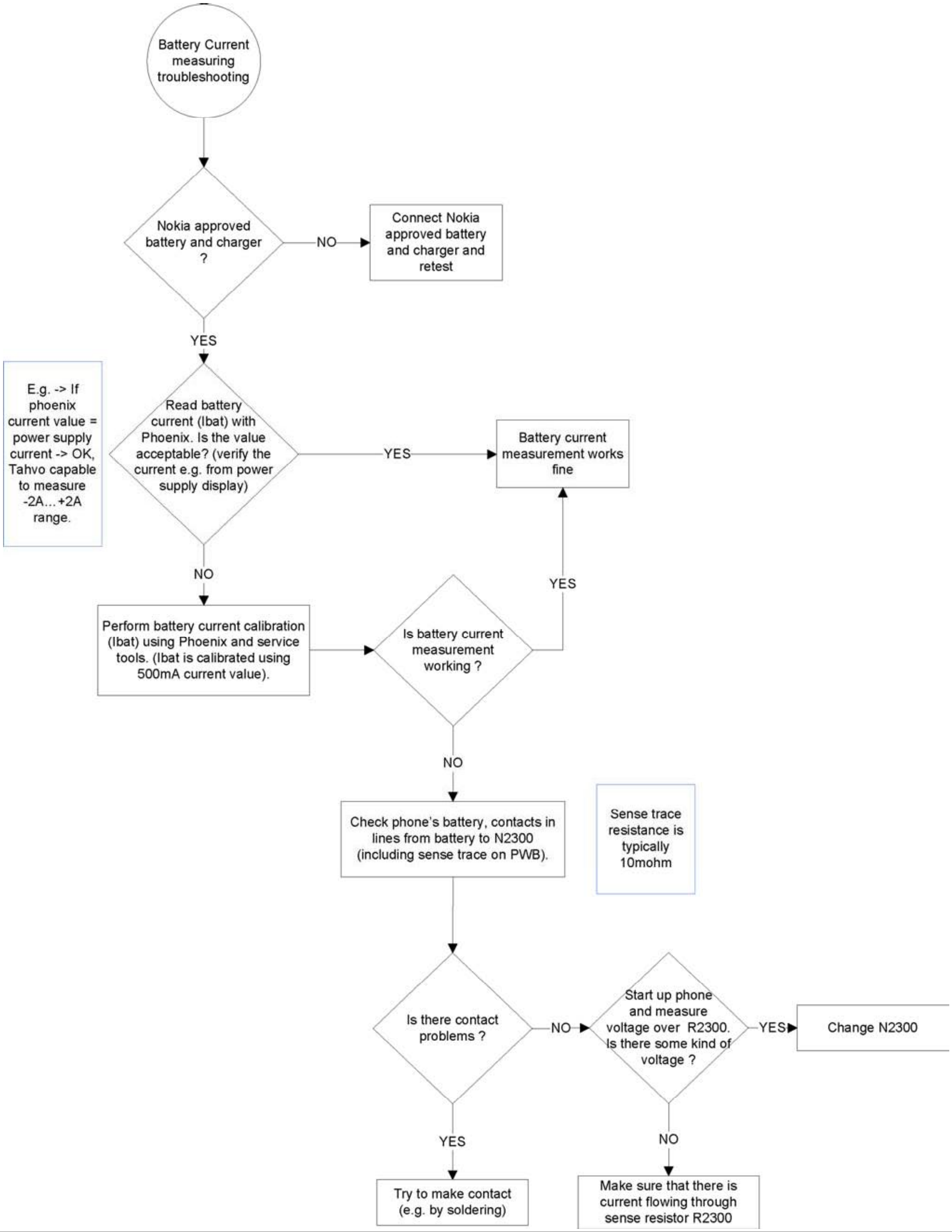
## Battery current measuring fault troubleshooting

### Troubleshooting flow





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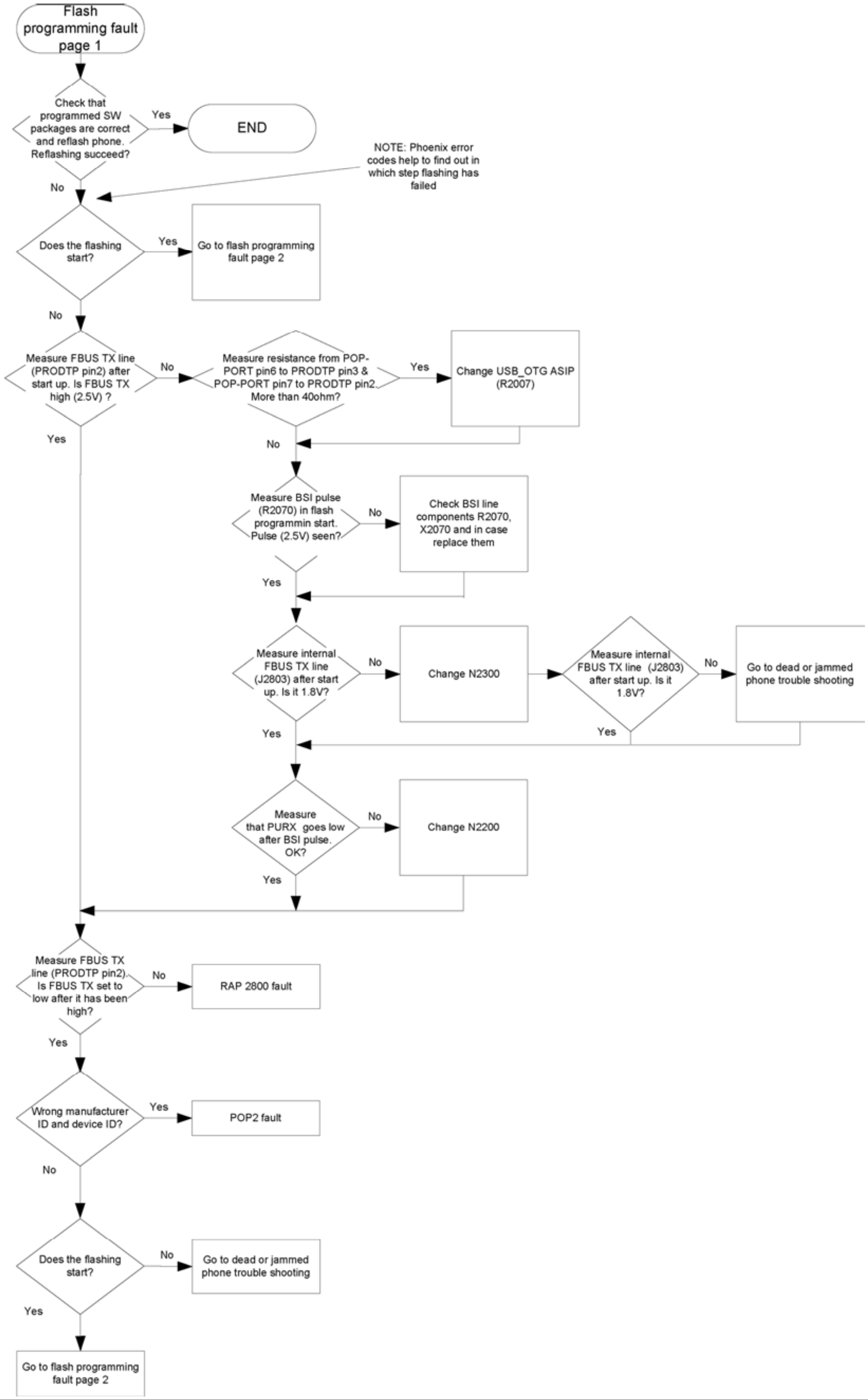
## Flash programming fault troubleshooting

### Troubleshooting flow





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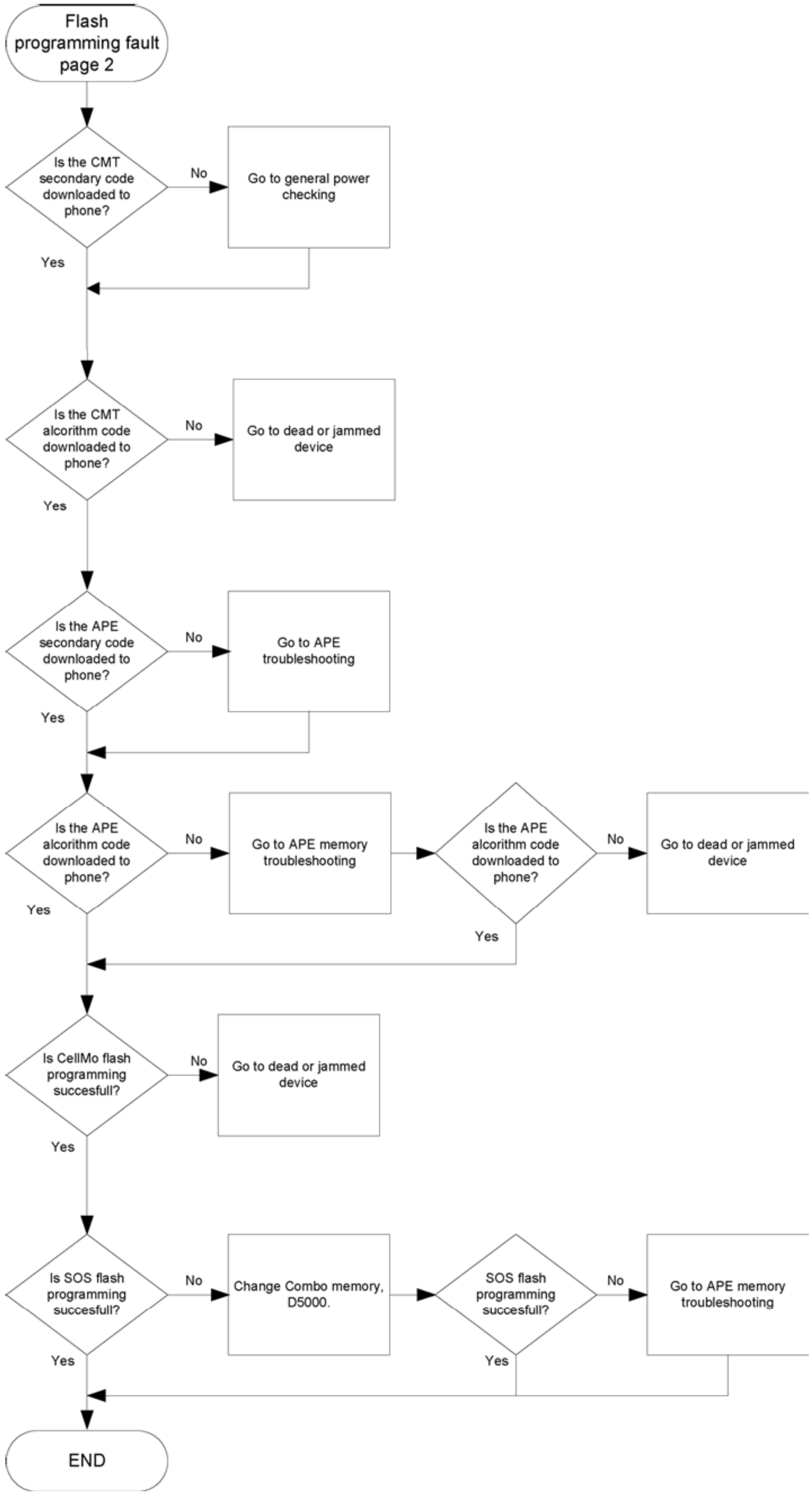


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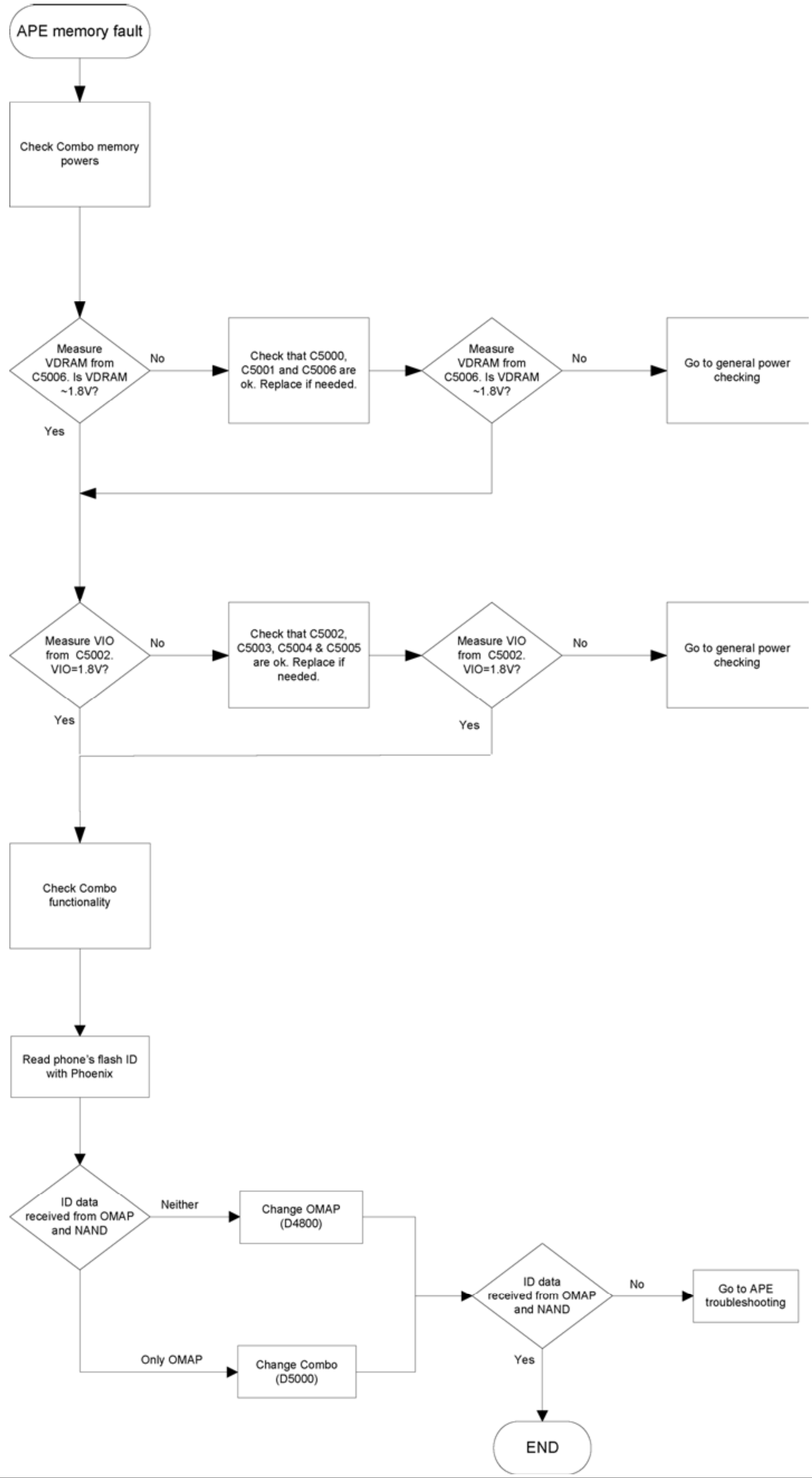
## APE memory troubleshooting

### Troubleshooting flow





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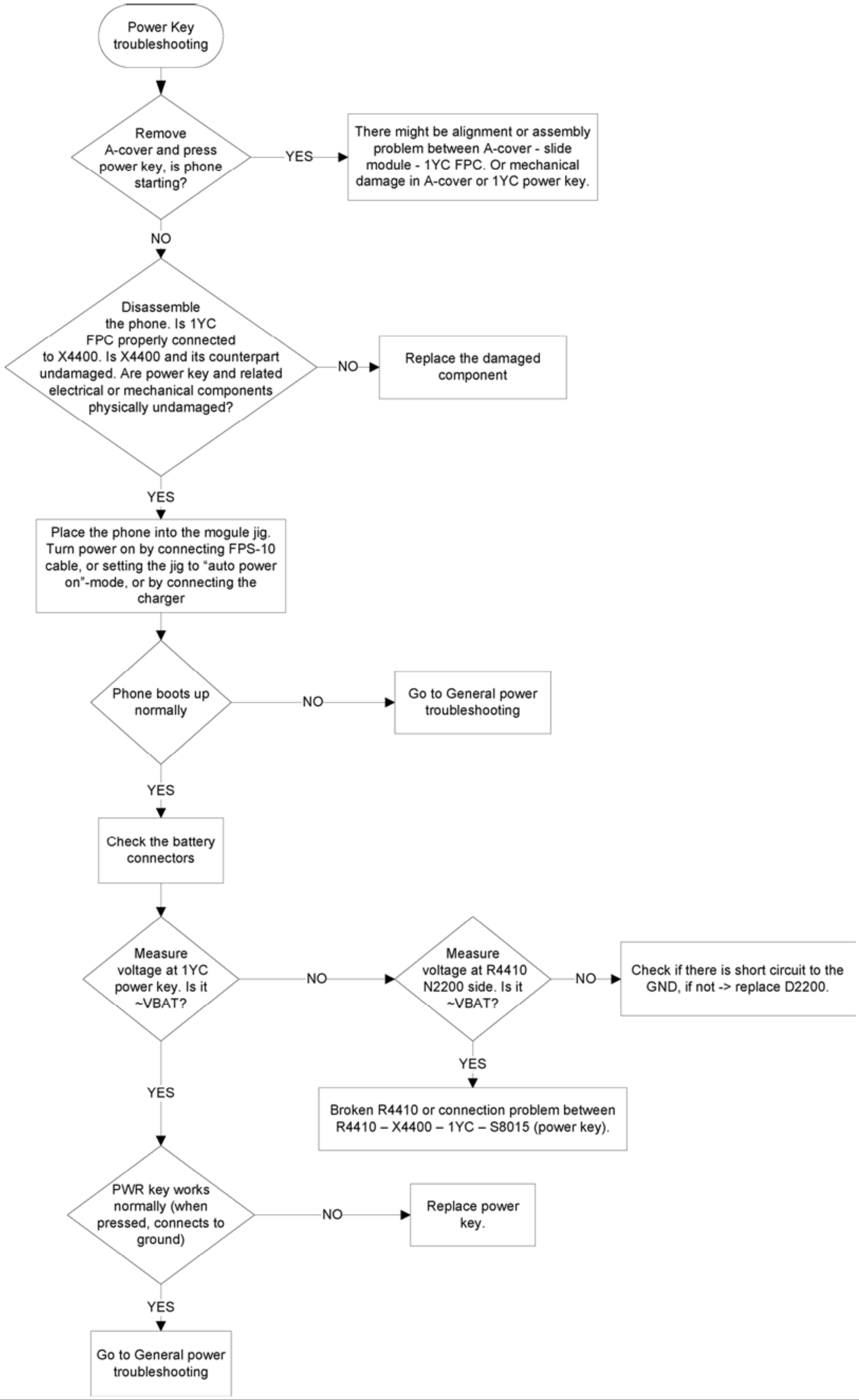
## Power key troubleshooting

### Troubleshooting flow





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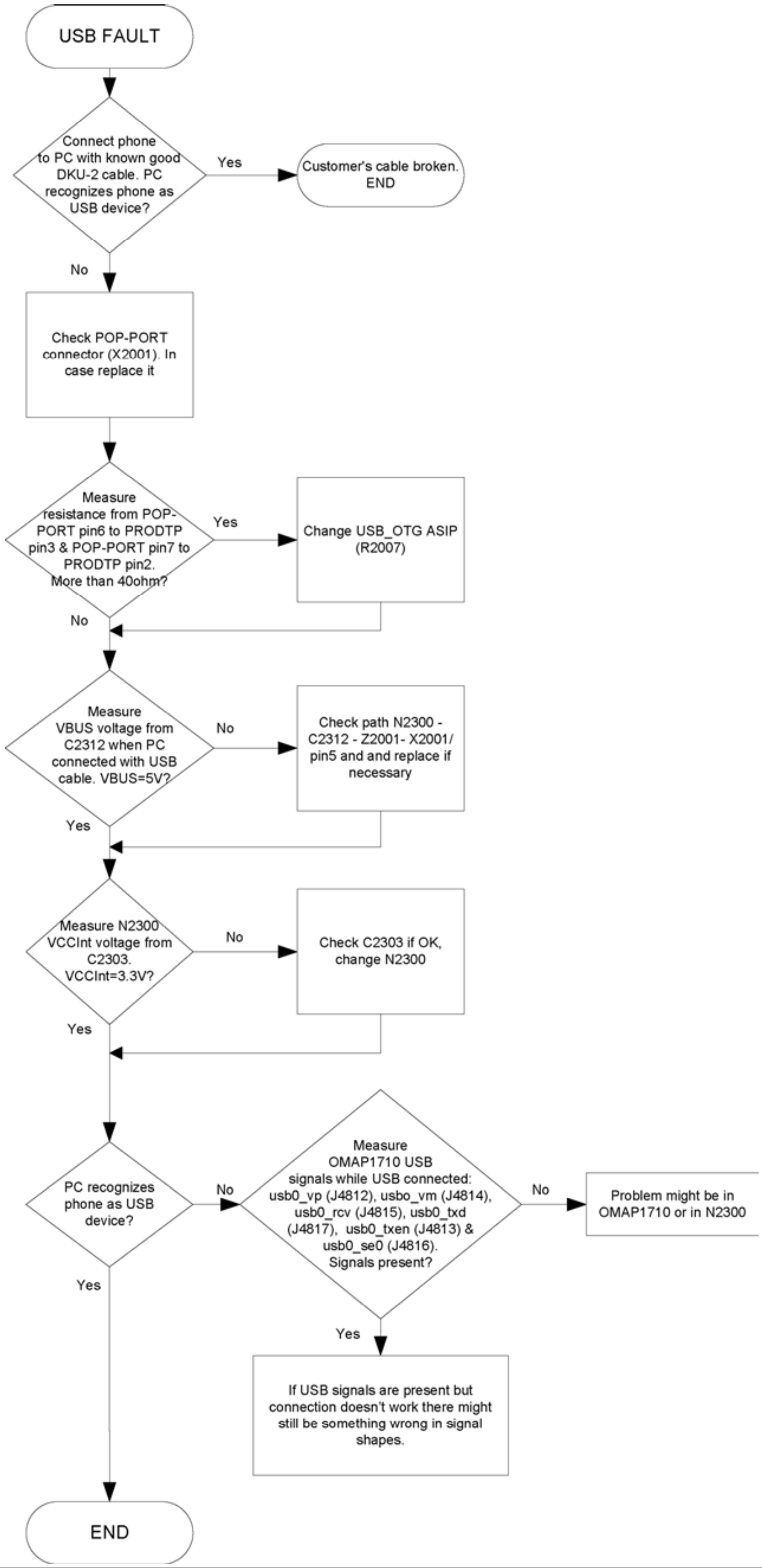
## USB interface troubleshooting

### Troubleshooting flow





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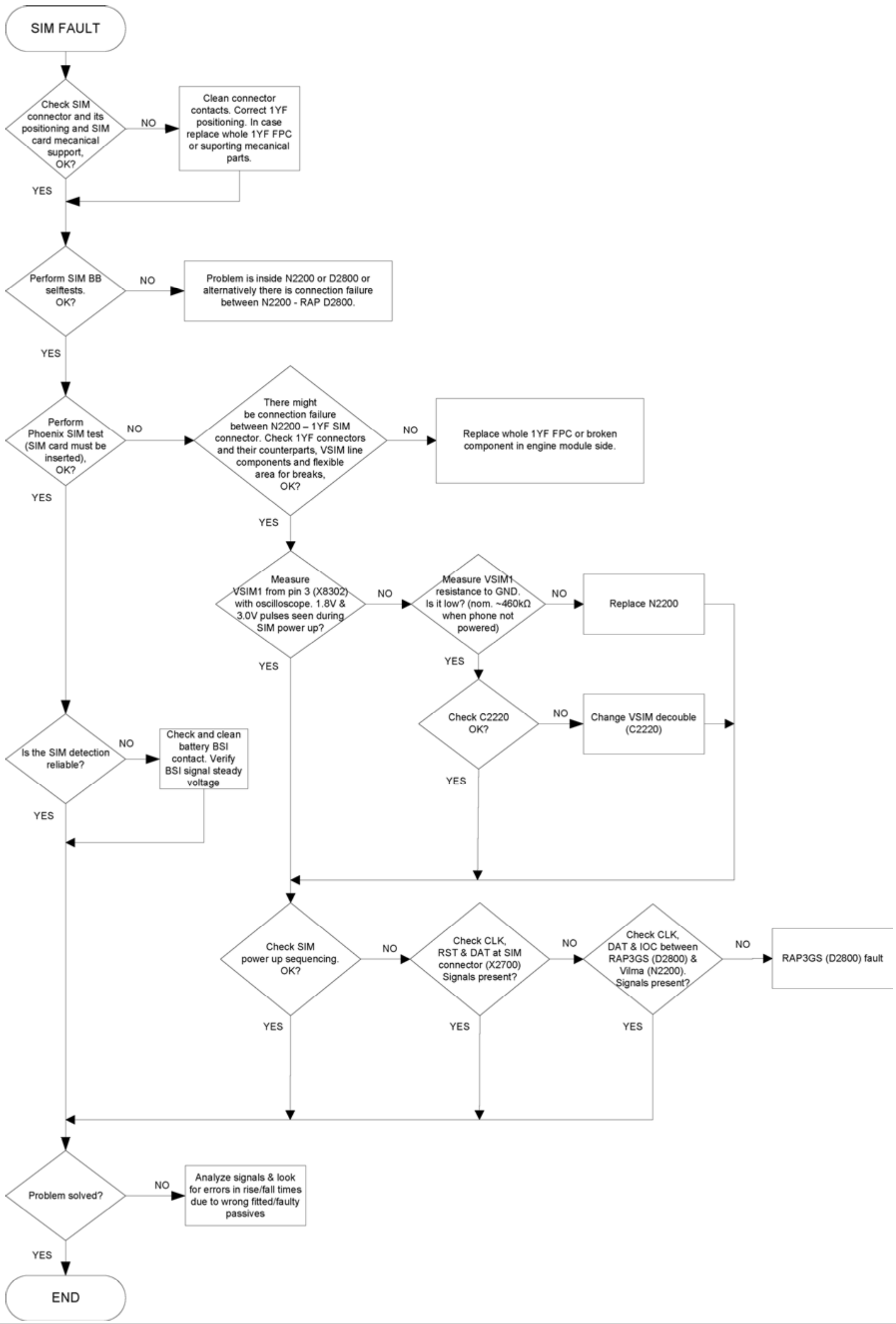
## SIM card troubleshooting

### Troubleshooting flow





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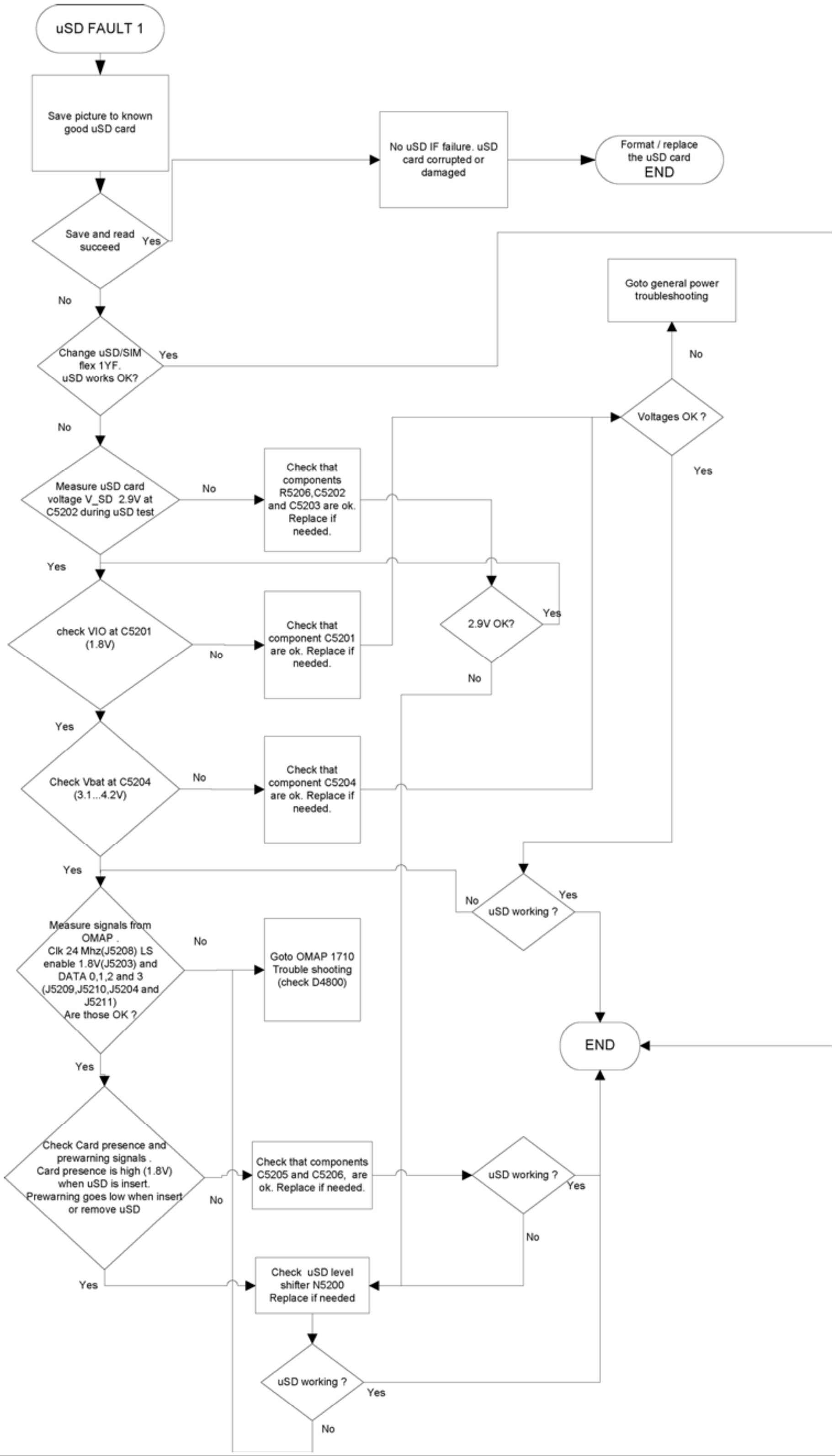
## MicroSD card troubleshooting

### Troubleshooting flow





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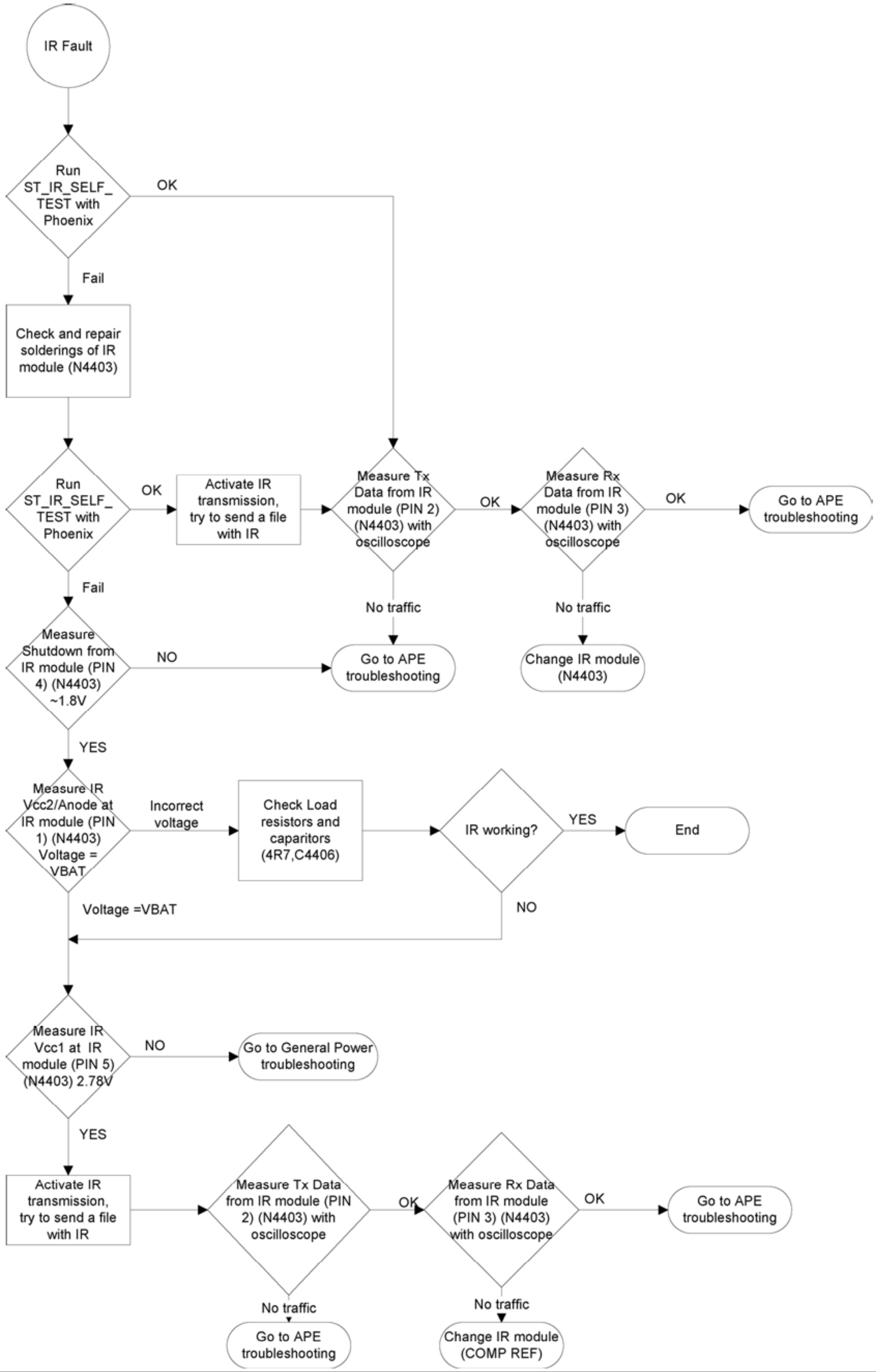
## IR troubleshooting

### Troubleshooting flow





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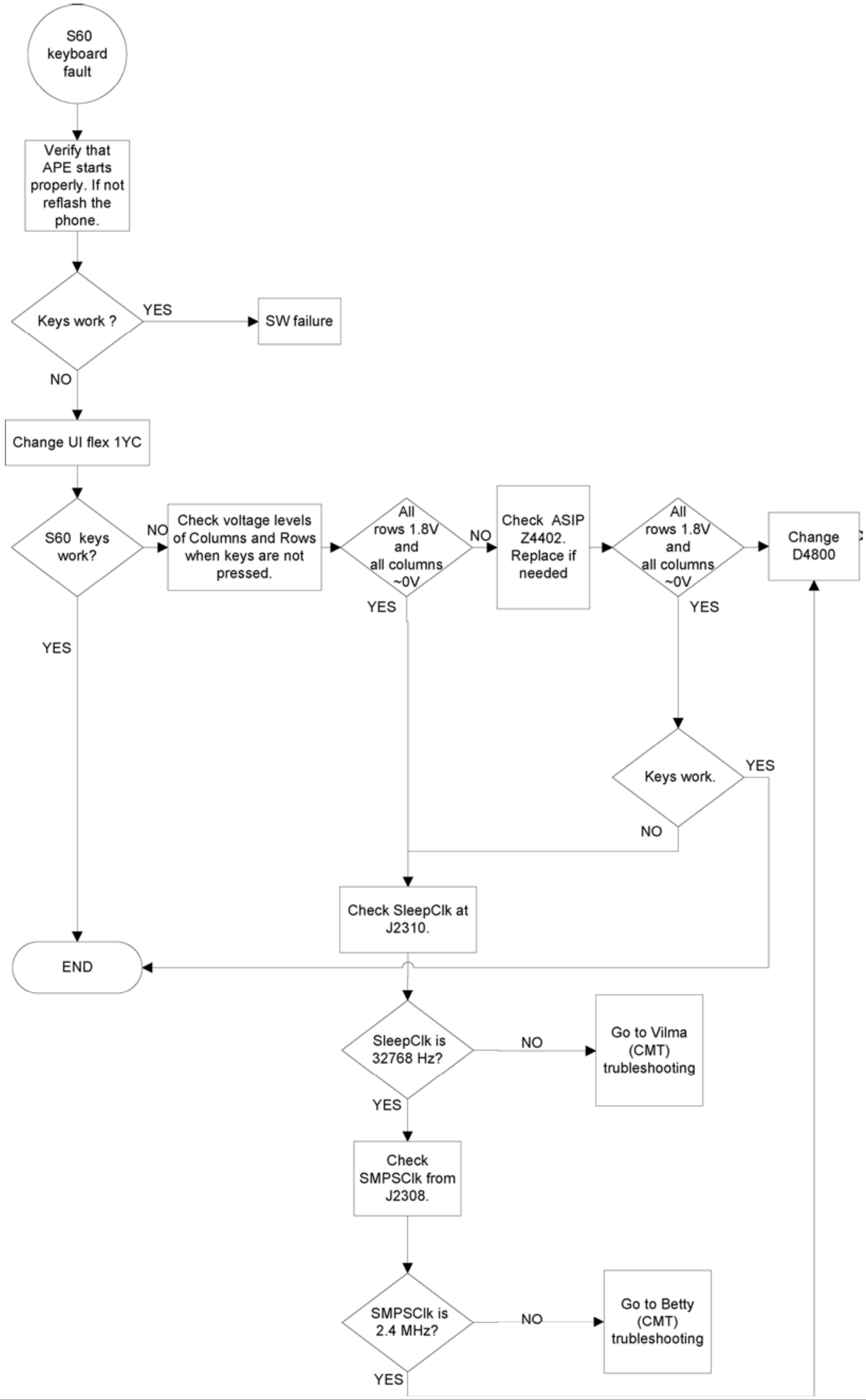
## S60 keyboard troubleshooting

### Troubleshooting flow





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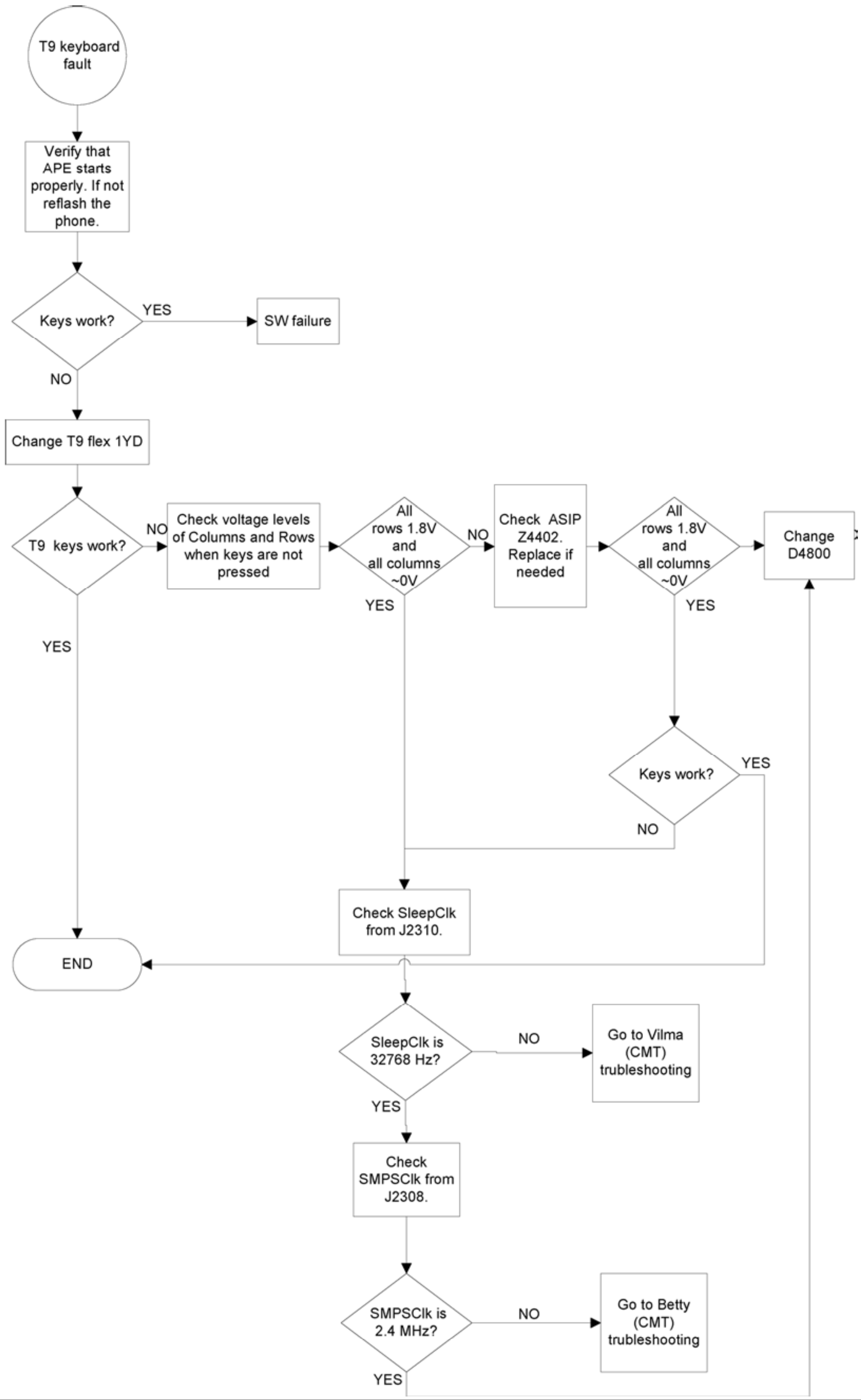
## T9 keyboard troubleshooting

### Troubleshooting flow





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## Certificate restoring for BB5 products

### Context

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

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

The procedure for certificate restoring is the following:

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

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

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

Required equipment and setup:

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

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

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

### Steps

1. Program the phone software.

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

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

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


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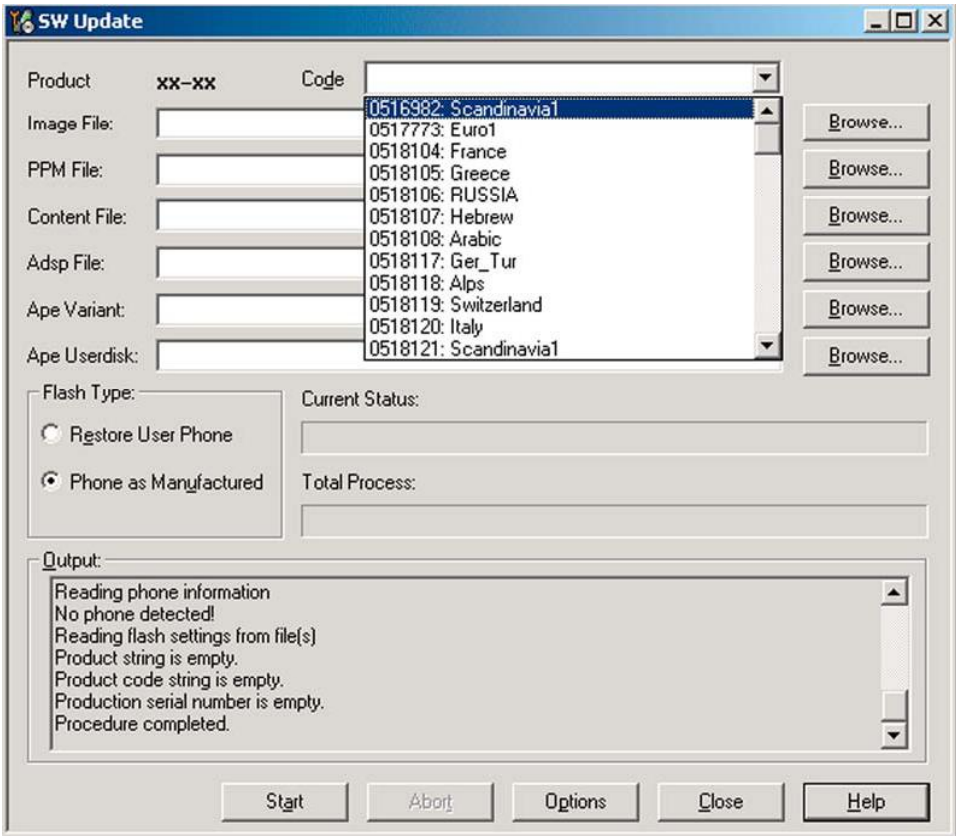
iii Choose the product manually from **File→Open Product** , and click **OK**.

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

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




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

v To continue, click **Start**.

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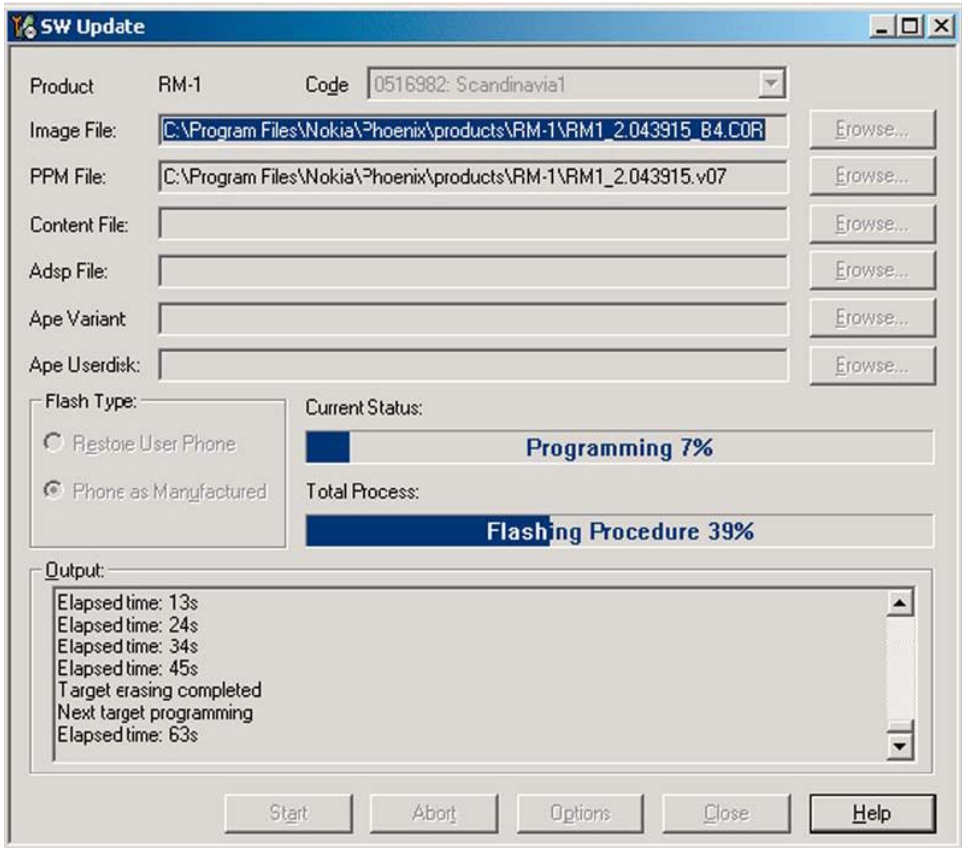



Programming is completed when *Flashing Completed* message is displayed.

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

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

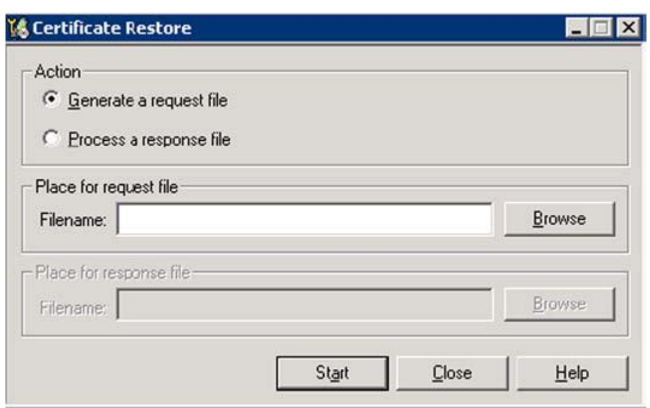
2. Create a *Request* file.

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

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

ii Choose **Tools**→**Certificate Restore** .

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





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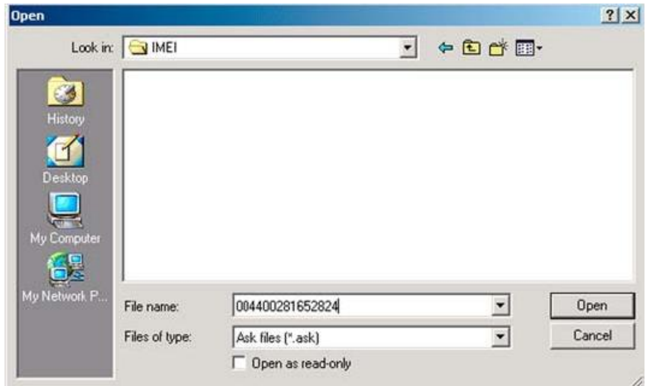
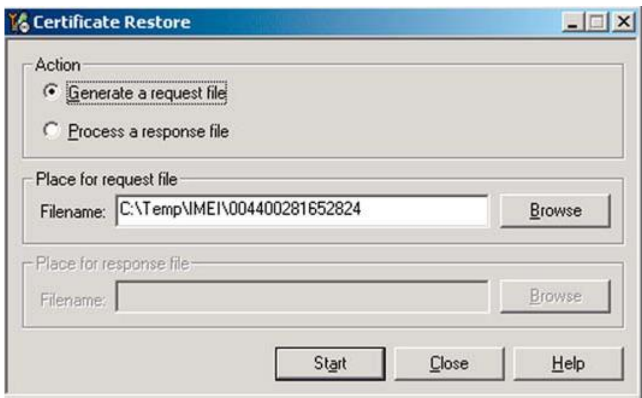
iv Name the file so that you can easily identify it, and click **Open**.




The name of the file and its location are shown.




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

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

3. Restore certificate.

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

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

ii Start *Phoenix* service software.

iii Choose **File→Scan Product**.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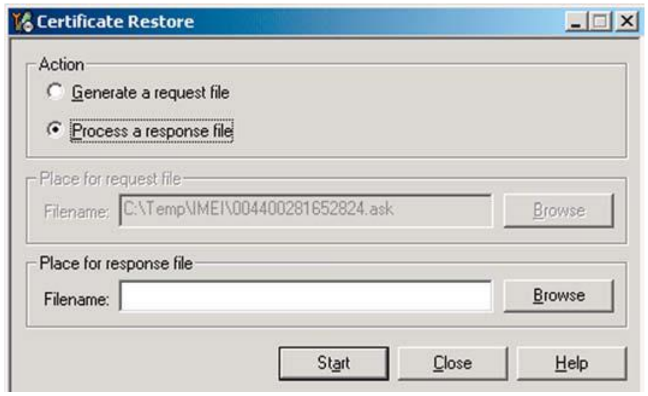
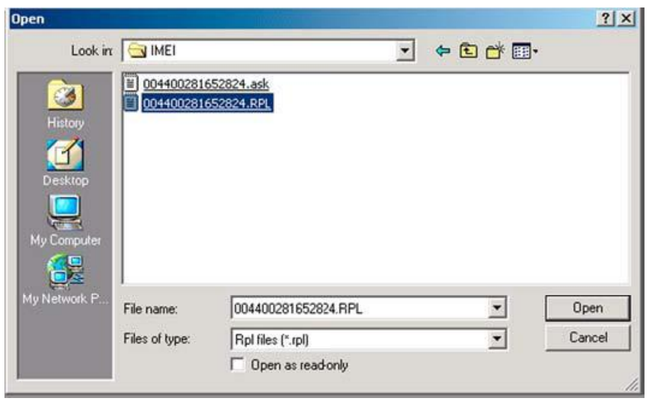
iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.



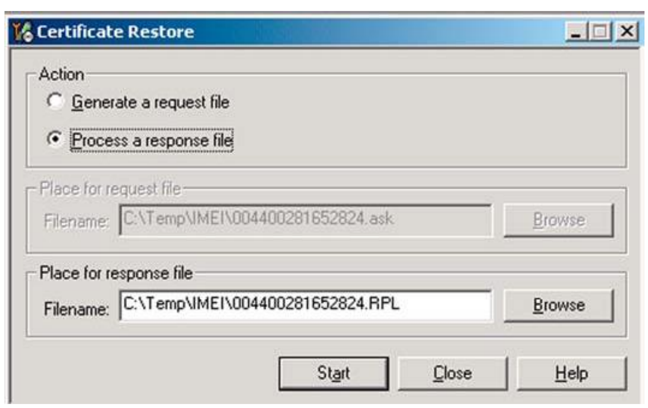

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.




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

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




## Next actions

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

**Important:** Perform all tunings: RF, BB, and UI.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## Display module troubleshooting

### General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

### Operating modes of the display

The display is in a normal mode when the phone is in active use.

The 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. Backlight is also controlled automatically by the ambient light sensor.<br>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.<br>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. |


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**Table 9 Pixel defects**

<table>
<tr><th colspan="2">Item</th><th colspan="4">Bright dot defect</th><th colspan="4">Dim dot defect</th></tr>
<tr><td rowspan="10">1</td><td rowspan="10">Defect counts</td><td>R</td><td>G</td><td>B</td><td>Total</td><td>R</td><td>G</td><td>B</td><td>Total</td></tr>
<tr><td>$R_0$</td><td>$G_0$</td><td>$B_0$</td><td rowspan="3">-</td><td rowspan="3"></td><td>$G_0$</td><td rowspan="3"></td><td rowspan="3">0</td></tr>
<tr><td colspan="3">Acceptable</td><td>0</td></tr>
<tr><td>$R_{BL2}$</td><td>$G_{BL2}$</td><td>$B_{BL2}$</td><td>$G_{DL2}$</td></tr>
<tr><td colspan="4" rowspan="3"></td><td>$R_0$</td><td>$G_{DM1}$</td><td>$B_0$</td><td rowspan="3">2</td></tr>
<tr><td>2</td><td>2</td><td>2</td></tr>
<tr><td>$R_{DM2}$</td><td>$G_{DM2}$</td><td>$B_{DM2}$</td></tr>
<tr><td>$R_{BH1}$</td><td>$G_{BH1}$</td><td>$B_{BH1}$</td><td rowspan="3">0</td><td>$R_{DH1}$</td><td>$G_{DH1}$</td><td>$B_{DH1}$</td><td rowspan="3">-</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td colspan="3">Acceptable</td></tr>
<tr><td>$R_{63}$</td><td>$G_{63}$</td><td>$B_{63}$</td><td>$R_{63}$</td><td>$G_{63}$</td><td>$B_{63}$</td></tr>
<tr><td>2</td><td>Combined defect counts</td><td colspan="8">No combine dot defect allowed.<br>*Two Single dim dot defects that are within 5mm of each other should be counted as a combined dot defect.</td></tr>
</table>

**Note:** Blinking pixels are not allowed in normal operating temperatures and light conditions.


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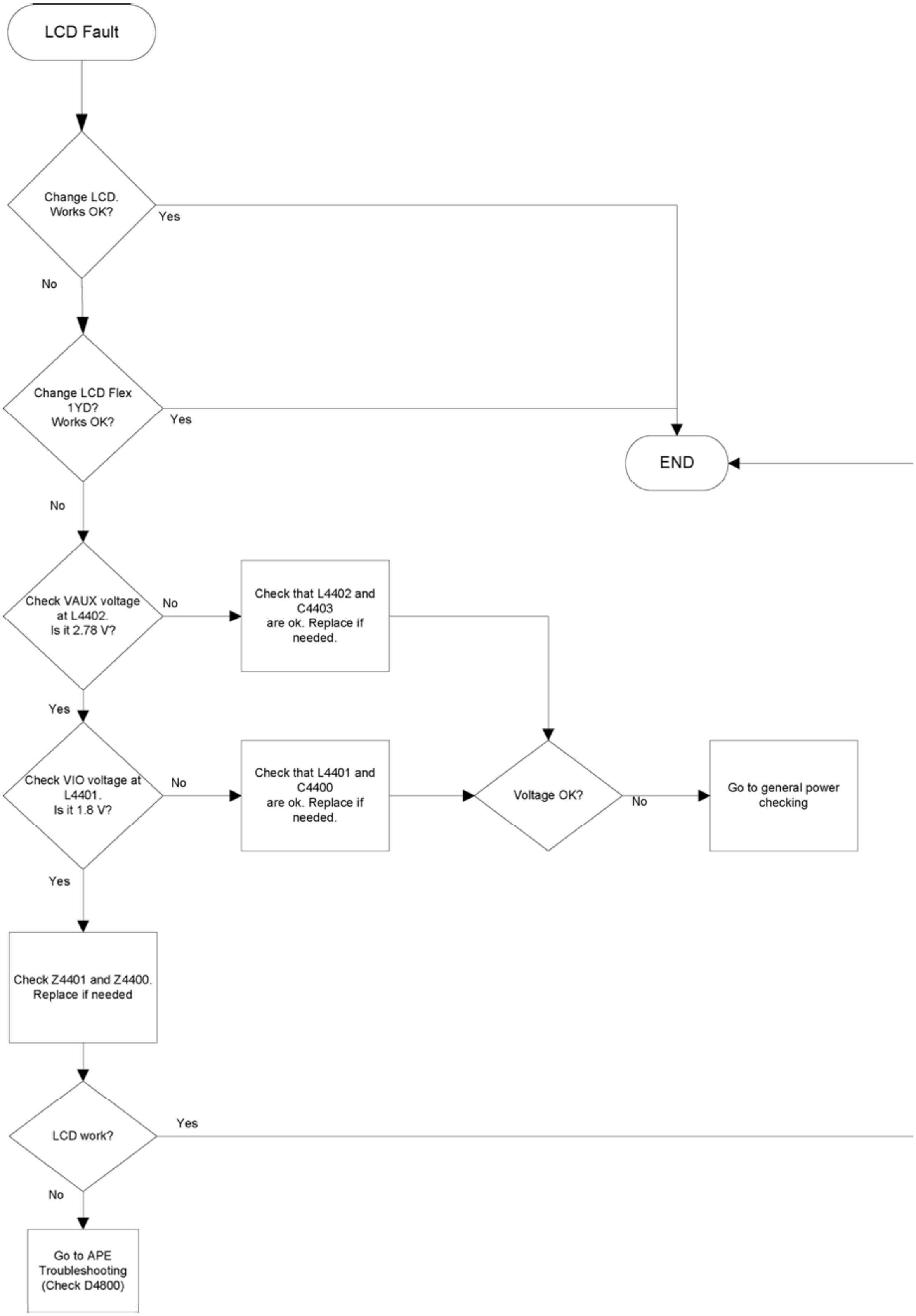
## LCD troubleshooting

### Troubleshooting flow





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## Display and keyboard backlight troubleshooting

### Context

The device has one LED driver that provides current for the display backlight.

The brightness of the display is adjusted by the Ambient Light Sensor (ALS).

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.


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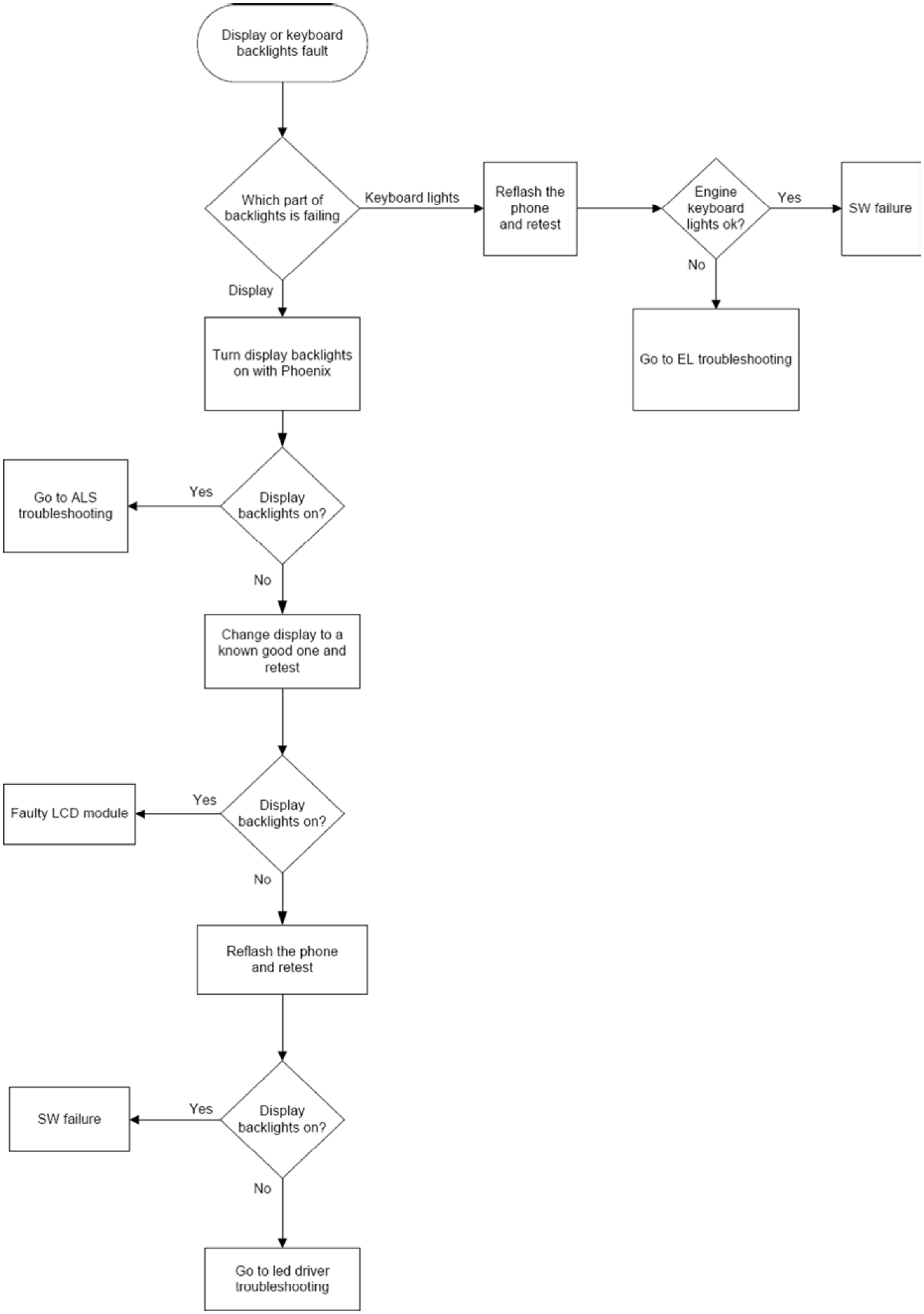
## Troubleshooting flow





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### Related information

- Display fault troubleshooting (page )
- LED driver troubleshooting (page )
- ALS troubleshooting (page 6–33)

## 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.**


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

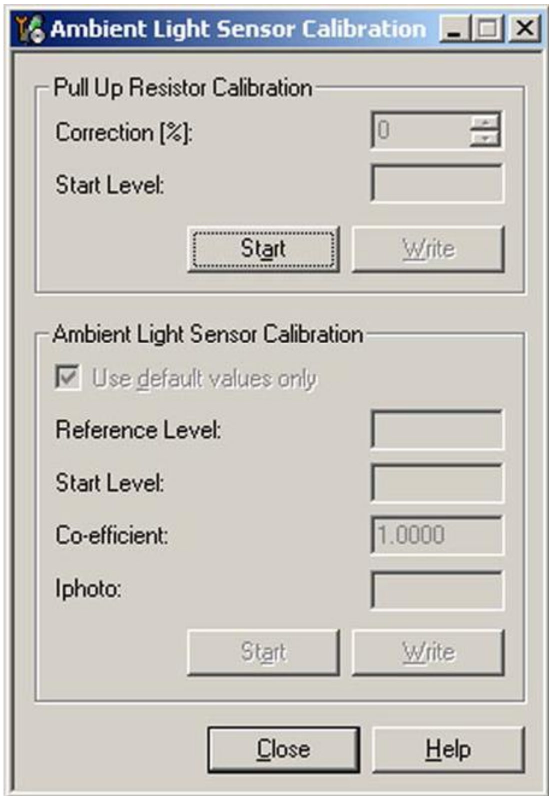


**Figure 33** ***Ambient Light Sensor Calibration*** **window**

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**.


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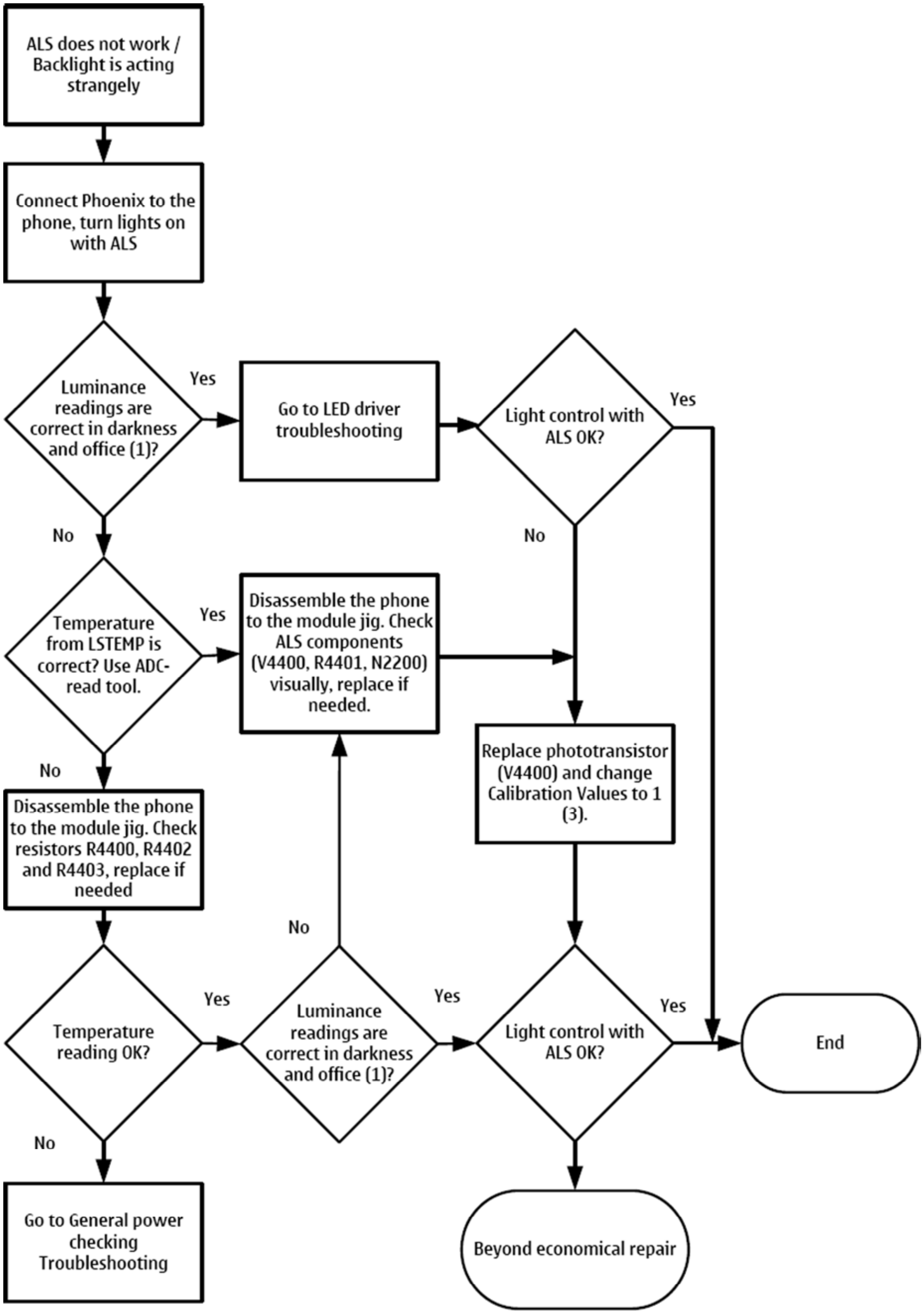
## Troubleshooting flow





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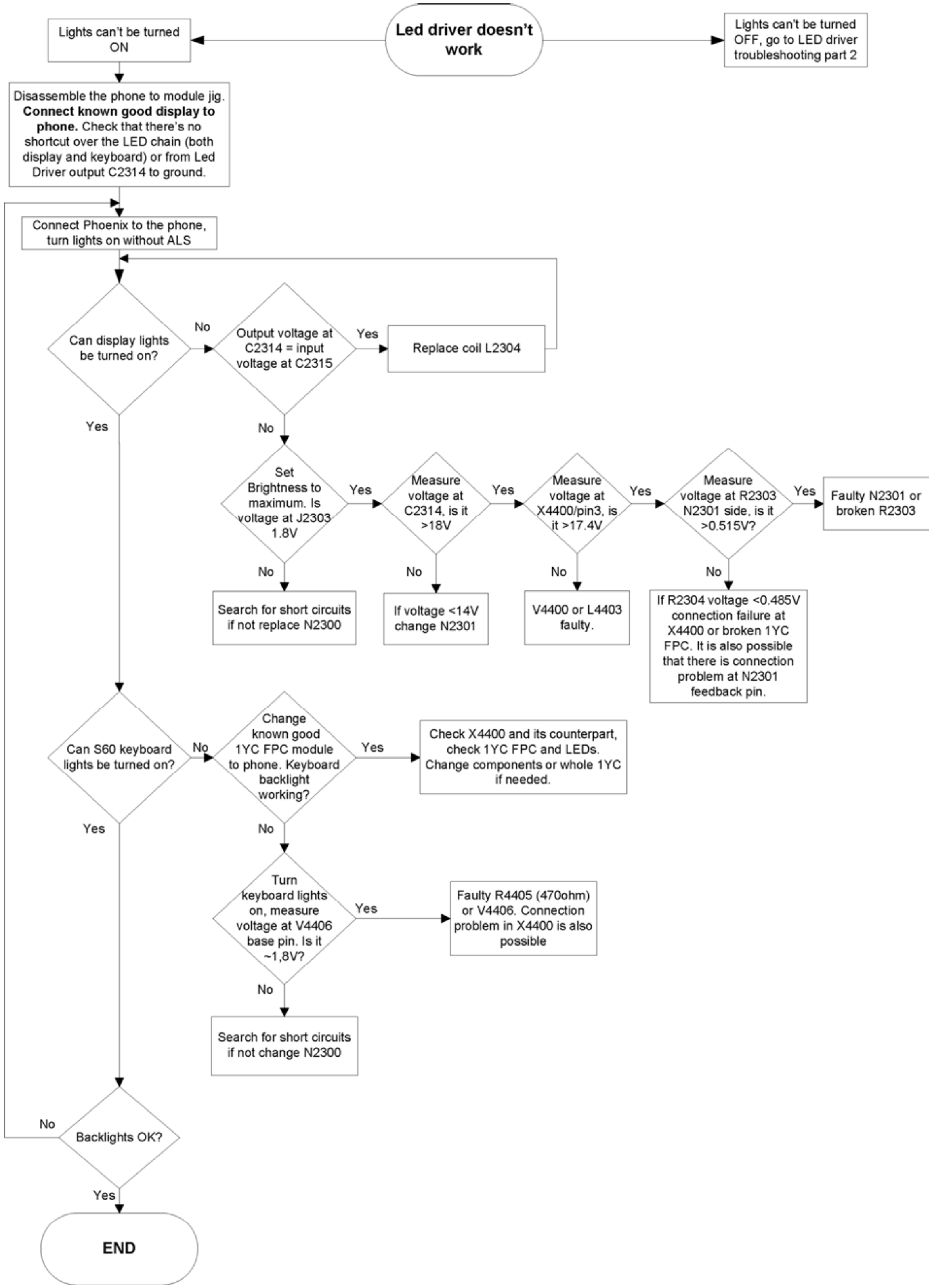
## LED driver troubleshooting

### Troubleshooting flow





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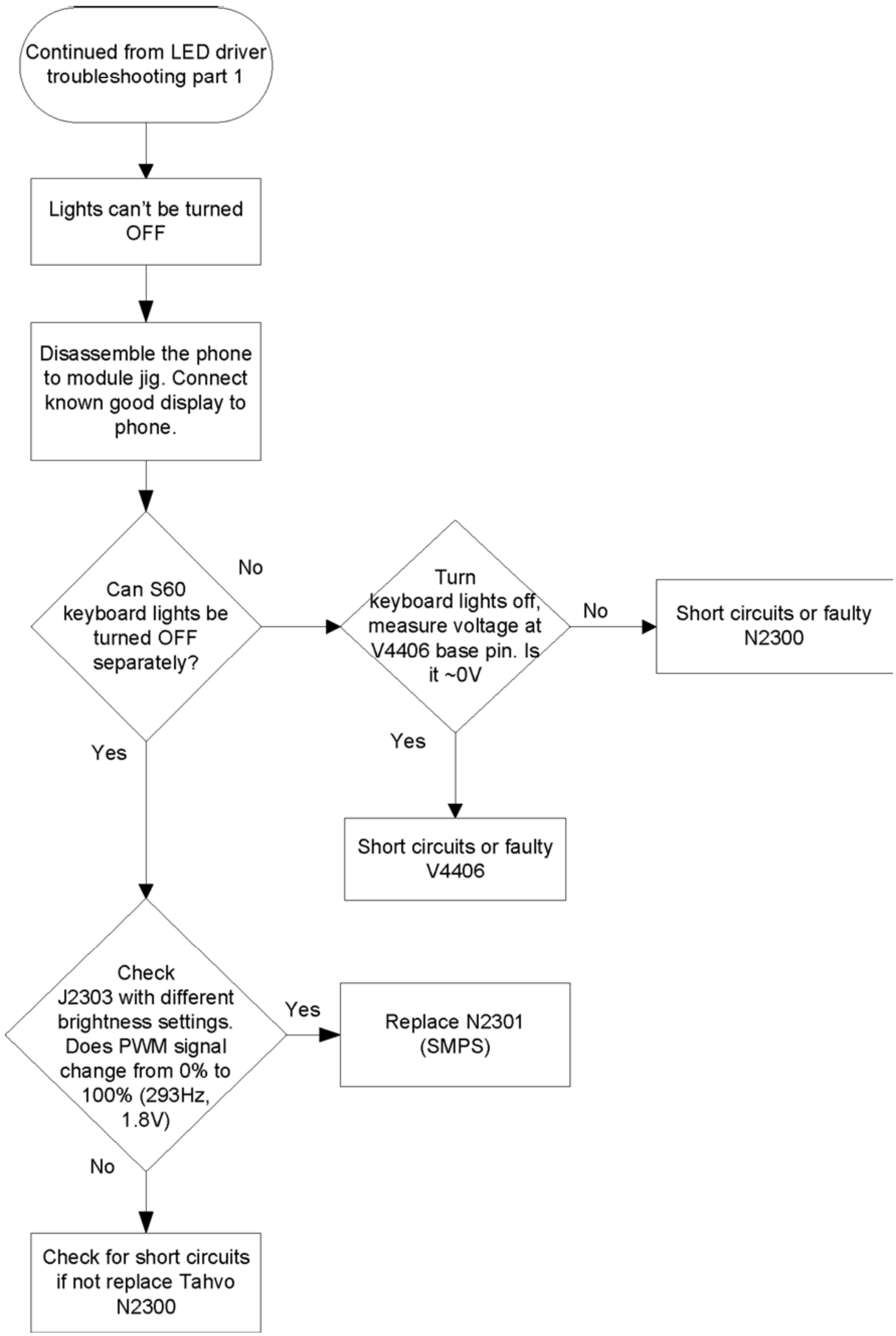



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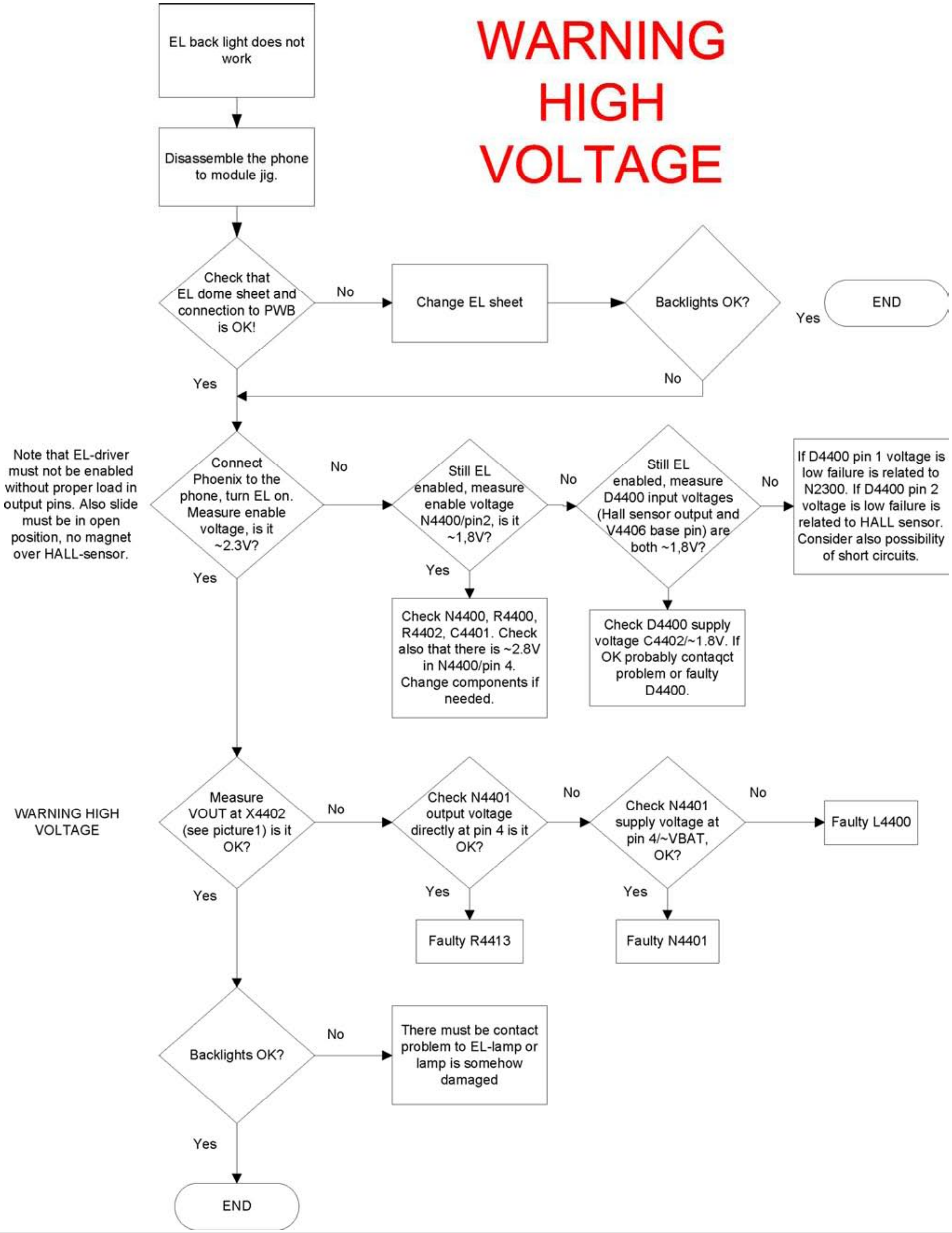
## EL backlight fault troubleshooting

### Troubleshooting flow





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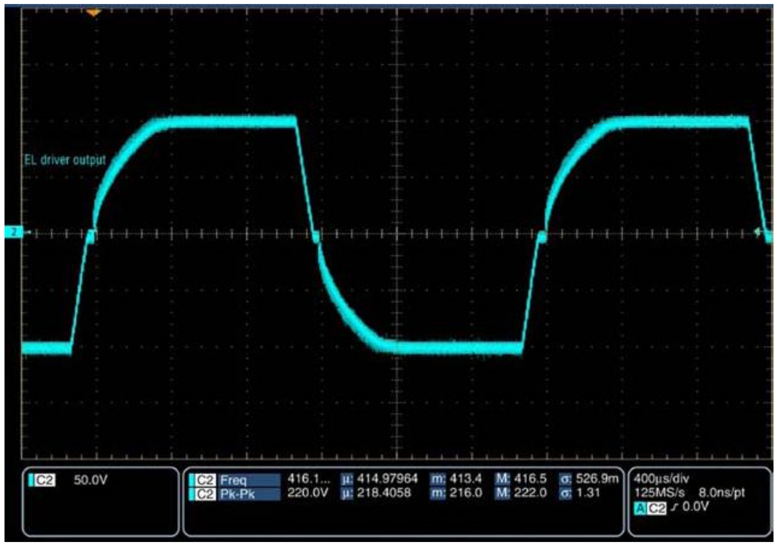


## Bluetooth troubleshooting

### 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 next page for details about BT antenna HW and Mechanics) |
| A 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.


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## Location of the Bluetooth/WLAN antenna


**Figure 34 BT/WLAN antenna location**

## Bluetooth self tests in 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. Connect the phone to a docking station in the local mode.
4. Choose **Testing**→**Self Tests** .
5. Choose the following Bluetooth related tests:
   - ST_LPRF_IF_TEST
   - ST_LPRF_AUDIO_LINES_TEST
   - ST_BT_WAKEUP_TEST
   - ST_BT _WLAN_COEXISTENCE_TEST


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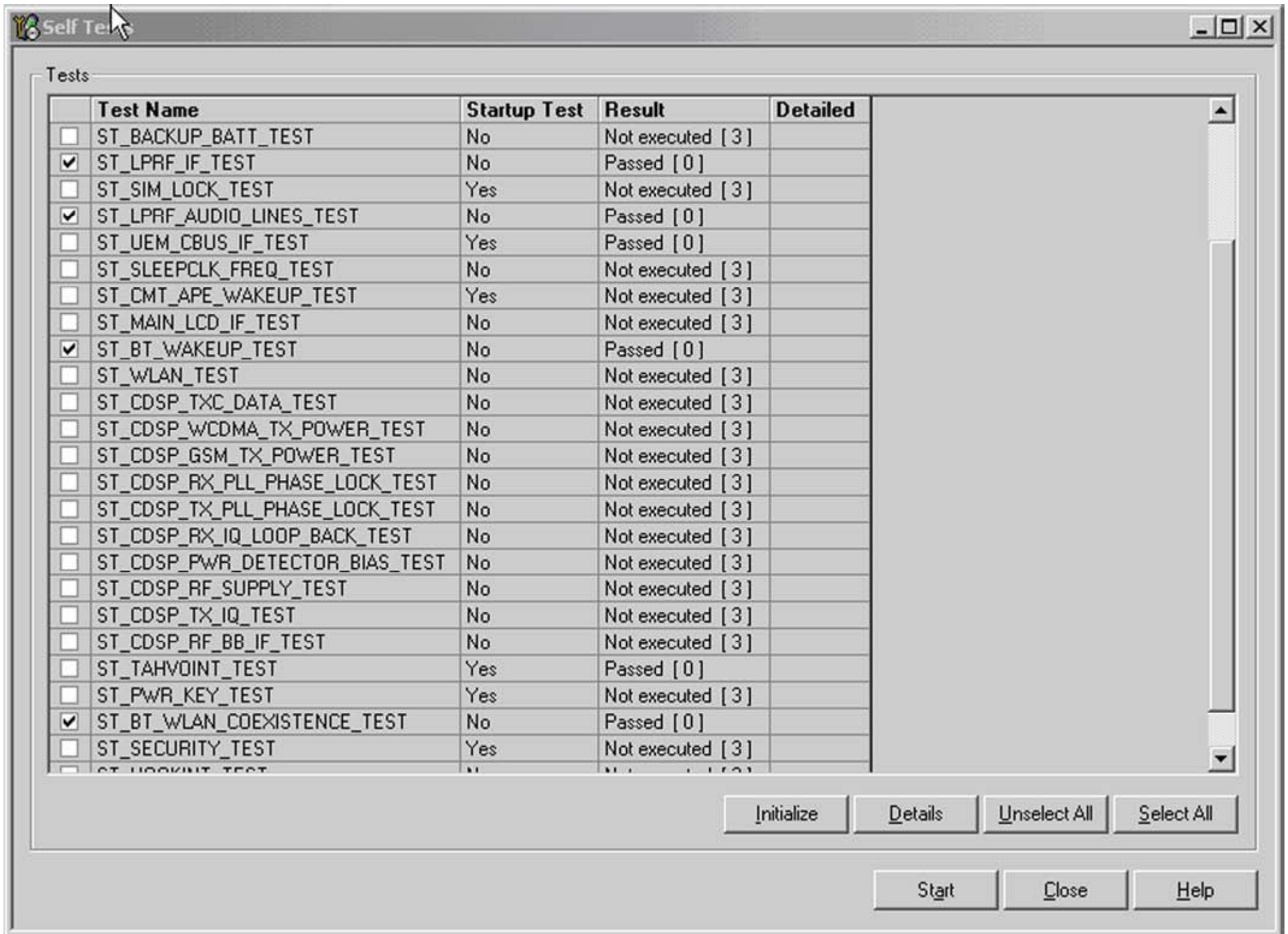


**Figure 35 Bluetooth self tests in *Phoenix***

6. To run the test, click **Start**. When the results are **Passed (0)**, the BT Self Test is accepted.

## Bluetooth BER tests in 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. Connect the phone to a docking station in the local mode.
4. Choose **Testing→Bluetooth LOCALS** .
5. Locate JBT-3's or SB-6's serial number (12 digits) found in the type label on the back of BT-box.
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-3 or SB-6 is not changed.


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7. Place the BT box near (within 10 – 15 cm) to the BT antenna.


8. To run the tests, click **Run BER Test**.

## Results

When the BER Test Result is **below 0.1%** (depending on distance), the test is passed.


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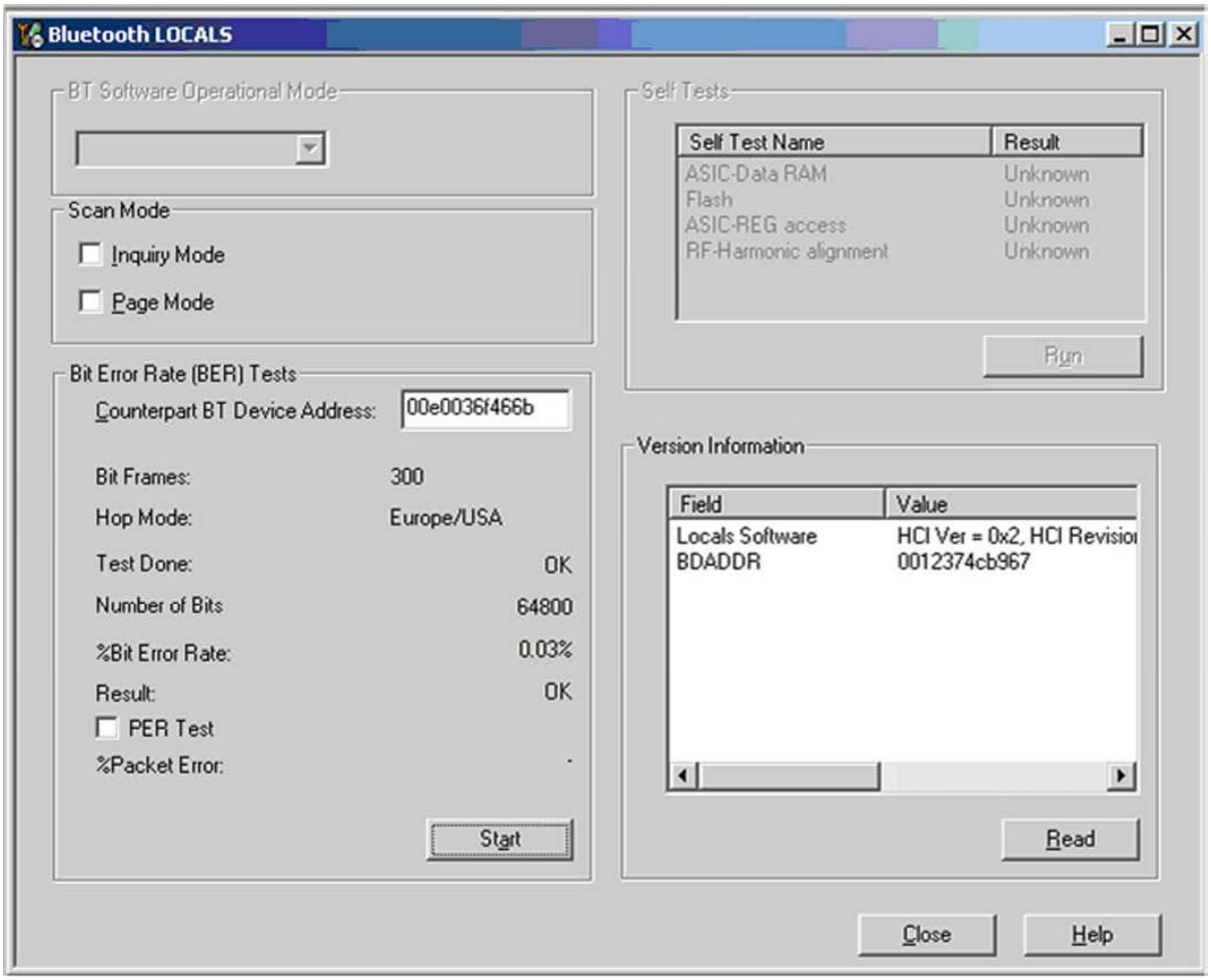


**Figure 36 Bluetooth BER test in Phoenix**


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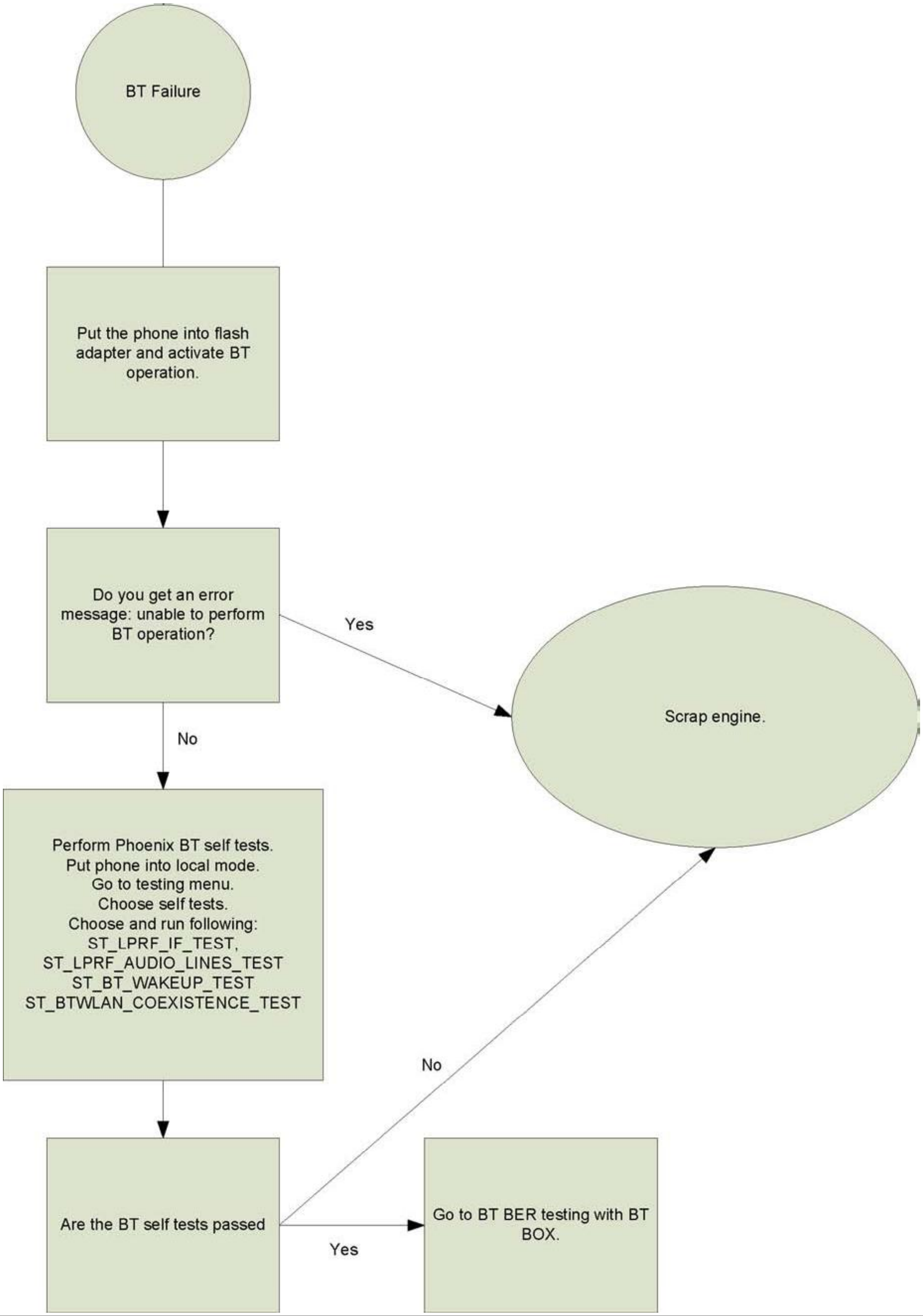
## BT failure troubleshooting

### Troubleshooting flow





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## Bluetooth BER failure troubleshooting

### Troubleshooting flow

Check that the BT/WLAN antenna is working correctly.


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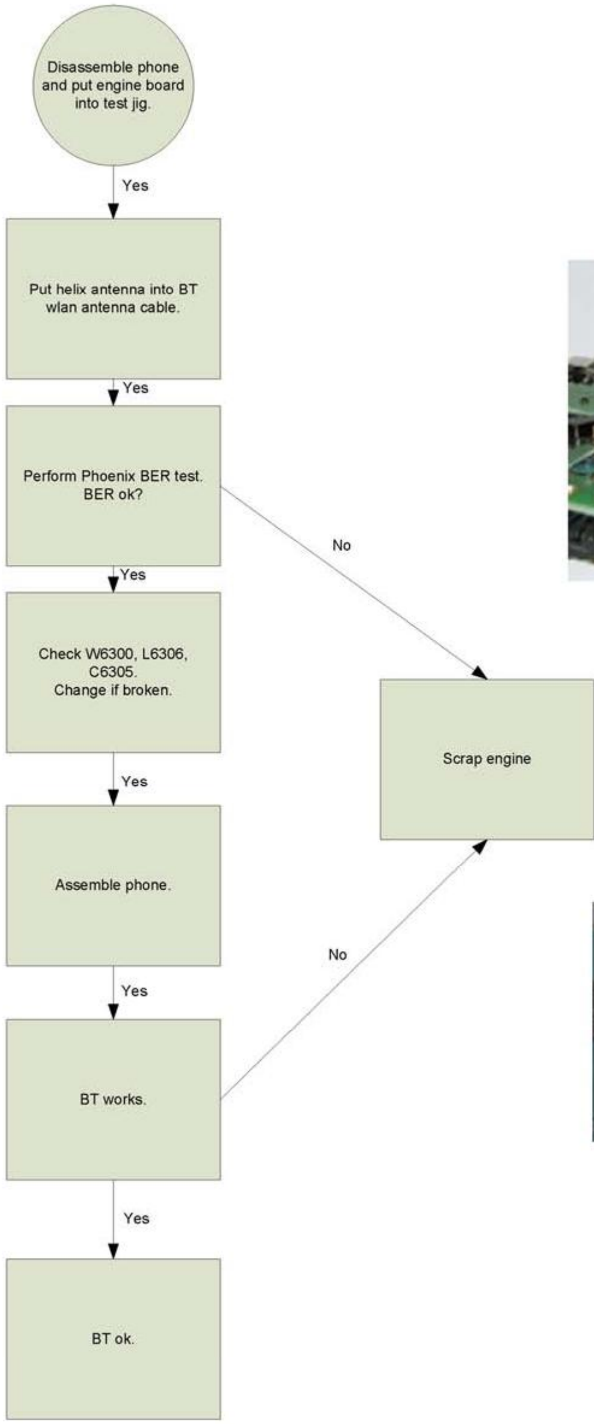


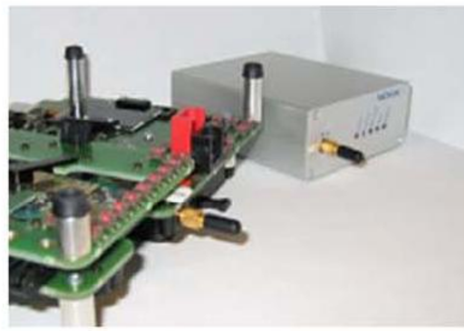


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# Audio troubleshooting

## Audio troubleshooting test instructions

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

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

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

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

### Required equipment

The following equipment is needed for the tests:

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

### Test procedure

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

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

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

### Phoenix audio loop tests and test results

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

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

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


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| Loop test | Input terminal | Output terminal | Path gain [dB] (fixed) | Input voltage [mVp-p] | Differential output voltage [mVp-p] | Output DC level [V] | Output current [mA] |
|---|---|---|---|---|---|---|---|
| External Mic to External Earpiece | XMICP and GND | HSEAR R P, HSEAR R N and GND | -2.9 | 1000 | 720 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | XMICN and GND | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |
| External Mic to Internal Earpiece | XMICP and GND | EarP and GND | -4.5 | 1000 | 600 | 1.2 | NA |
| | | EarN and GND | | | | | |
| | XMICN and GND | EarP and GND | | | | | |
| | | EarN and GND | | | | | |
| External Mic to Internal handsfree | XMICP and GND | X2100 pads | -5 | 1000 | 560 | 0 | 25mA (calc.) |
| | XMICN and GND | X2101 pads | | | | | |
| Internal Mic to External Earpiece | B2100 (OUT/GND) | HSEAR R P, HSEAR R N and GND | 22.7 | 100 | 1360 | 1.2 | NA |
| | | HSEAR P, HSEAR N and GND | | | | | |
| | | HSEAR R P, HSEAR R N and GND | | | | | |
| | | HSEAR P, HSEAR N and GND | | | | | |


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## Measurement data

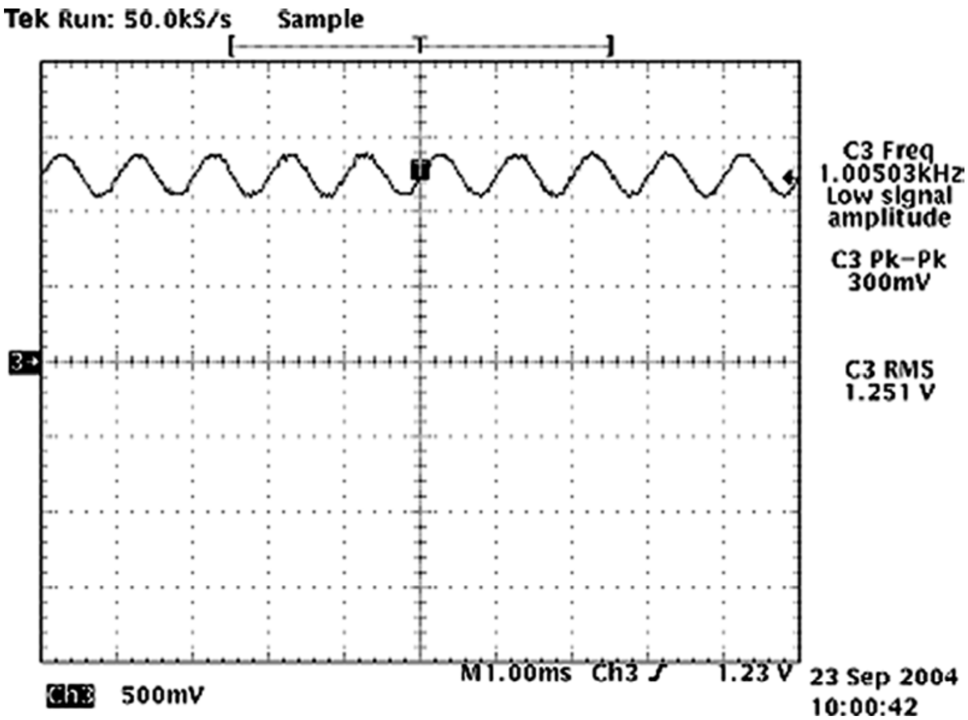
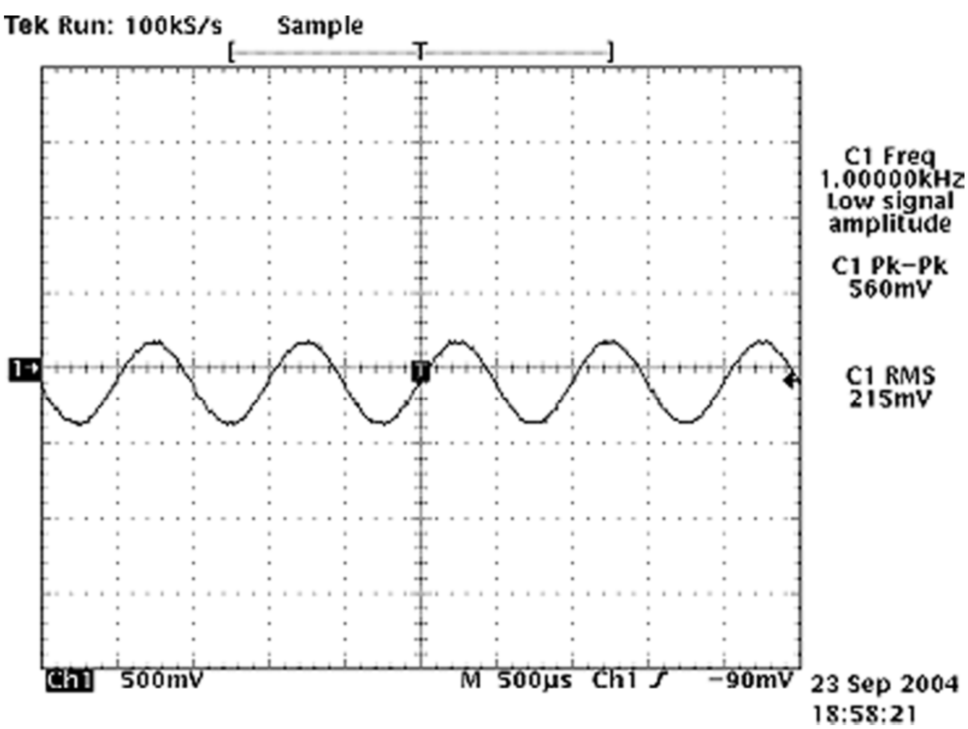



**Figure 37 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.**




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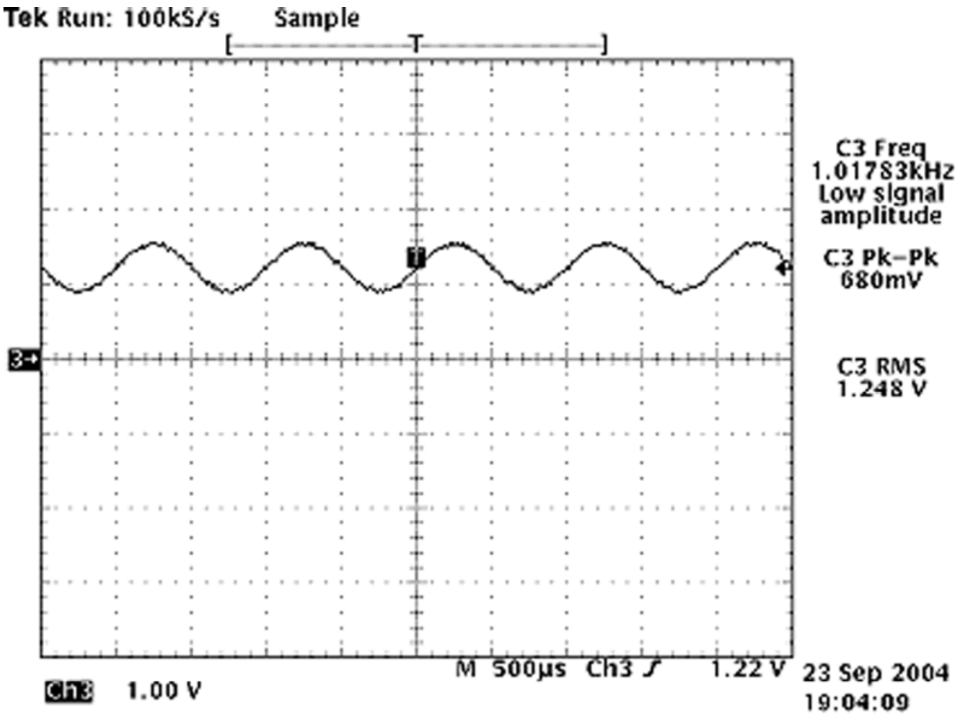


**Figure 39 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.**


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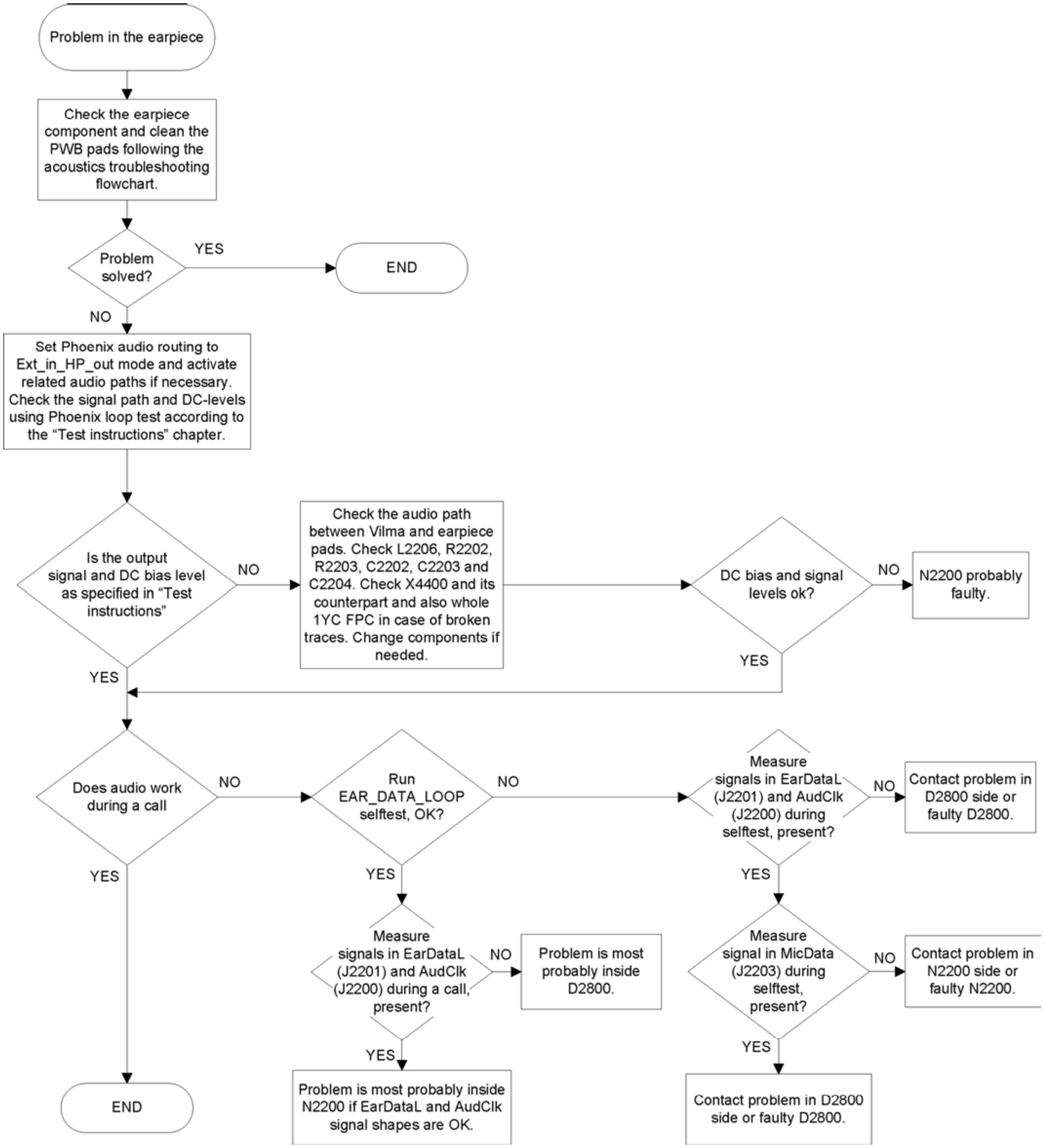
## Internal earpiece troubleshooting

### Troubleshooting flow





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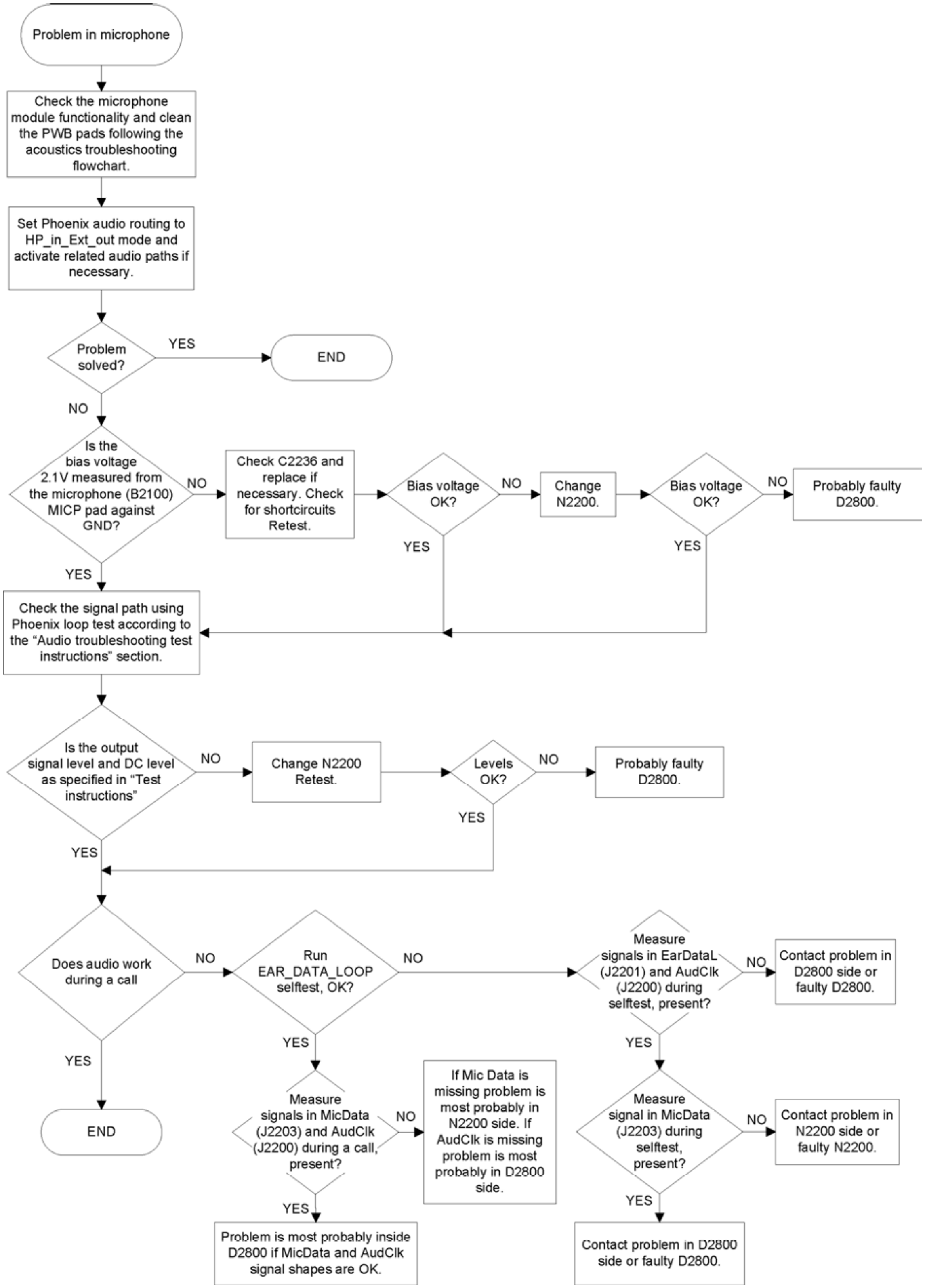
## Internal microphone troubleshooting

### Troubleshooting flow





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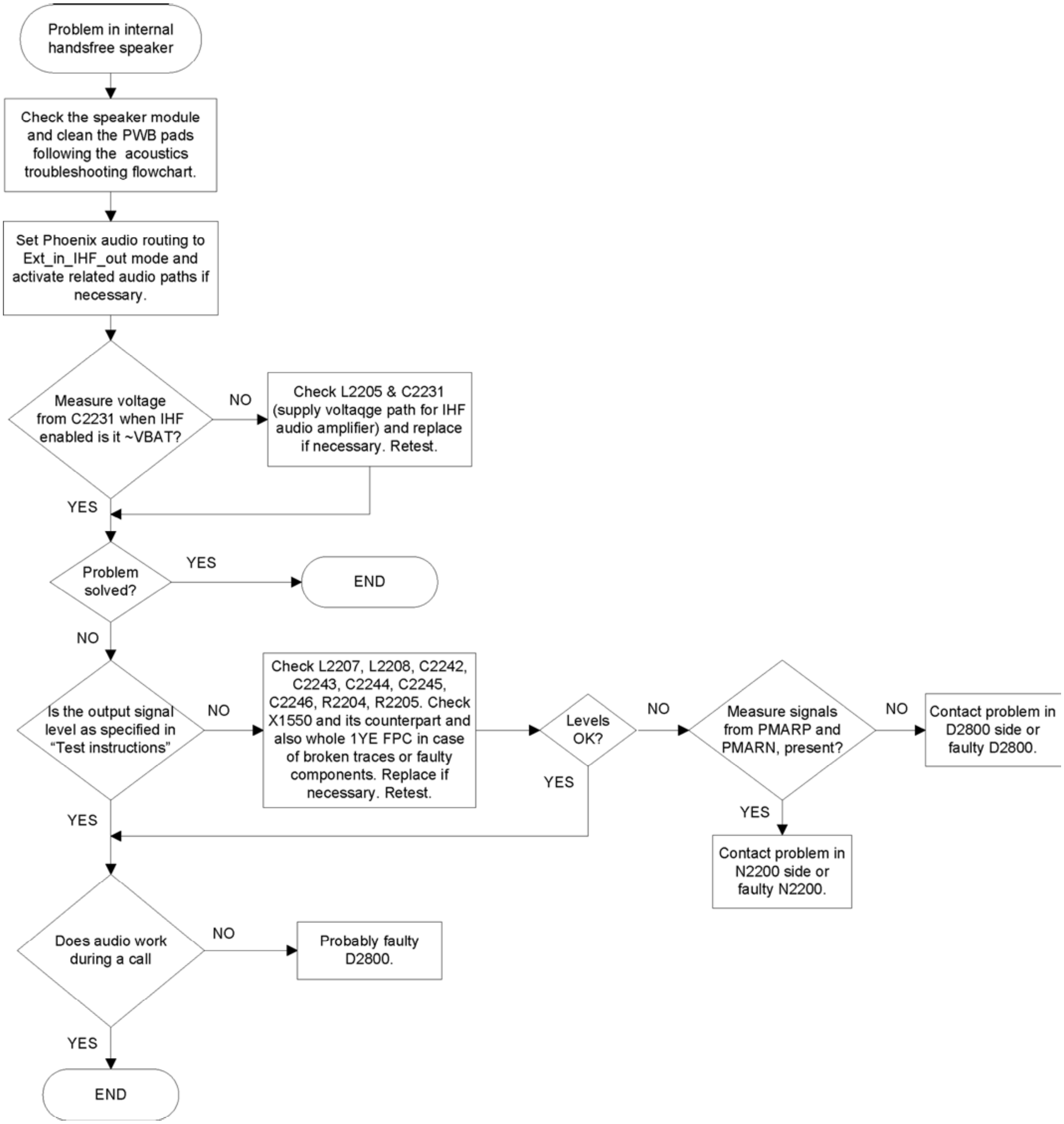
## IHF troubleshooting

### Troubleshooting flow





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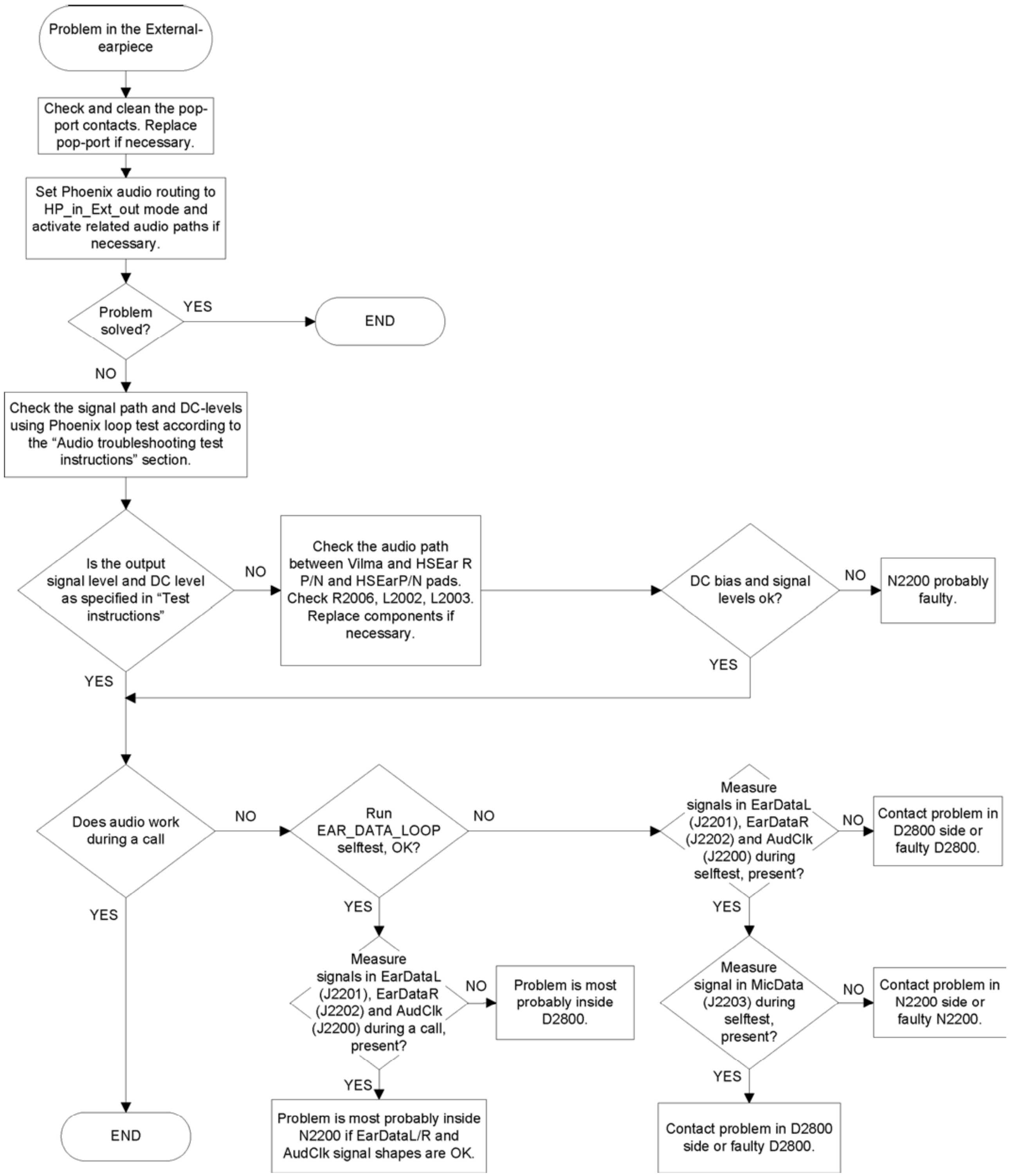
## External earpiece troubleshooting

### Troubleshooting flow





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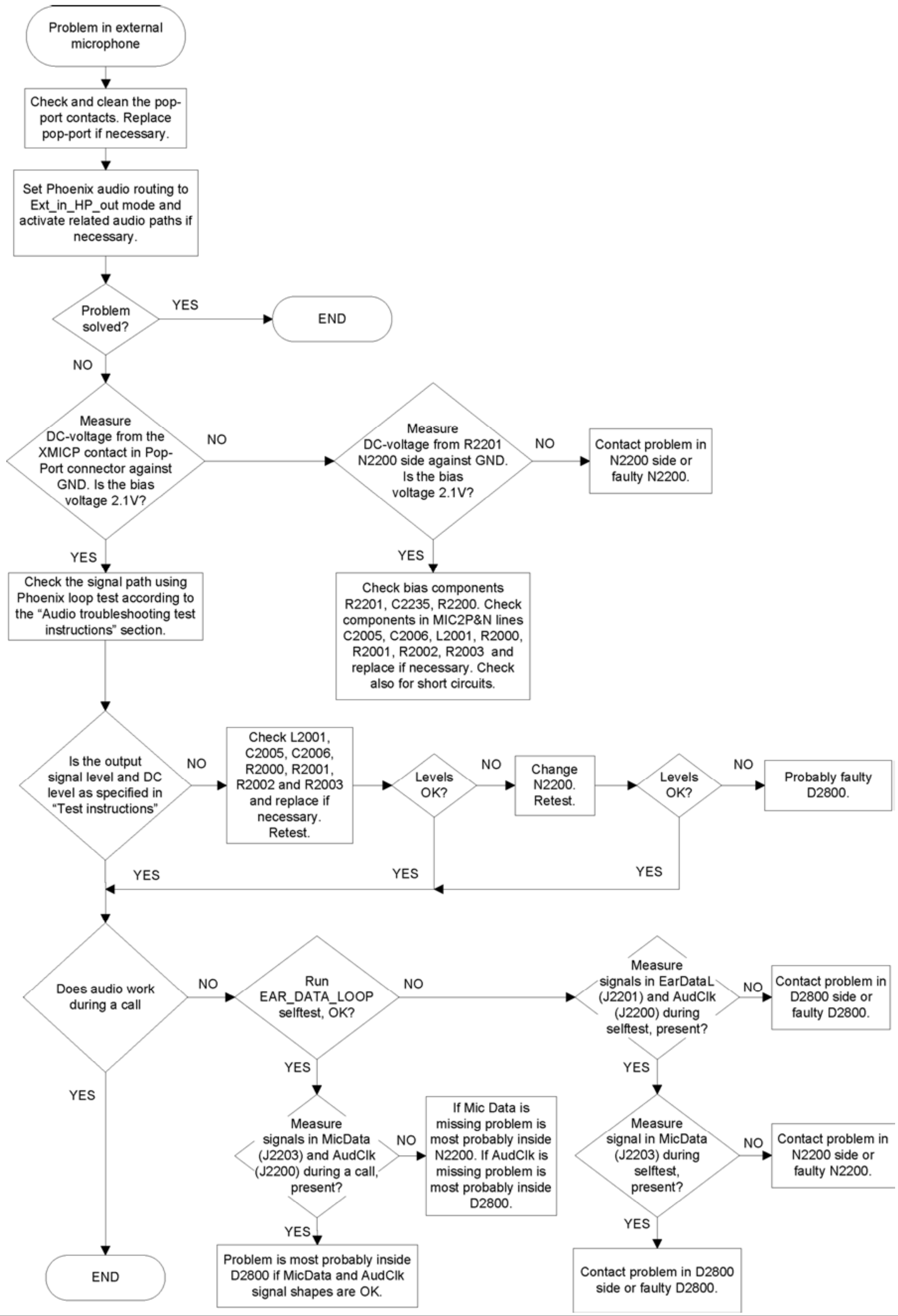
## External microphone troubleshooting

### Troubleshooting flow





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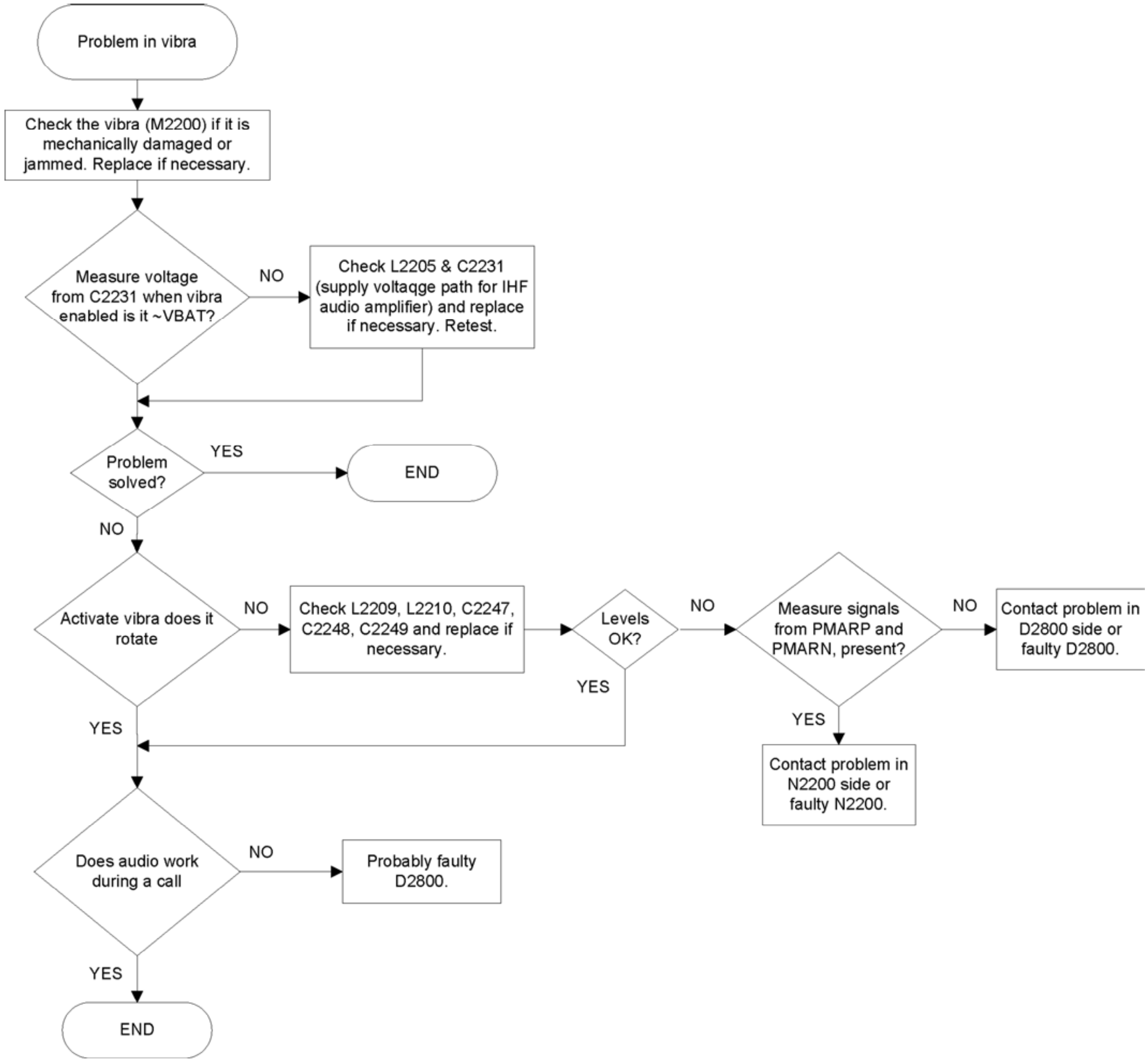
### Vibra troubleshooting

#### 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.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- 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.


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# 7 — RF Troubleshooting and Manual Tuning Guide


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## Table of Contents



**List of Tables**



**List of Figures**


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## Introduction to RF troubleshooting

Soldered metal shieldings and components below them are not allowed to be changed or removed. The purpose of the following troubleshooting document is only to identify possible RF faults and advice how to tune the phone if it is necessary.

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:** A mobile phone WCDMA transmitter should never be tested with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in wide area. WCDMA Tx measurements should be performed at least in an RF-shielded box and never with higher Tx power level than 0 dBm! Test full WCDMA Tx power only in RF-shielded environment.

Also 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 built around one RF ASIC N7505. There are also GSM TXFEM (integrated PA and front end module) N7520 and WCDMA PA N7540 on board.

The WCDMA PA needs variable supply voltage to work properly, and therefore there is a switched mode power supply component added to the PWB (N7541).

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, both PAs and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.


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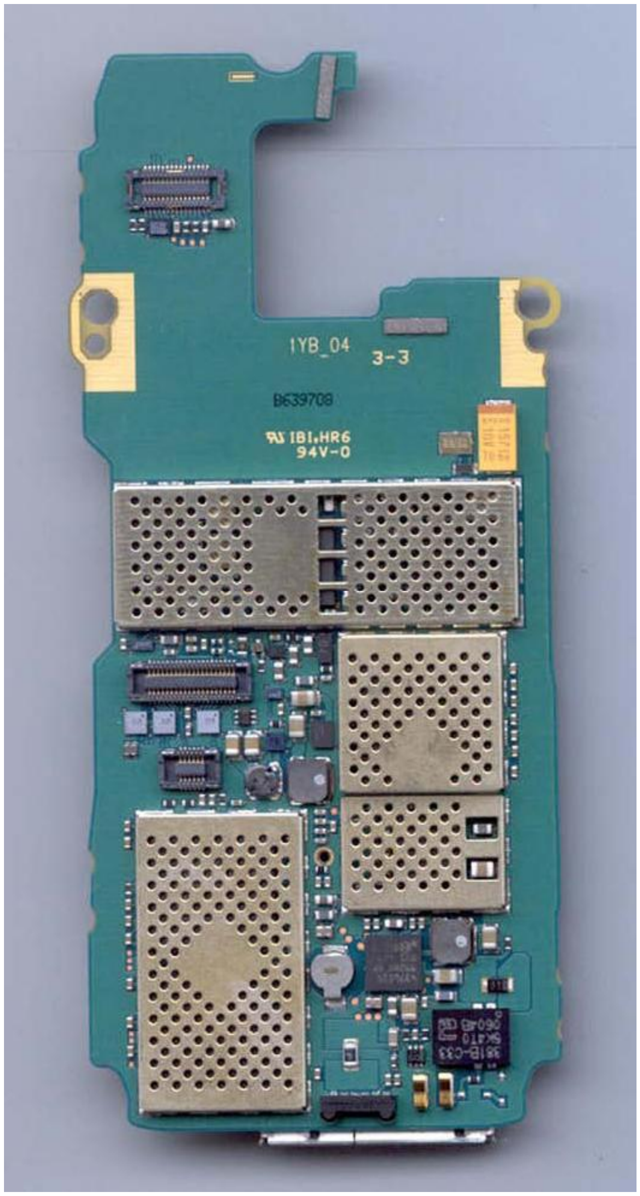
## Troubleshooting test point locations PWB top and bottom

### RM-208 PWB top





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## RM-208 PWB bottom


Table 11 GSM TXFEM / Antenna load switch CONTROL

| Vgain GMSK=0 EDGE=1 | GSM850 | | GSM900 | | GSM1800 | | GSM1900 | |
|---|---|---|---|---|---|---|---|---|
| | RX | TX | RX | TX | RX | TX | RX | TX |
| VC1_TXFEM | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| VC2_TXFEM | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| VC3_TXFEM | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| RFC4 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| RFC9 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |


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Control logic levels 0 = 0 V and 1 = 2.8 V measured with oscilloscope. Mode selections through **Testing -> GSM -> RF Controls**.

## Receiver troubleshooting

### Introduction to Rx troubleshooting

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

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

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

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

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

#### Related information

- WCDMA Rx chain activation for manual measurement (page 7–9)

### 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 –90 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.


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4. In the *RSSI Reading* window, select the appropriate band and channel.

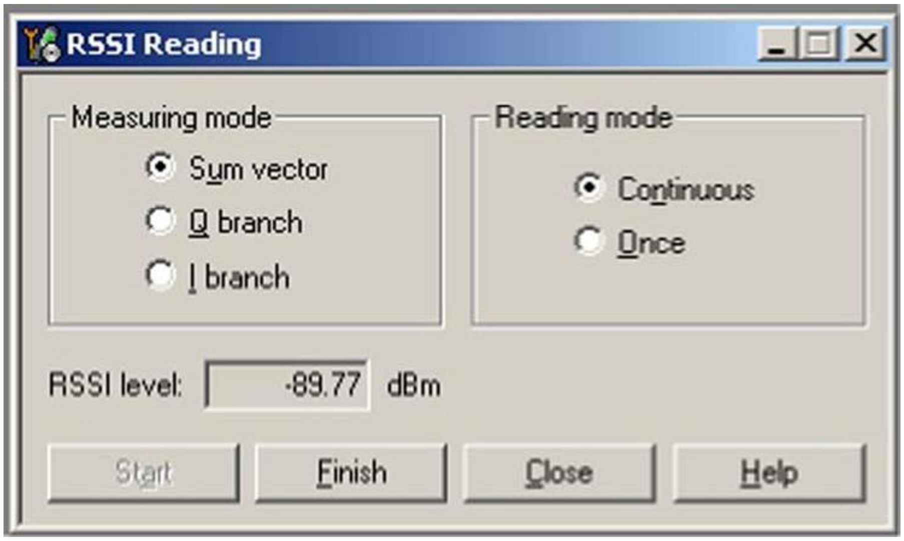


**Figure 40** ***RSSI Reading*** **window**

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 (-90 dBm).

## WCDMA Rx chain activation for manual measurement

## Steps

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


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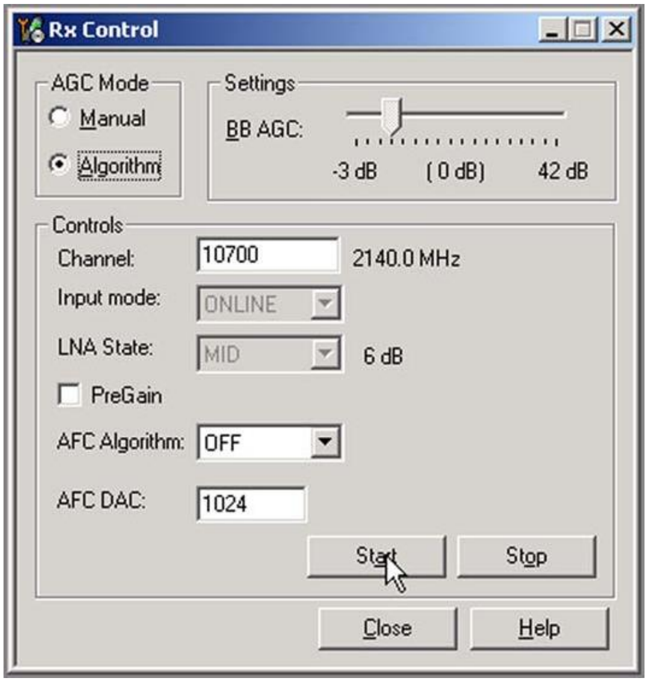


**Figure 41** ***Rx Control*** **window**

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

## Next actions

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

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

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

# WCDMA RSSI measurement

## Prerequisites

WCDMA Rx must be activated before RSSI can be measured. See WCDMA Rx chain activation for manual measurement (page 7–9).

## Steps

1. Start *Phoenix* service software.
2. Choose **Testing→WCDMA→Rx Power Measurement** .
3. Set RF signal: CW signal 1 MHz above the carrier frequency OR real WCDMA signal with -60 dBm level.
4. In the *Rx Power Measurement* window, choose the following settings:
   - Mode: RSSI
   - Continuous Mode


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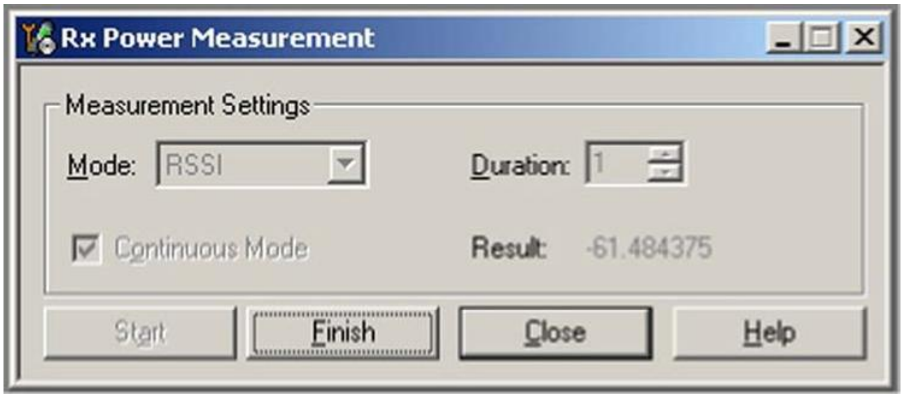


**Figure 42 RSSI reading window (WCDMA)**

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

### Results

RSSI reading value of the selected channel is displayed.

## 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"; in WCDMA transmitter testing the best tool is "Tx Control".
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

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

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software. The first section is for the GSM850/EGSM900/GSM1800/GSM1900 bands and the latter for WCDMA.

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

### Steps

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

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

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.
   >
   > Set the DC supply voltage to 12V and set the CU-4 voltage to 3.7V from Phoenix: **Tools -> CU4/ Terminal current consumption**. Move voltage bar in the window to value 3.7V.
3. Connect an RF cable between the RF connector of the product-specific module test jig and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM or WCDMA PA may be damaged.


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**Note:** There are two antenna connectors in the module jig:

- one for GSM/WCDMA
- one for Bluetooth and WLAN

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

Normally a spectrum analyser is used as measurement equipment.

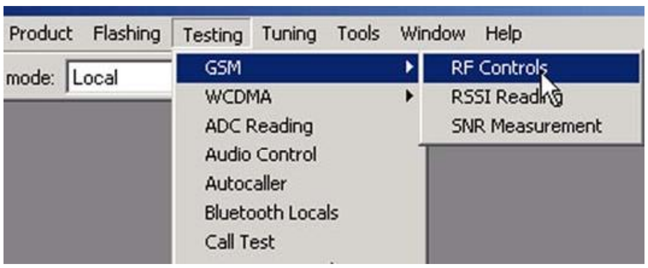
**Note:** The maximum input power of a spectrum analyser is +30 dBm.

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

4. Set Tx on.
   i Set the phone module to the test jig and start *Phoenix service software*.
   ii Initialize connection to the phone. (With FPS-10 use FBUS driver when using DAU-9S and COMBOX driver).
   iii From the File menu, choose product: **File -> Choose 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 From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .




  ii In the *RF Controls* window:
  - Select band "GSM850" or "GSM900" or "GSM1800" or "GSM1900" (Default = "GSM900").
  - Set Active unit to "Tx" (Default = "Rx").
  - Set Operation mode to "Burst" (Default = "Burst").
  - Set Tx data type to "All1" (Default = "All1").
  - Set Rx/Tx channel to 190 on GSM850 or 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
  - Set Edge to "Off" (Default).
  - Set Tx PA mode to "Free" (Default).
  - Set power level to 5 (Default = 19) on GSM850/GSM900 or to 0 (Default = 15) on GSM1800/GSM1900.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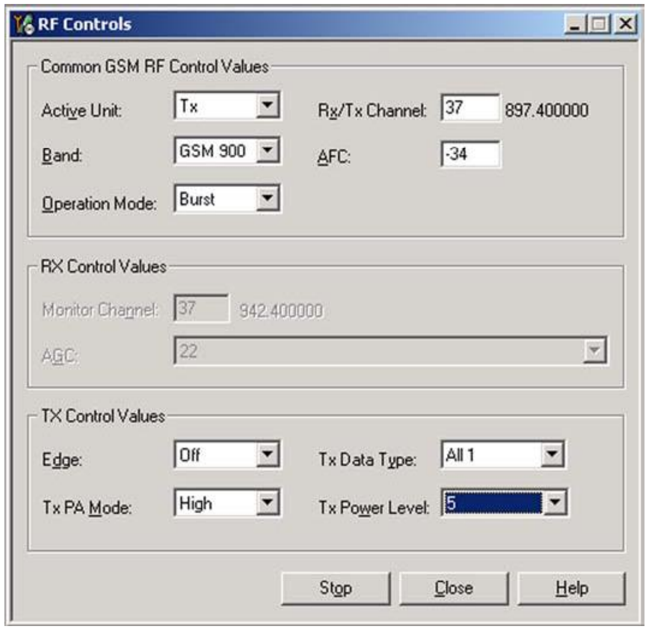



**Figure 43 RF Controls window**

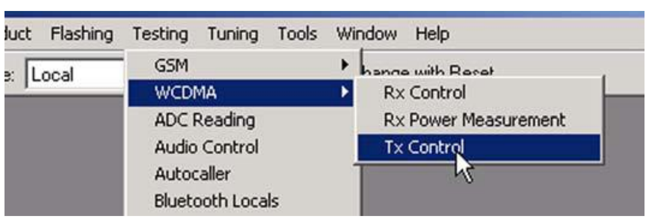
**GSM TX output power measurement**

Power meter or spectrum analyzer is used for power measurement. Spectrum analyzer settings see section “Tx power level tuning (GSM)”.

Power level value (dBm) for selected band and power level is read from the measurement equipment.

- WCDMA troubleshooting

i From the Testing menu, activate the *Tx Control* window:**Testing -> WCDMA -> Tx Control** .




ii In the *Tx Control* window:

- Select the *Algorithm mode* tab.
- Set Start level to “0” dBm (Default = “0”).
- Set Step size, Step count and Sequence to “0” (Default = “0”).
- Set Scrambling code class to “LONG” (Default = “LONG”).
- Set Scrambling code to “16” (Default = “16”).
- Set DPDCH Code number to “0”, Code class to “2” and Weight to “15” (Defaults).
- Set DPCCH Code number to “0”, Code class to "2" and Weight to “8” (Defaults).
- Set Channel to 9750.
- Check the "DPDCH enabled" checkbox (Default).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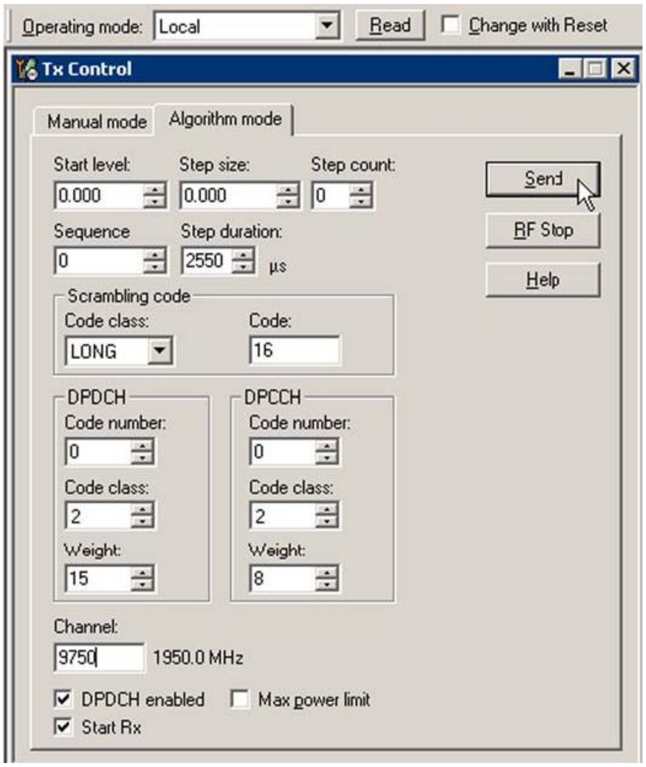


**Figure 44 Tx Control window**

## Next actions

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

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

## Checking antenna functionality

The main antenna has one antenna element: GSM and WCDMA.

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

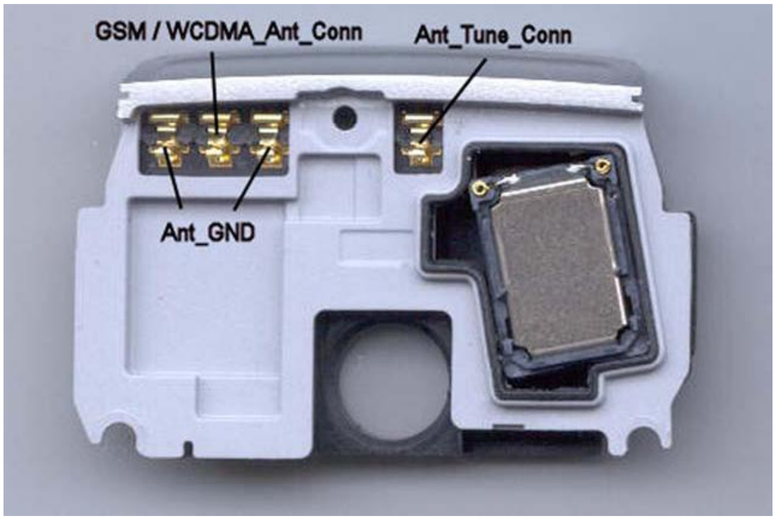


**Figure 45 RM-208 antenna**


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BT / WLAN antenna is a discrete component on the PWB.

## RF tunings

### Introduction to RF tunings

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

- FLASH memory chip is corrupted.

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

**Important:** **Always** use autotuning. Manual tunings are only required in rare cases.

### Cable and adapter losses

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

**Table 12 Attenuation values for galvanic RF connection Module Jig MJ-120**

| Band | Tuning Channel | Attenuation RX | Tolerance RX | Attenuation TX | Tolerance TX |
|---|---|---|---|---|---|
| GSM 850 | 190 | -0.1 | +/- 0.1 | -0.1 | +/- 0.1 |
| GSM 900 | 37 | -0.2 | +/- 0.1 | -0.1 | +/- 0.1 |
| GSM 1800 | 700 | -0.5 | +/- 0.1 | -0.6 | +/- 0.1 |
| GSM 1900 | 661 | -0.5 | +/- 0.1 | -0.5 | +/- 0.1 |
| WCDMA 2100 | 9750/10700 | -0.6 | +/- 0.1 | -0.5 | +/- 0.1 |

### RF autotuning

#### *RF autotuning*

### Prerequisites

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

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

The file used in autotuning must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\rfconf_xx-x*.xml** (**= indicates the type designator of the phone, e.g. RM-208*)

### Context

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

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

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

### Steps

1. Connect the communication tester to the GPIB bus.


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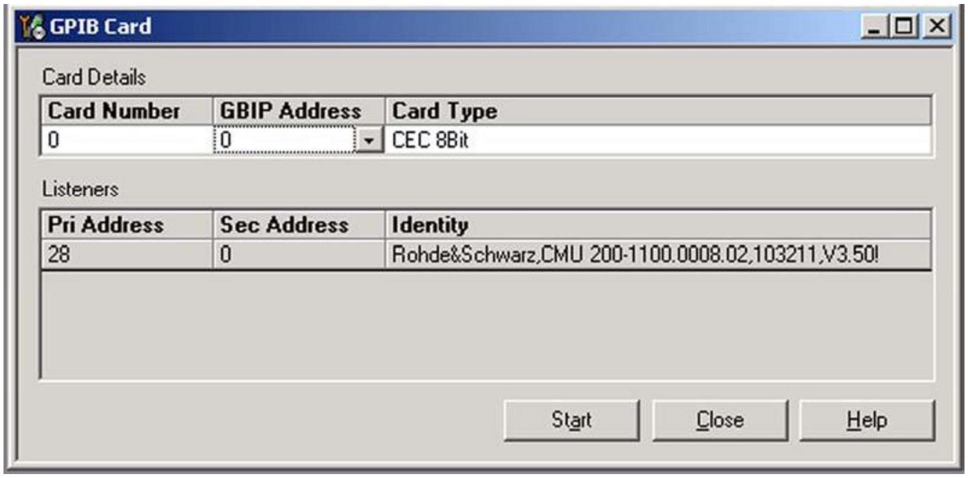
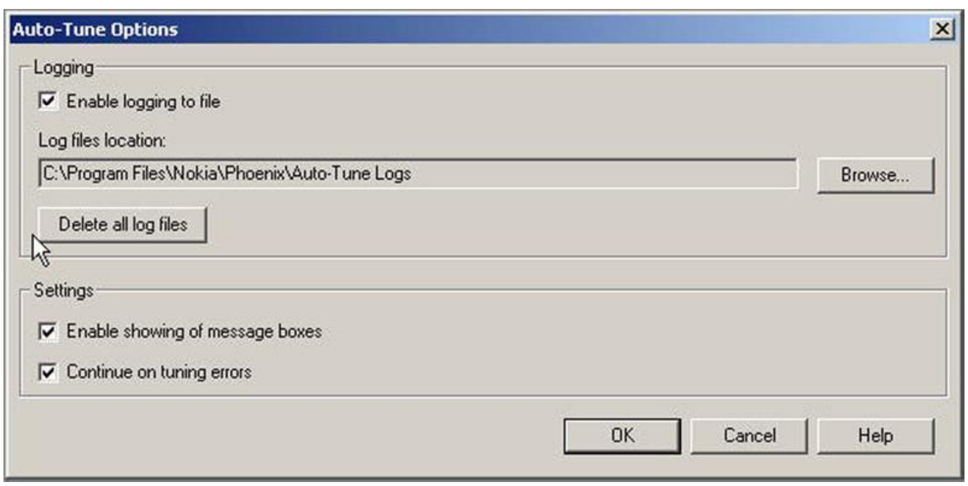
2. Start *Phoenix* service software.
3. Choose **Tools→Options→GPIB Card.**
4. From the **Card Type** drop-down menu, choose the GPIB card used, then click **Start**.

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




5. To start autotuning, choose **Auto-Tune** from the **Tuning** menu.
6. In the *Auto-Tune* window, click **Options**.
7. In the *Auto-Tune options* window, ensure the **Enable showing of message boxes** check box is checked, and click **OK**.





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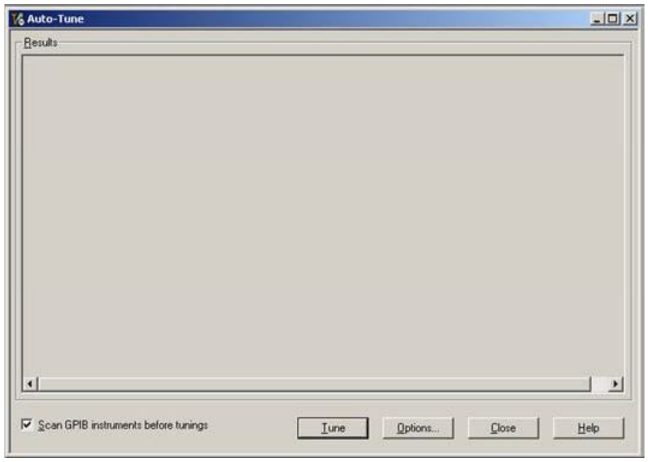
8. Connect the phone to module jig's RF port to the communication tester, and click **Tune**.




## Results

*Autotuning completed successfully!* message appears.


# RF manual tuning guide

## *Required manual tunings after component changes*

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

## *System mode independent manual tunings*

### *Rf channel filter calibration*

#### Context

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

One common calibration is made for both GSM and WCDMA.


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**Table 13 Rf channel filter calibration tuning limits**

| | Min | Typ | Max |
|---|---|---|---|
| Tx filter | 0 | 10 | 31 |
| Rx filter | 0 | 16 | 31 |
| Rx mixer | 0 | 16 | 31 |

## Steps

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

## Results

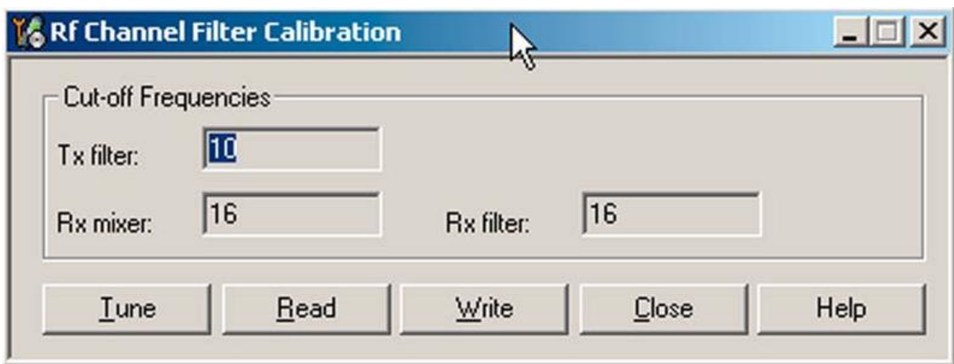


**Figure 46 Rf channel filter calibration typical values**

# *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.


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

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

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

### Steps

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

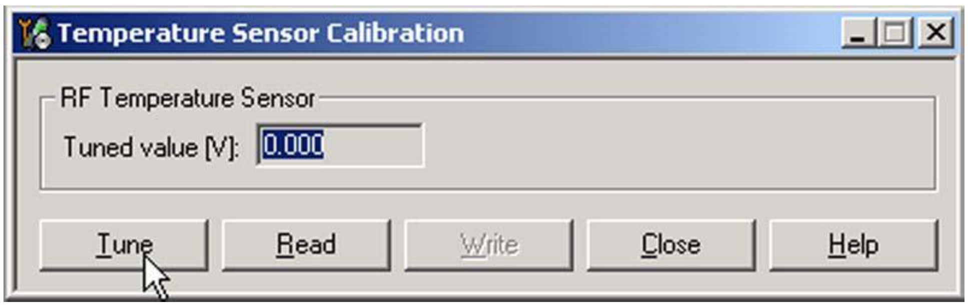



**Table 14 Temperature sensor calibration tuning limits**

| Min | Typ | Max | Unit |
|---|---|---|---|
| -0.25 | 0 | 0.25 | V |

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

## *GSM receiver tunings*

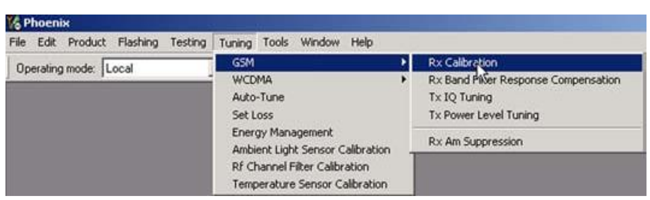
## *Rx calibration (GSM)*

### 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 module jig's GSM connector to signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".
3. From the Tuning menu, choose GSM -> Rx Calibration.





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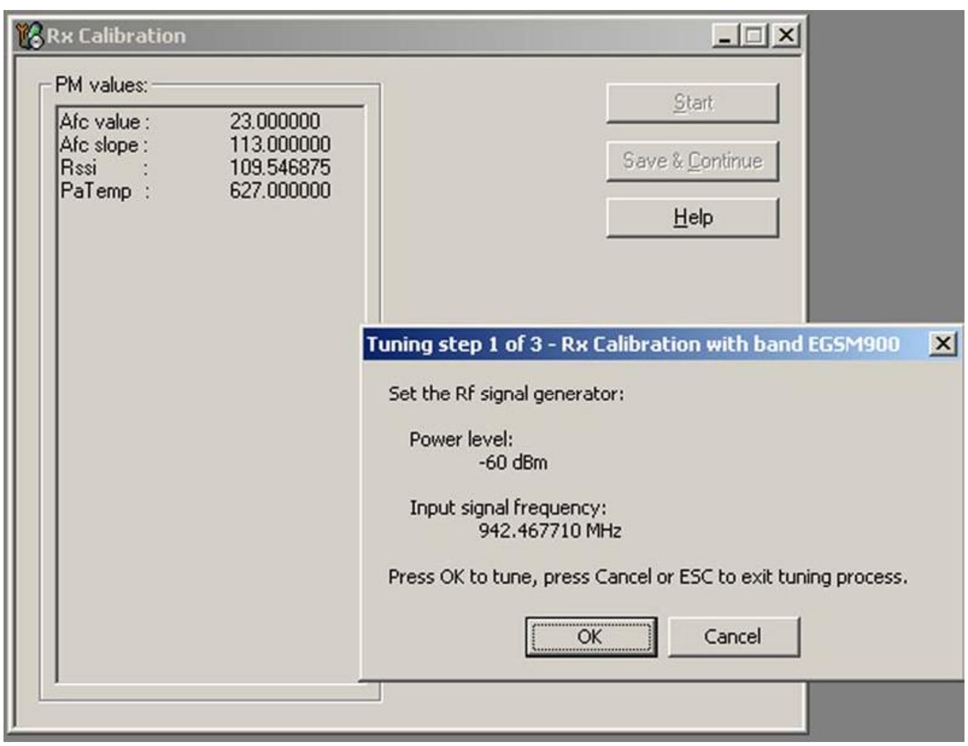
4. Click Start (if not active already).


5. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Calibration with band GSM850" popup window.

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




6. To perform tuning, click OK.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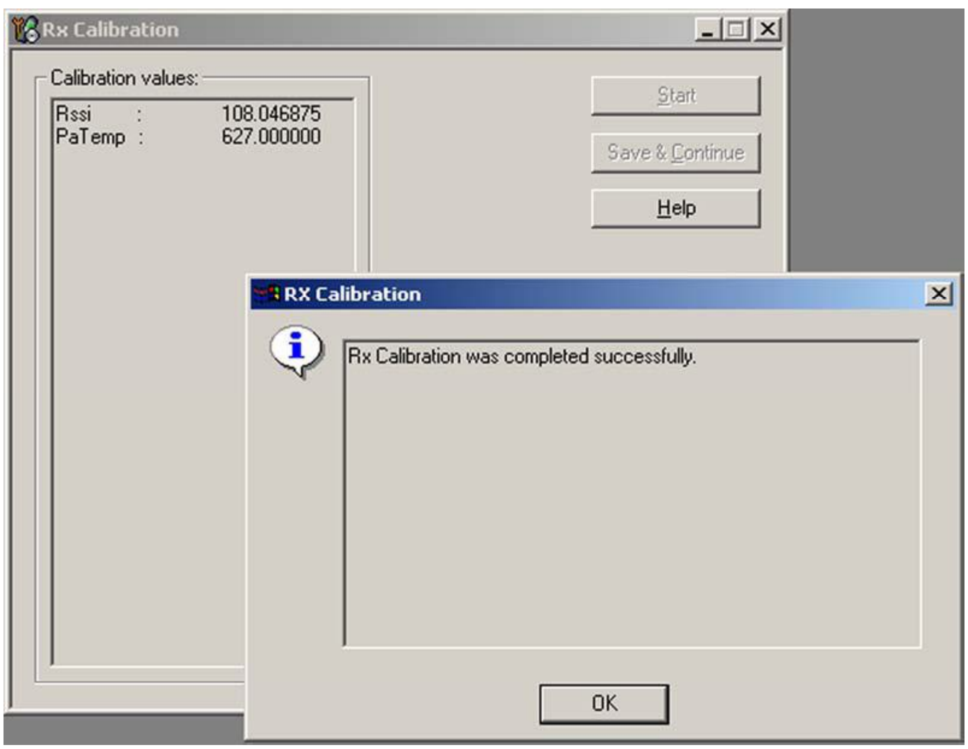
7. Check that the tuning values are within the limits specified in this table:

**Table 15 RF tuning limits in Rx calibration**

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM850/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 |

8. Go to the next band RX calibration by clicking "Next".
9. The last RX calibration is done at GSM1900 band. Click “next” after GSM1900 RX calibration and the tuning values are saved.

## Results




## *Rx band filter response compensation (GSM)*

## Prerequisites

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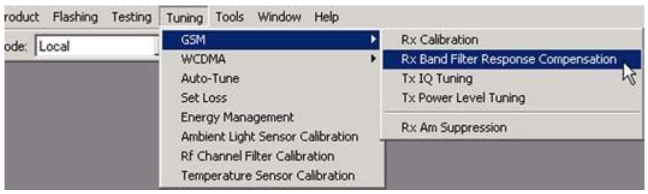
## Context

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

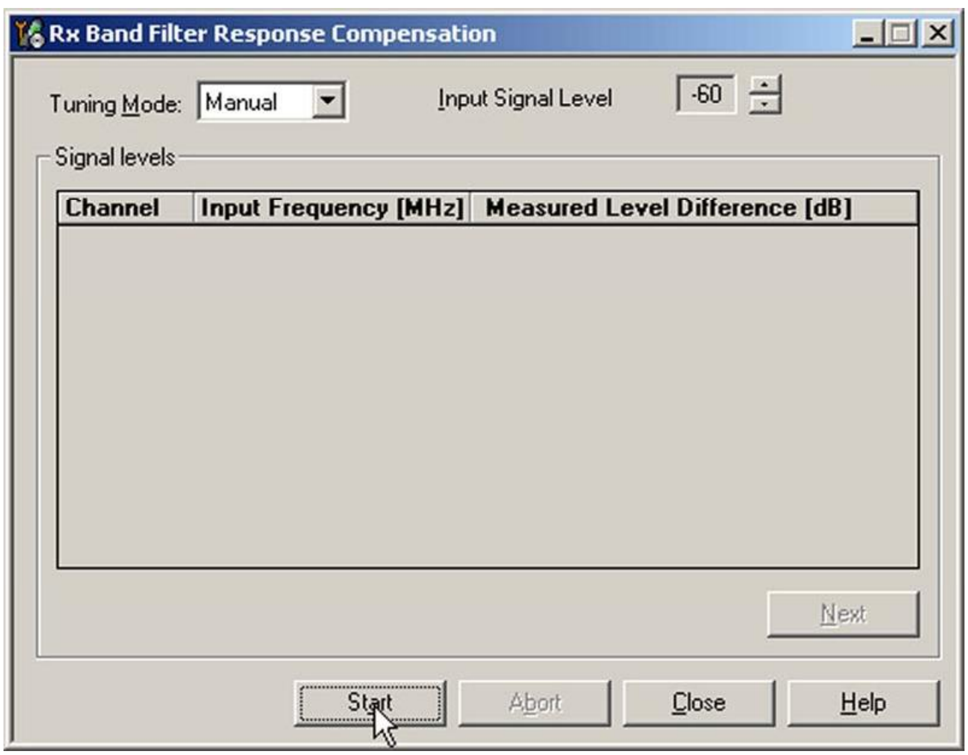
The calibration has to be repeated for each GSM band.

## Steps

1. Connect the module jig's GSM connector to the signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".
3. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.




4. In the *Tuning mode* pane, select **Manual**.
5. Click Start.





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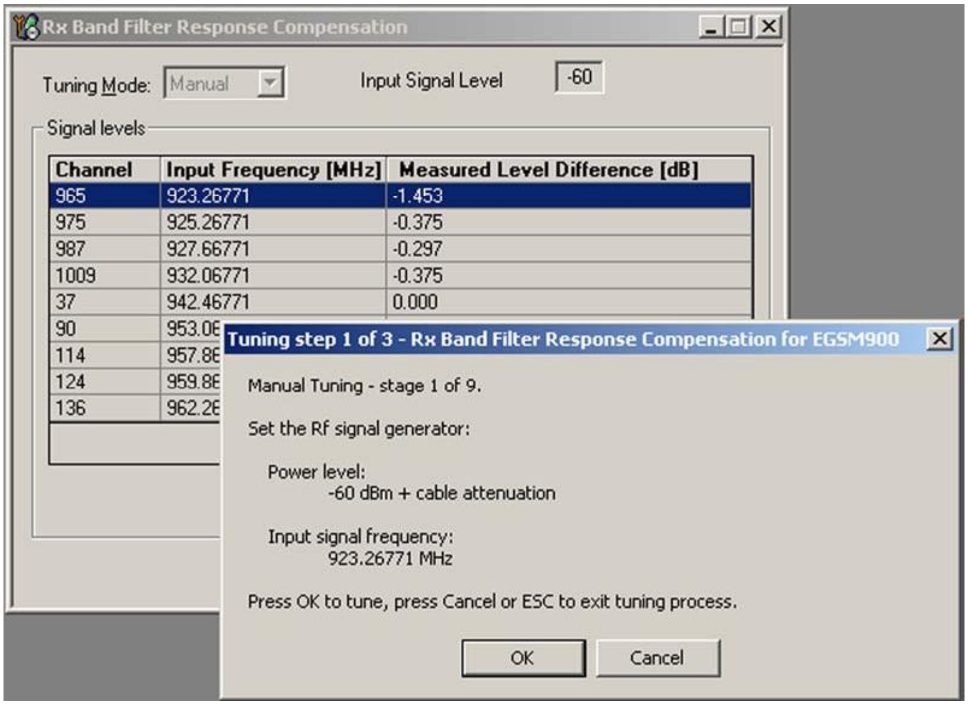
6. Connect the signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.




7. To perform tuning, click OK.
8. Go through all 9 frequencies.
9. Check that the tuning values are within the limits specified in the following table:

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM850/GSM900** | | | | |
| GSM850 | | | | |
| Ch.118 / 867.26771 MHz | -6 | -1 | 2 | dB |
| Ch.128 / 869.26771 MHz | -3 | 0 | 2 | dB |
| Ch.140 / 871.66771 MHz | -3 | 0 | 2 | dB |
| Ch.172 / 878.06771 MHz | -3 | 0 | 2 | dB |
| Ch.190 / 881.66771 MHz | -3 | 0 | 2 | dB |
| Ch.217 / 887.06771 MHz | -3 | 0 | 2 | dB |
| Ch.241 / 891.86771 MHz | -3 | 0 | 2 | dB |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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Ch.251 / 893.86771 MHz | -3 | 0 | 2 | dB |
| Ch.261 / 895.86771 MHz | -6 | -1 | 2 | dB |
| GSM900 | | | | |
| Ch. 965 / 923.26771 MHz | -6 | -1 | 2 | dB |
| Ch. 975 / 925.26771 MHz | -3 | 0 | 2 | dB |
| Ch. 987 / 927.66771 MHz | -3 | 0 | 2 | dB |
| Ch. 1009 / 932.06771 MHz | -3 | 0 | 2 | dB |
| Ch. 37 / 942.46771 MHz | -3 | 0 | 2 | dB |
| Ch. 90 / 953.06771 MHz | -3 | 0 | 2 | dB |
| Ch. 114 / 957.86771 MHz | -3 | 0 | 2 | dB |
| Ch. 124 / 959.86771 MHz | -3 | 0 | 2 | dB |
| Ch. 136 / 962.26771 MHz | -6 | -1 | 2 | dB |
| 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 |


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| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| **GSM1800** | | | | |
| Ch. 497 / 1802.26771 MHz | -6 | -1 | 3 | dB |
| Ch. 512 / 1805.26771 MHz | -3 | 0 | 3 | dB |
| Ch. 535 / 1809.86771 MHz | -3 | 0 | 3 | dB |
| Ch. 606 / 1824.06771 MHz | -3 | 0 | 3 | dB |
| Ch. 700 / 1842.86771 MHz | -3 | 0 | 3 | dB |
| Ch. 791 / 1861.06771 MHz | -3 | 0 | 3 | dB |
| Ch. 870 / 1876.86771 MHz | -3 | 0 | 3 | dB |
| Ch. 885 / 1879.86771 MHz | -3 | 0 | 3 | dB |
| Ch. 908 / 1884.46771 MHz | -6 | -1 | 3 | dB |
| **GSM1900** | | | | |
| Ch. 496 / 1927.06771 MHz | -6 | -1 | 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 | -6 | -1 | 5 | dB |

10. If the values are within the limits, click "Next".
11. GSM900 tuning is automatically started. After GSM900 tuning, GSM1800 and GSM1900 tuning is followed.


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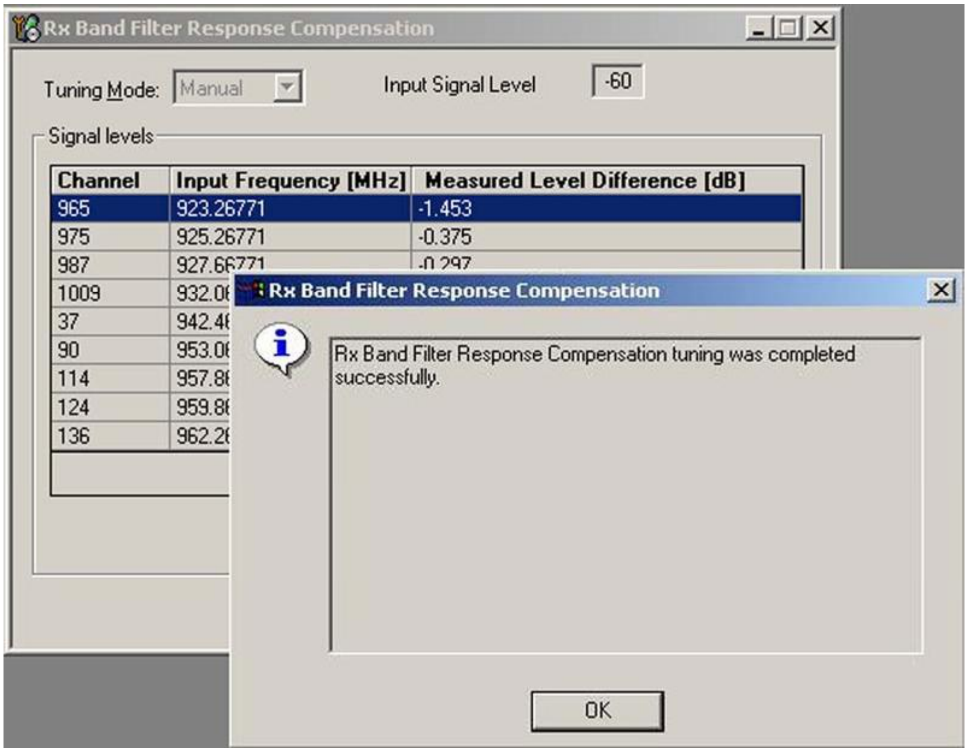
## Results




### *Rx AM suppression (GSM)*

## Context

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

AM suppression is not tunable, it is only a check. In Rx AM suppression, a continuous useful signal accompanied with an AM modulated signal 10 MHz above the current channel is fed to the antenna and RSSI value is read.

## Steps

1. Connect the module jig's GSM connector to the signal generator.
2. From the "Operating mode" dropdown menu, set mode to "Local".
3. From the Tuning menu, choose GSM -> Rx AM Suppression.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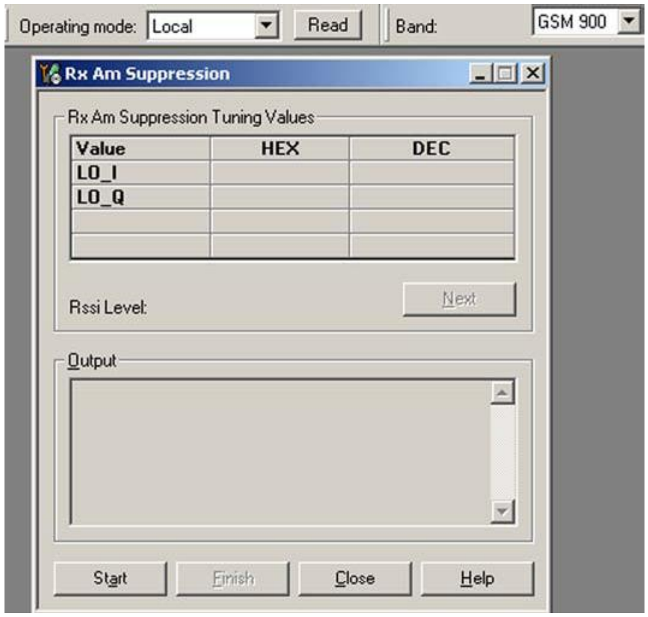
4. Click Start.




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

| | |
|---|---|
| Frequency | 891.66771 MHz / 952.46771 MHz / 1852.86771 MHz / 1970.06771 MHz (depending on the band used) |
| Power level | -29 dBm / -29 dBm / -29 dBm / -29 dBm (increase by cable and jig attenuations) |
| Modulation | AM |
| AM modulation depth | 90% |
| Modulation signal | 50 kHz sinewave (or 15 kHz if 50 kHz is not available) |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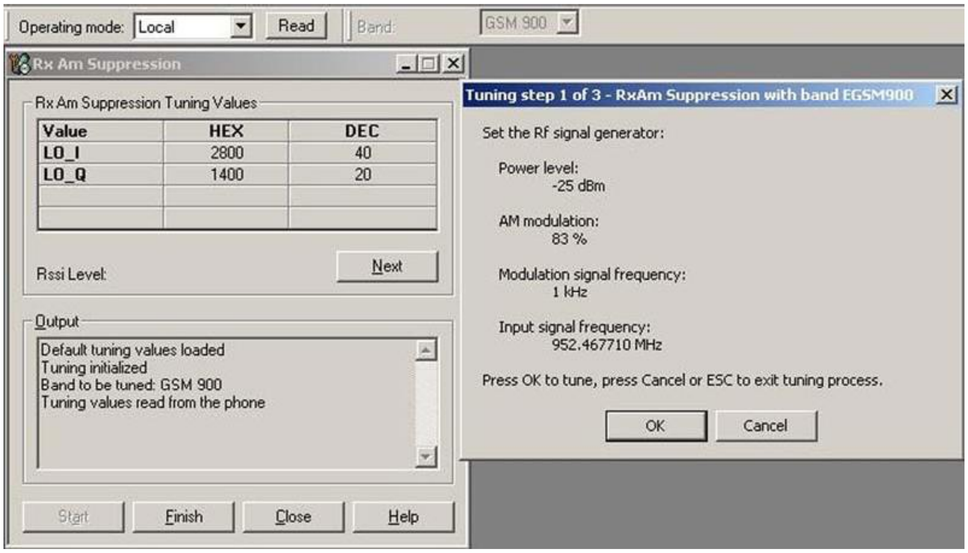
6. Click OK.




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

**Table 16 RSSI level values**

| Band | Min | Max | Unit |
|---|---|---|---|
| GSM850/GSM900 | -115 | -95 | dB |
| GSM1800 | -115 | -95 | dB |
| GSM1900 | -115 | -96 | dB |

**Note:** The limit values are to be used with a low noise signal generator. If other signal generators (for example CMU200 tester or Willtek tester) are used, the limits should be higher.

8. To proceed to the next band, click "Next".

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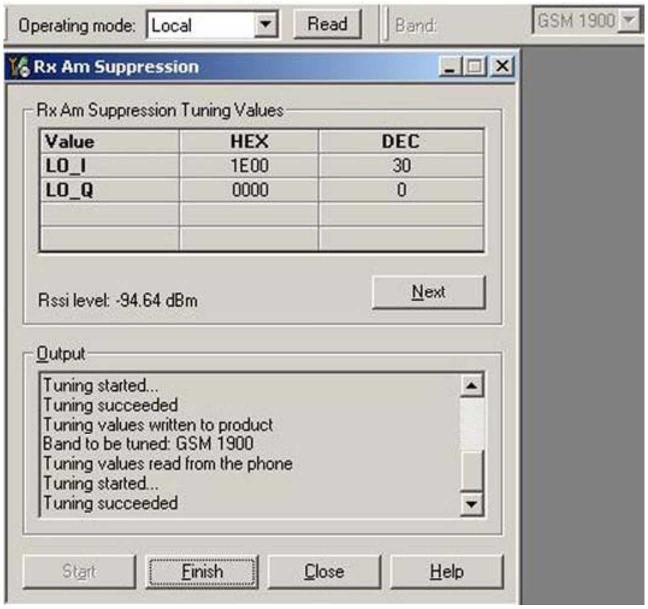
9. To end the tuning, click "Finish" and "Close".




## GSM transmitter tunings

## Tx IQ selftuning (GSM)

### Context

- The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.
- Tx IQ tuning must be performed 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 selftuning.
5. Click Start.
6. Check **tune all** checkbox and press tune button.

   Wait until the automatic tuning feature has finished. Values are written to the phone memory automatically.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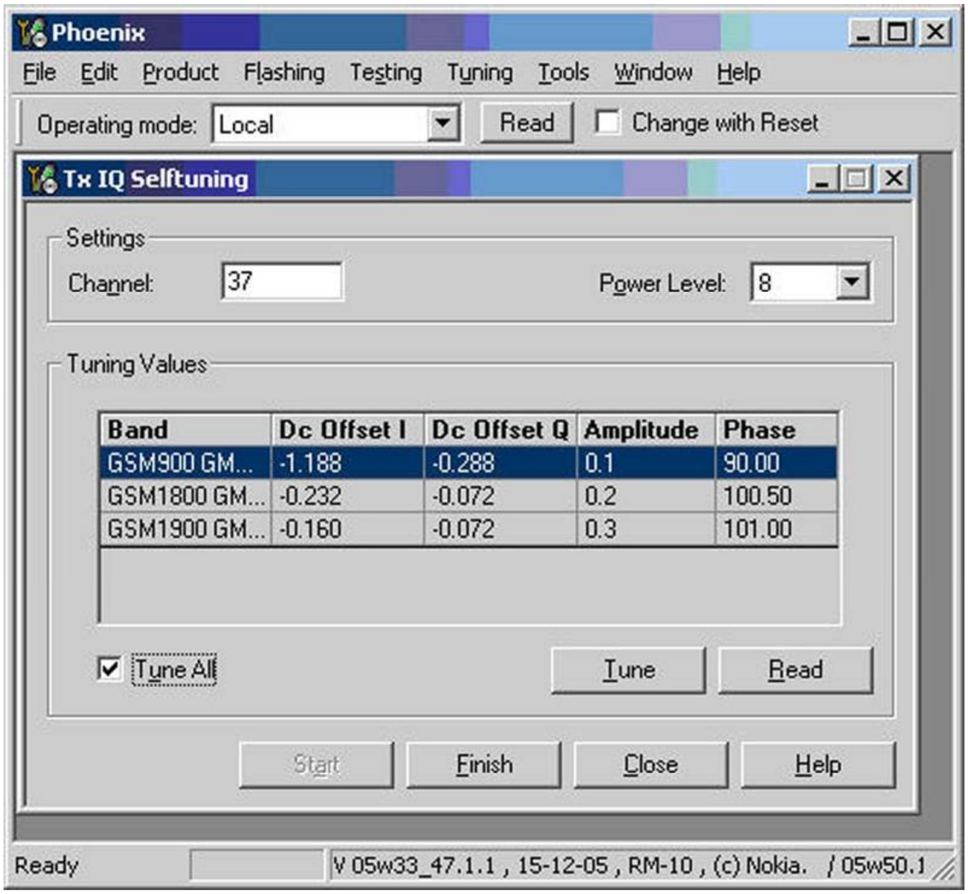



## *Tx power level tuning (GSM)*

### Context

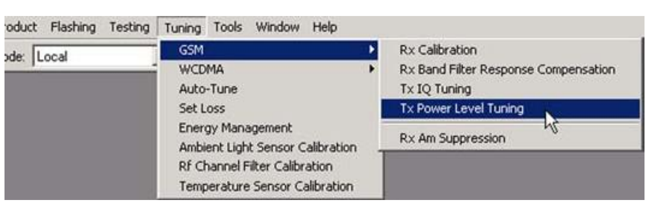
Because of variations at IC process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

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

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

### Steps

1. Connect the phone to a spectrum analyzer.
2. Start Phoenix service software.
3. From the "Operating mode" dropdown menu, set mode to "Local".
4. From the Tuning menu, choose GSM -> Tx Power Level Tuning.





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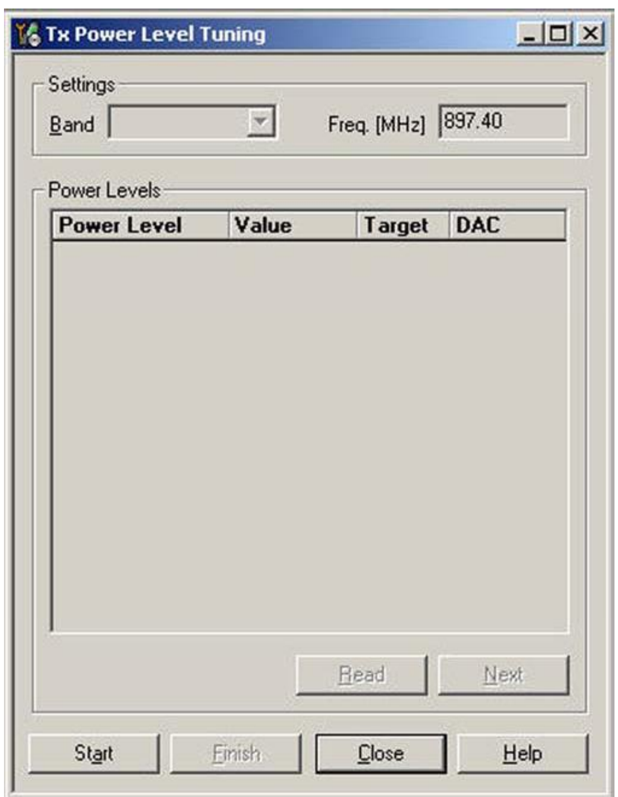
5. Set the spectrum analyzer for power level tuning:

**Table 17**

| | |
|---|---|
| Frequency | Channel frequency (836.6MHz GSM850, 897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900) |
| Span | 200 kHz |
| Sweep time | 3 s |
| Trigger | Video triggering: Free run |
| Resolution BW | 1 MHz (min. 600 kHz) |
| Video BW | 3 kHz |
| Reference level offset | Sum cable attenuation with module jig attenuation |
| Reference level | 35 dBm |
| Detector | Max Peak |

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

6. Click Start.





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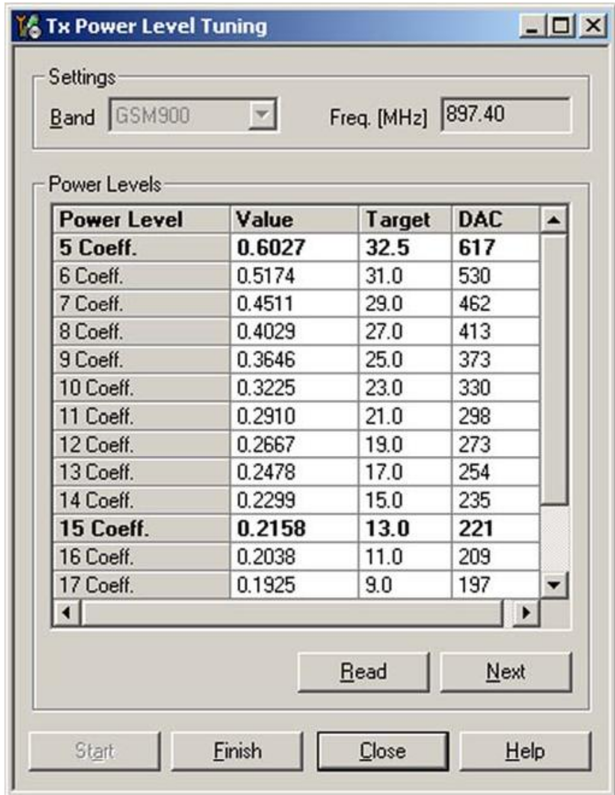
7. Adjust power levels **5, 15** and **19** to correspond the "Target dBm" column by pressing + or – keys.




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

| | Min | Typ | Max |
|---|---|---|---|
| **GSM850/GSM900 EDGE off** | | | |
| PL5 coefficient | 0.45 | 0.626 | 0.73 |
| PL15 coefficient | | 0.234 | |
| PL19 coefficient | 0.12 | 0.195 | 0.3 |
| **GSM850/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 | |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| | 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, If the values are within the limits, proceed to EDGE tuning by clicking **Next**.
9. Change video averaging to 50 in EDGE tuning if possible (remember to use spectrum analyzer's PEAK detector; some spectrum analyzer cannot use averaging when using PEAK detector).
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. Proceed to the next band by pressing **Next**.
12. When the tuning is completed, close the Tx Power Level Tuning window.

## *WCDMA receiver tunings*

## *RX calibration (WCDMA)*

### Context

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

### Steps

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


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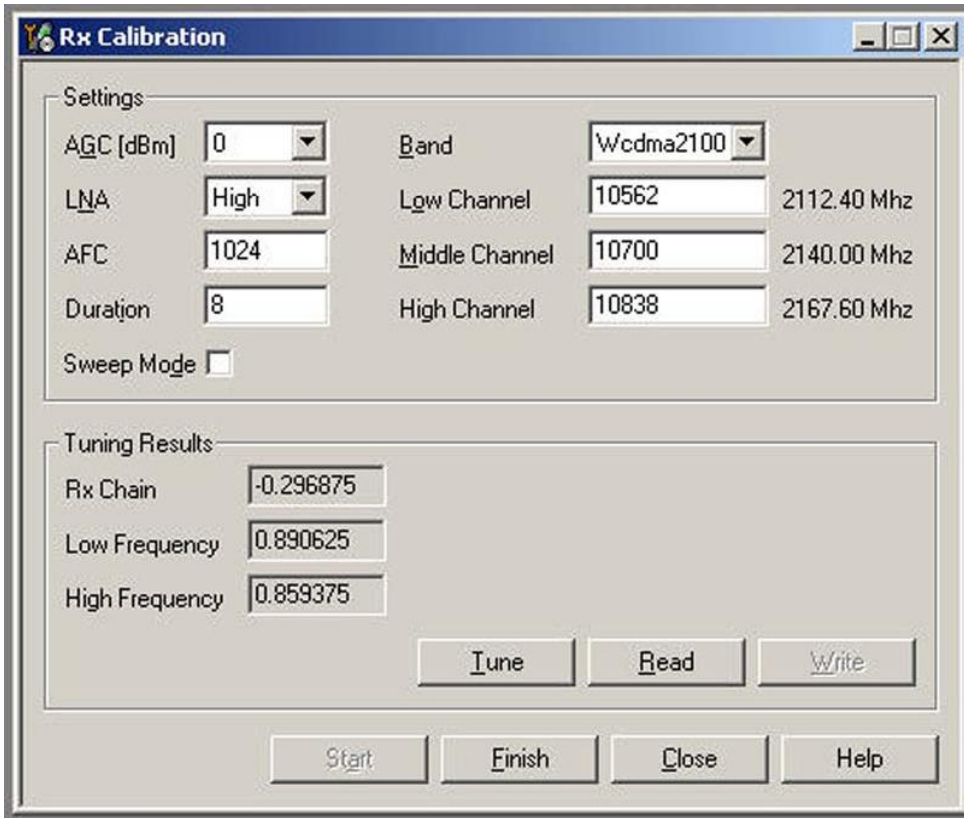
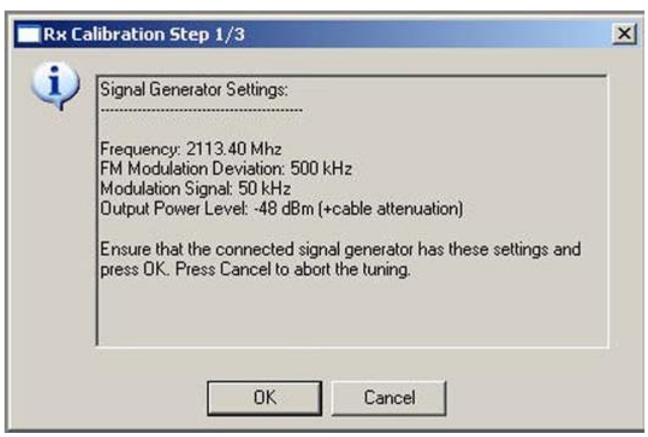
4. Click **Start** and **Tune**.




5. Setup the signal generator to correspond the values in the *RX Calibration* pop-up window and click **OK**. RX Calibration includes 3 steps calibration with 3 frequencies. Click “OK” after each step.





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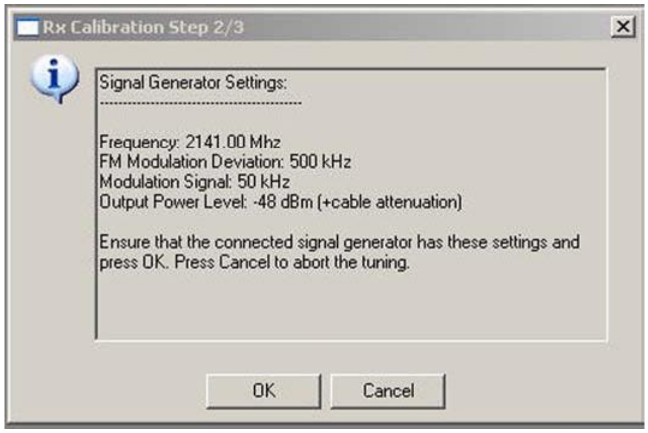


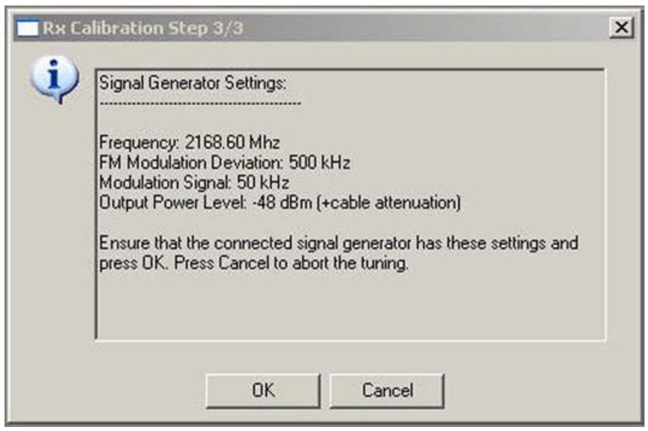


6. Check that the *Rx chain* value in *Tuning Results* is within the limits presented in the following table.

| | Min | Typ | Max | Unit |
|---|---|---|---|---|
| RX chain | -6 | -2... 2 | 6 | dB |
| Low freq | -3 | -1... 2 | 3 | |
| High freq | -3 | -1... 2 | 3 | |

i If the RX calibration values are within the limits, click **Write** and **Finish** to save the results to the phone.

7. To close the *Rx AGC Alignment* window, click **Close**.

## *WCDMA transmitter tunings*

## *Tx AGC & power detector (WCDMA)*

### Context

Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

### Steps

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


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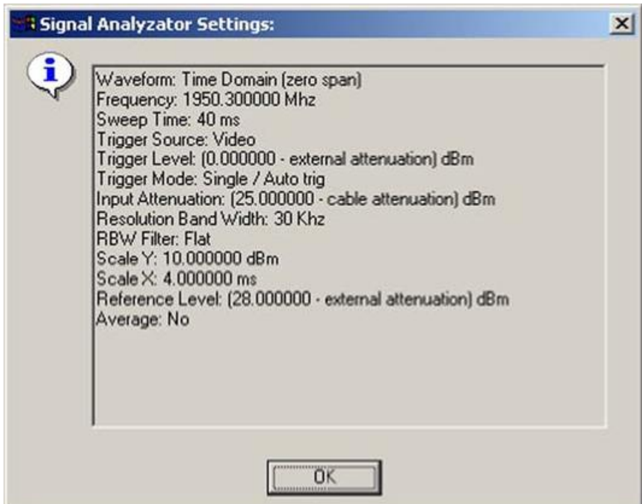
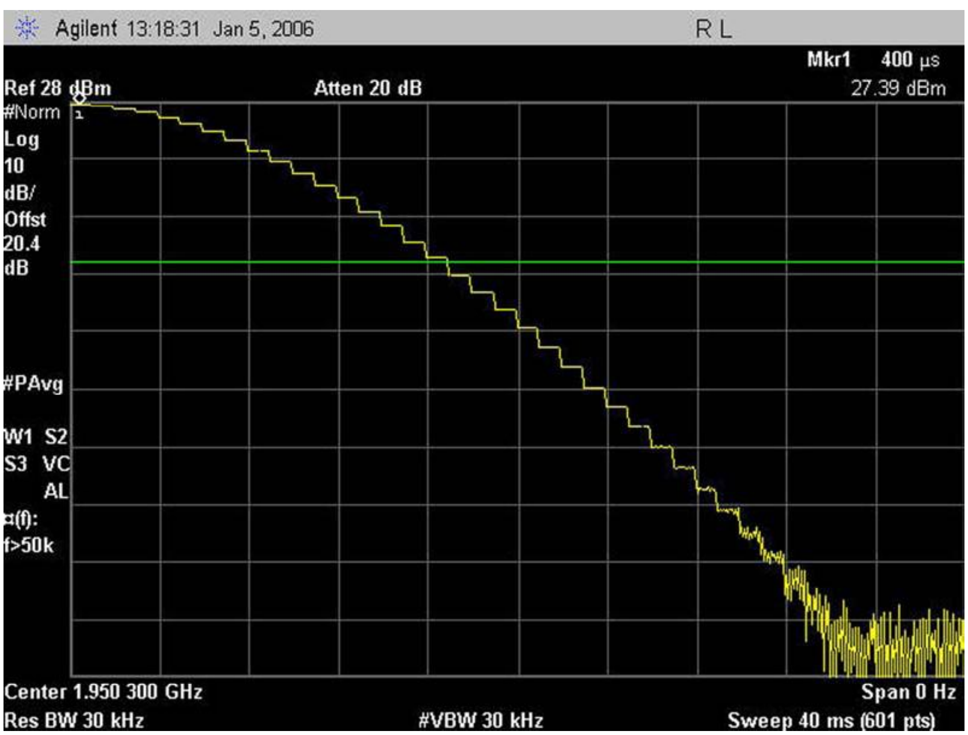
2. Choose **Tuning→WCDMA→TX AGC And Power Detector Tuning.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:




6. After setting the spectrum analyzer, click **OK**.
7. Measure the power levels with a marker and fill them to the table starting from the highest one. The lowest power level filled to the table should be at least <-50 dBm. Measured power levels must be monotonously decreasing.





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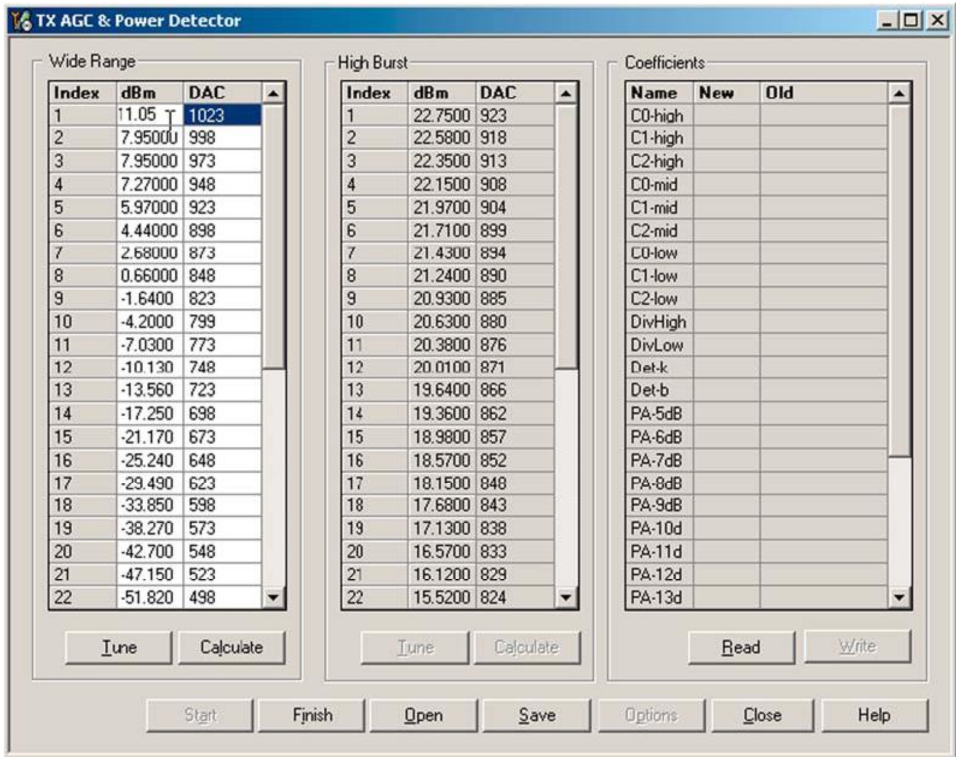
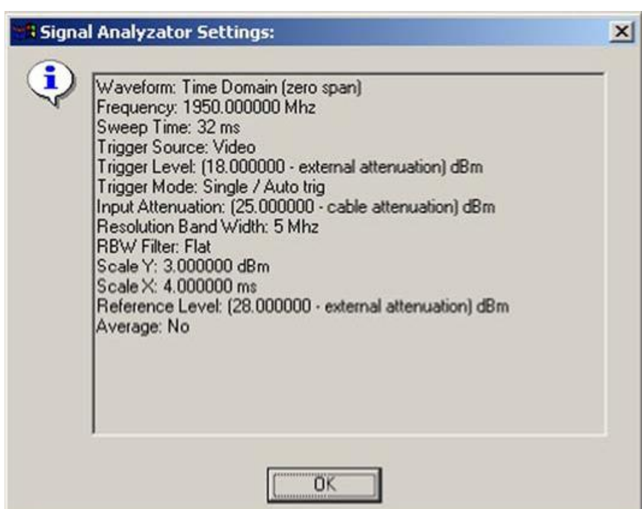
8. Fill in the power level values (in dBm) to the *Wide Range* table.




9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Power Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings (in addition depending on spectrum analyzer use 30 kHz video bandwidth):





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12. Measure the power levels with a marker and fill them to the table starting from the highest one. Measured power levels must be monotonously decreasing.

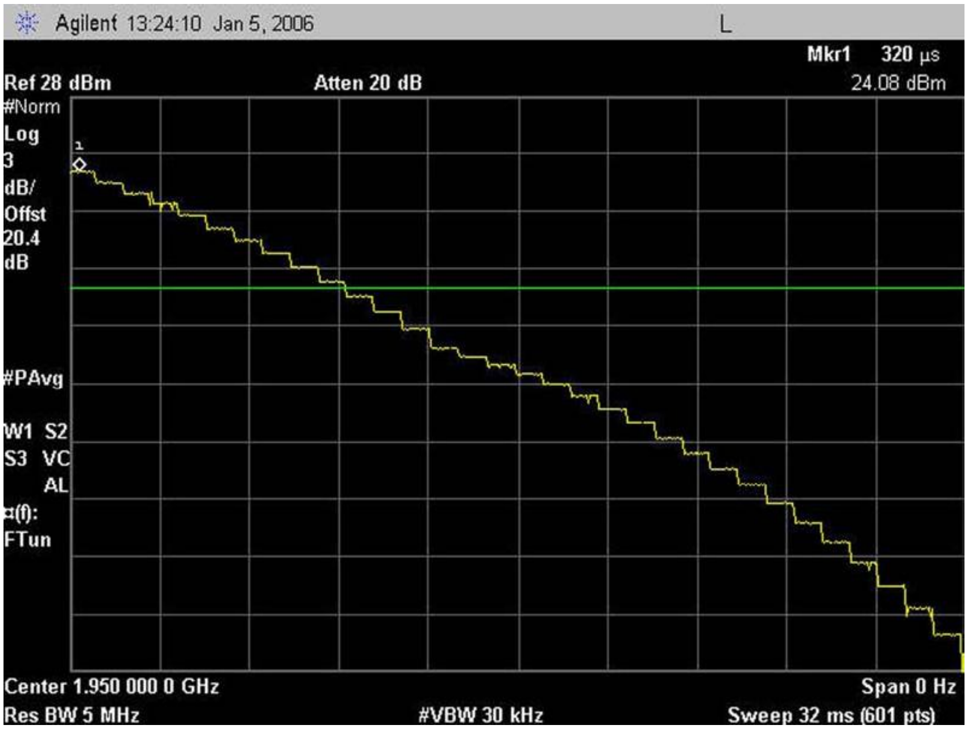


**Figure 47 High burst measurement**

13. In the *High Burst* pane, click **Calculate**.
14. Check that the calculated values are within the limits specified in the following table:

| | Min | Max |
|---|---|---|
| C0-high | -0.5 | 5 |
| C1-high | -50 | 50 |
| C2-high | 400 | 900 |
| C0-mid | -0.7 | 0.7 |
| C1-mid | 0 | 50 |
| C2-mid | 400 | 900 |
| C0-low | -4 | 4 |
| C1-low | -400 | 440 |
| C2-low | -10000 | 15000 |
| Det-k | 100 | 220 |
| Det-b | 0 | 150 |

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing**→**WCDMA**→ **Tx Control.**


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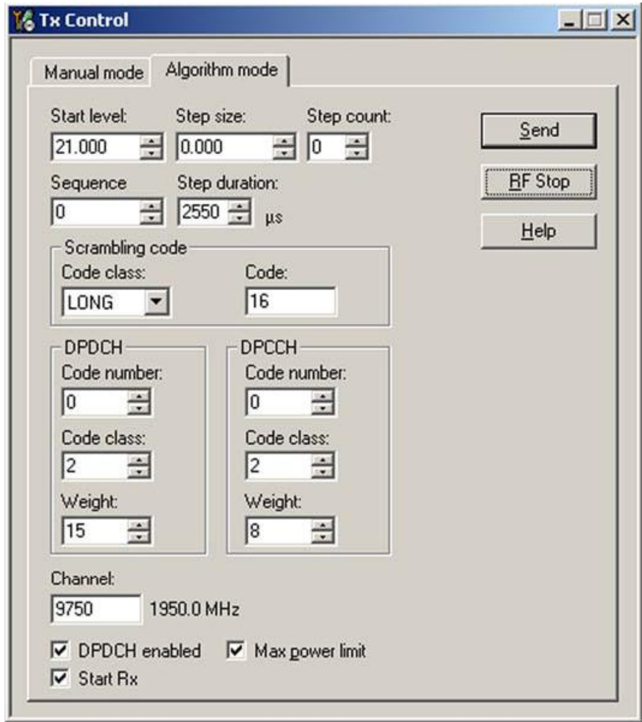
18. Select the *Algorithm* mode tab.




19. Write the target power level 28 dBm to the *Start level* box and check the **Max power limit** check box (detector calibration check). Write "1" to *Sequence* box.
20. Setup the spectrum analyzer with the following settings:

**Table 18**

| | |
|---|---|
| Center frequency | 1950.0 MHz |
| Span | 0 Hz |
| Reference level offset | Cable attenuations + adapter attenuation |
| Reference level | 28 dBm or -20 dBm depending on the level measured |
| Input attenuation | Automatic |
| Resolution bandwidth | 5 MHz |
| Video bandwidth | 5 MHz (depending on spectrum analyzer use 30 kHz VBW) |
| Sweep time | 5 ms |
| Detector | RMS detector |
| Average | No |
| Trigger level | Video 0 dBm or -45 dBm |

21. Measure the WCDMA output power. It should be around 23.5 dBm.
22. Click **RF Stop** and uncheck the **Max power limit** check box.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23. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

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

    Remember to stop the RF before sending new data.

## *Tx band response calibration (WCDMA)*

### Context

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

- In the *Tuning Settings* pane, it is possible to select WCDMA band (WCDMA I).
- **Target power** shows the power level used for calibrating tx frequency in this tuning procedure.
- In *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- **Abort** button aborts the tuning operation without saving the tuned values.
- **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

### Steps

1. Start *Phoenix* service software.
2. Choose **File**→**Scan Product** .
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning**→**WCDMA**→**Tx Band Response Calibration** .


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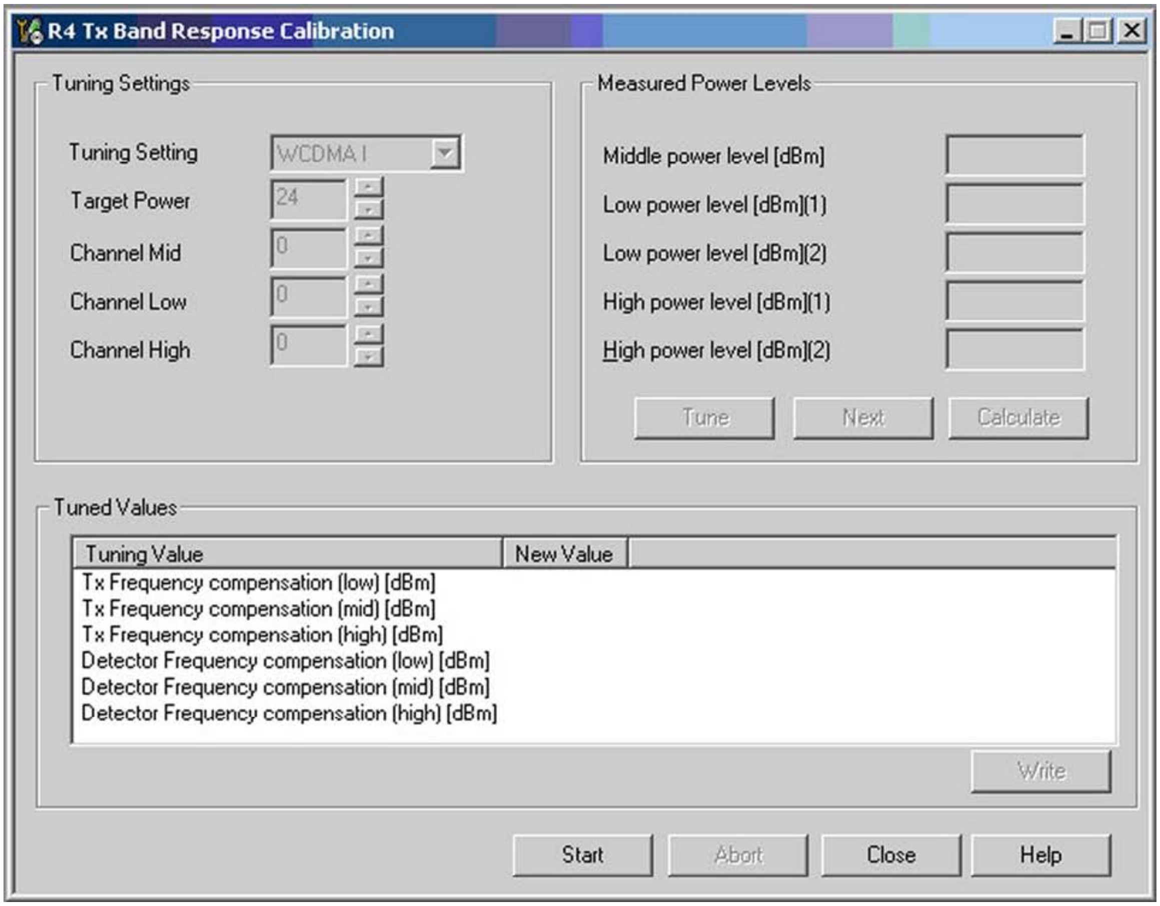
5. Click **Start.**




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

6. Click **Tune.**
7. Connect the spectrum analyzer to the terminal, and set it to **Channel Mid** frequency. Use spectrum analyzer's RMS detector and depending on spectrum analyzer use 30 kHz video bandwidth.
8. Read the values from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.
9. Click **Next.**
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next.**
15. Click **Calculate.**

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. Check that the tuned values are within the limits presented in the following table. If they are OK, click **Yes.**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| | Min | Max |
|---|---|---|
| Tx Freq Comp (the first and last value) | -4 | +4 |

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

### *Tx LO leakage (WCDMA)*

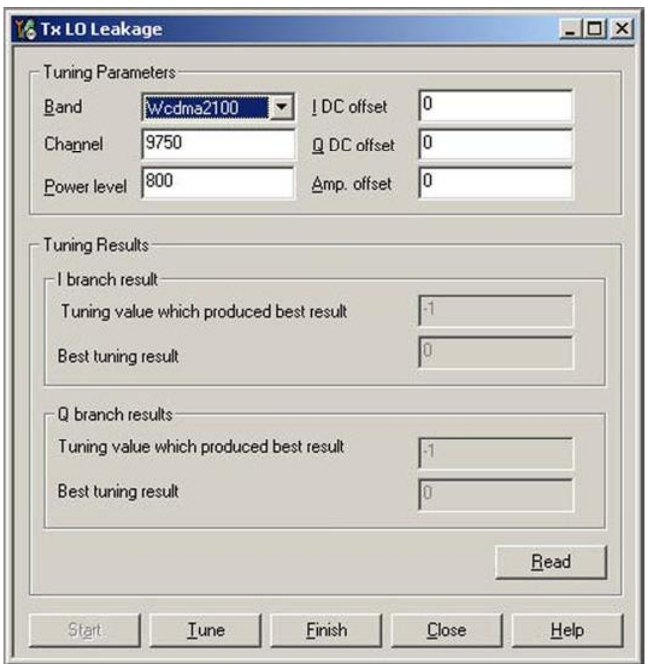
#### Context

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

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

#### Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→WCDMA→ Tx LO Leakage** .
3. Click **Tune**.




4. Click **Finish** and then **Close**.

## WLAN troubleshooting

### Introduction to WLAN troubleshooting

The main problem that can occur is malfunction in WLAN or WLAN ASICs or WLAN SMD components. Such problems are unpredictable and may have many causes, either HW or SW related.

> **Note:** While WLAN power tuning is not possible without power meter especially capable for measuring WLAN wideband power, WLAN ICs (WLAN IC and BTH/WLAN front-end module) shall not be changed.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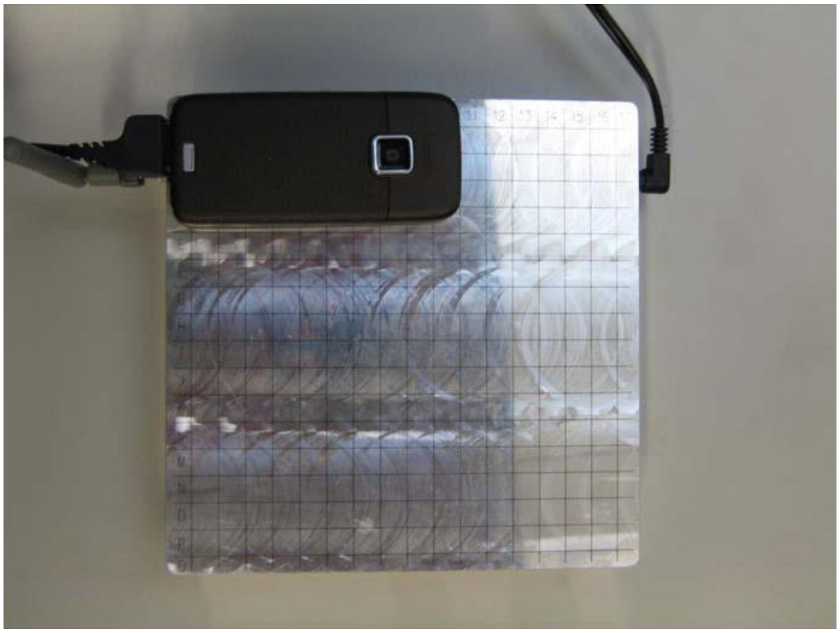
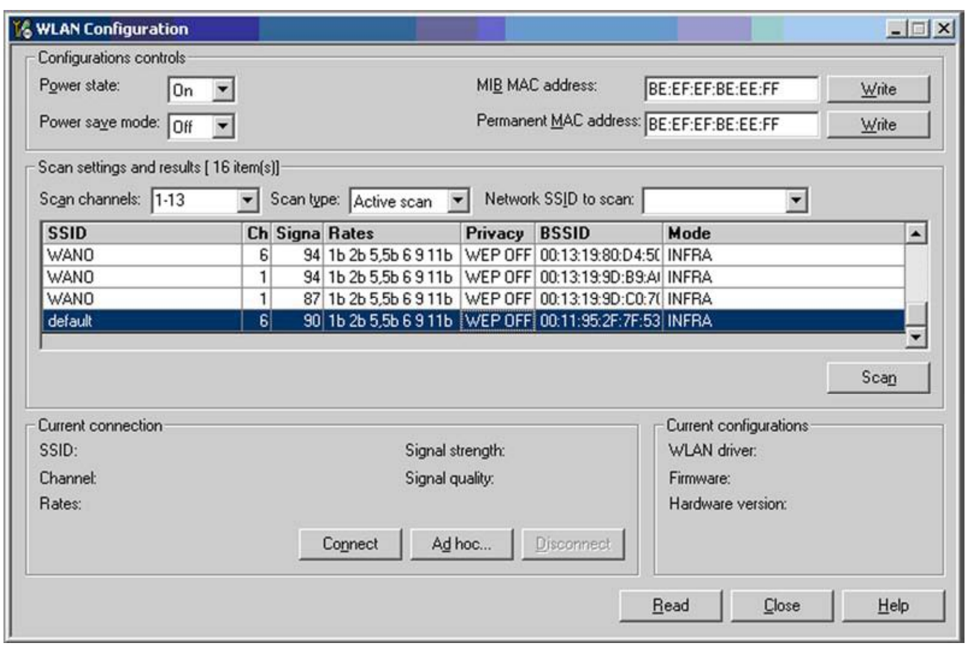
## WLAN functionality test using SB-7 and Phoenix

### Steps

1. Place the phone on the SB-7 WLAN test box, see figure below.



2. Start *Phoenix* service software and turn the phone to the local mode.
3. 3. From the **Testing** menu, choose **WLAN Configuration**, the following window should come up:




4. Turn the **Power state: On** and press **Scan**.
5. After few seconds, list of found WLAN networks should be updated. If WLAN is working, and at least a station with SSID name **default**, should be found.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# 8 — Camera Module Troubleshooting


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## Introduction to camera module troubleshooting

### Background, tools and terminology

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

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

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; for example, this product has a 1600 x 1200 pixel sensor resolution. In some occasions the term resolution is used for describing the sharpness of the images. |


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| | |
|---|---|
| *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 40 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 40 cm. The lack of sharpness is first visible in full resolution (1280 x 1024) 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 48 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.


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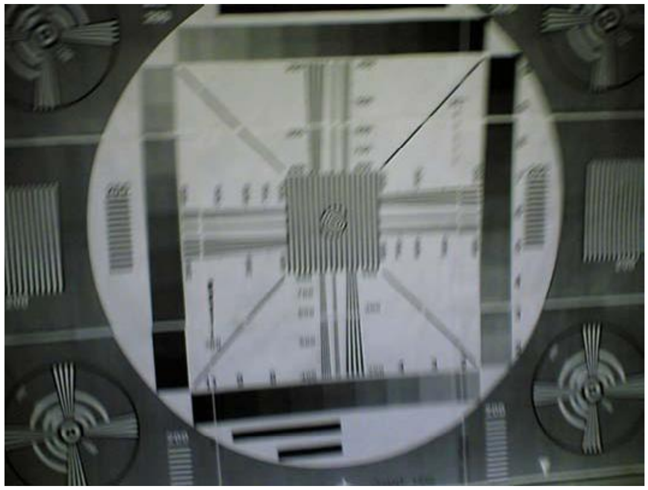

**Figure 49 Blurring caused by shaking hands**

## 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 50 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.


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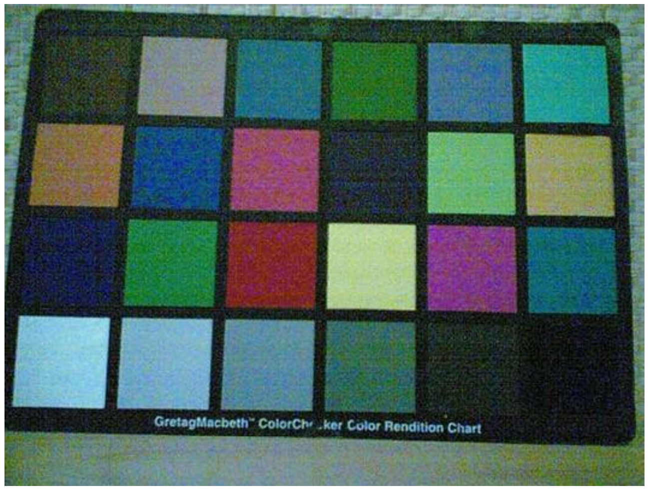


**Figure 51 Noisy image taken in +70 degrees Celsius**

## 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 52 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.


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**Figure 53 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 54 A lens reflection effect caused by sunshine**


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## Examples of good quality images

**Figure 55 Good image taken indoors**

**Figure 56 Good image taken outdoors**

## 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.


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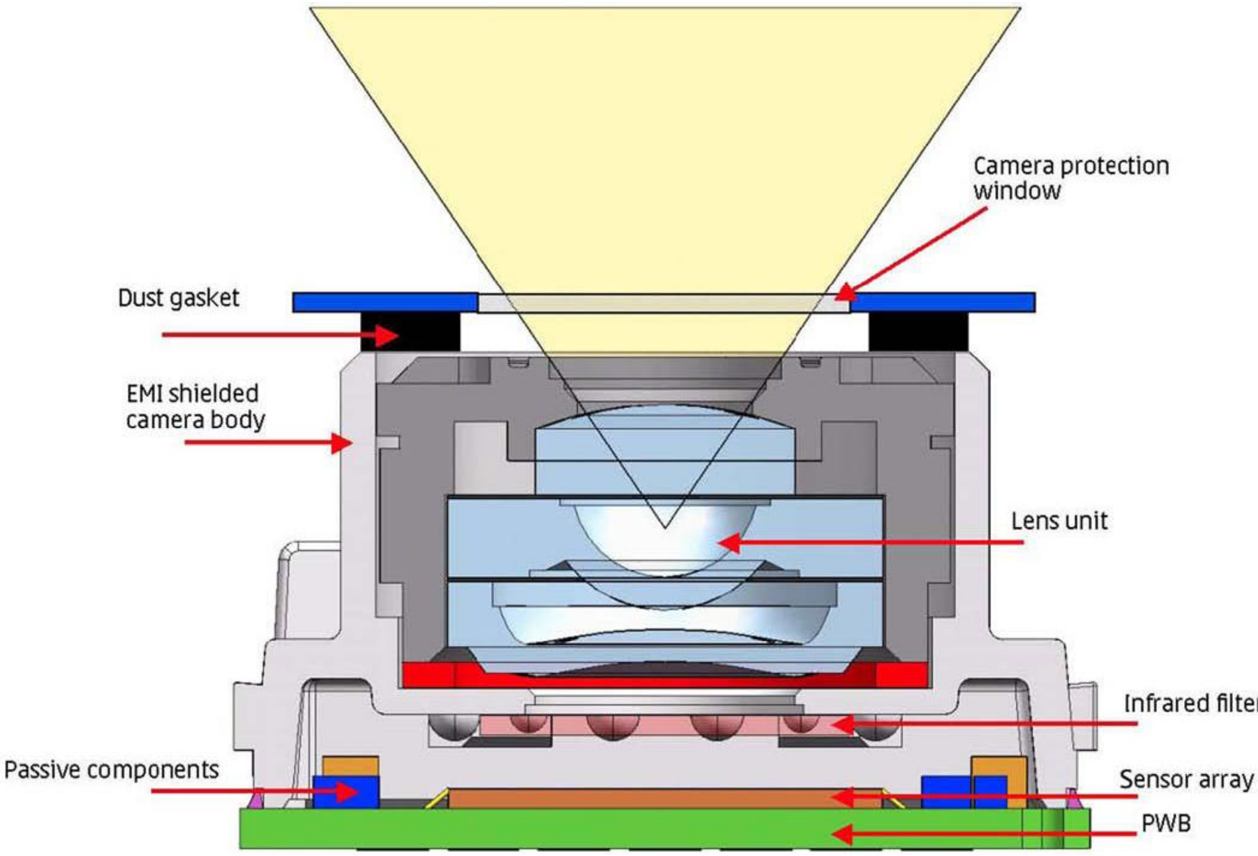


**Figure 57 Camera module cross section and assembly principle**

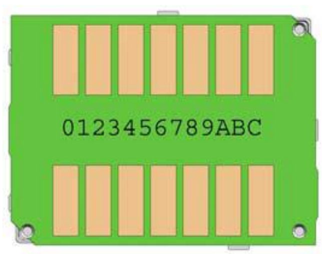


**Figure 58 Camera module bottom view including serial numbering**

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 colors. 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
- Socket type connection


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- Laser-marked serial numbering on PWB (for versioning)
- Passive components
- Camera protection window; part of the phone cover mechanics
- Dust gasket between the lens unit and camera protection window

## 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 59 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.


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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 40 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.


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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.

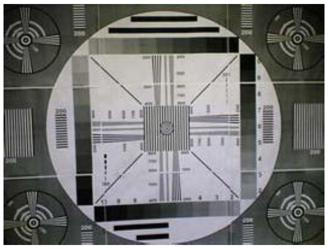

**Figure 60 Image taken with clean protection window**

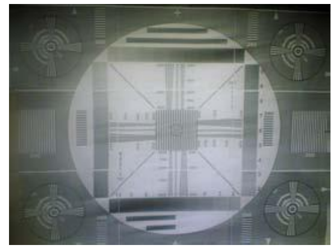

**Figure 61 Image taken with greasy protection window**

## 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 62 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


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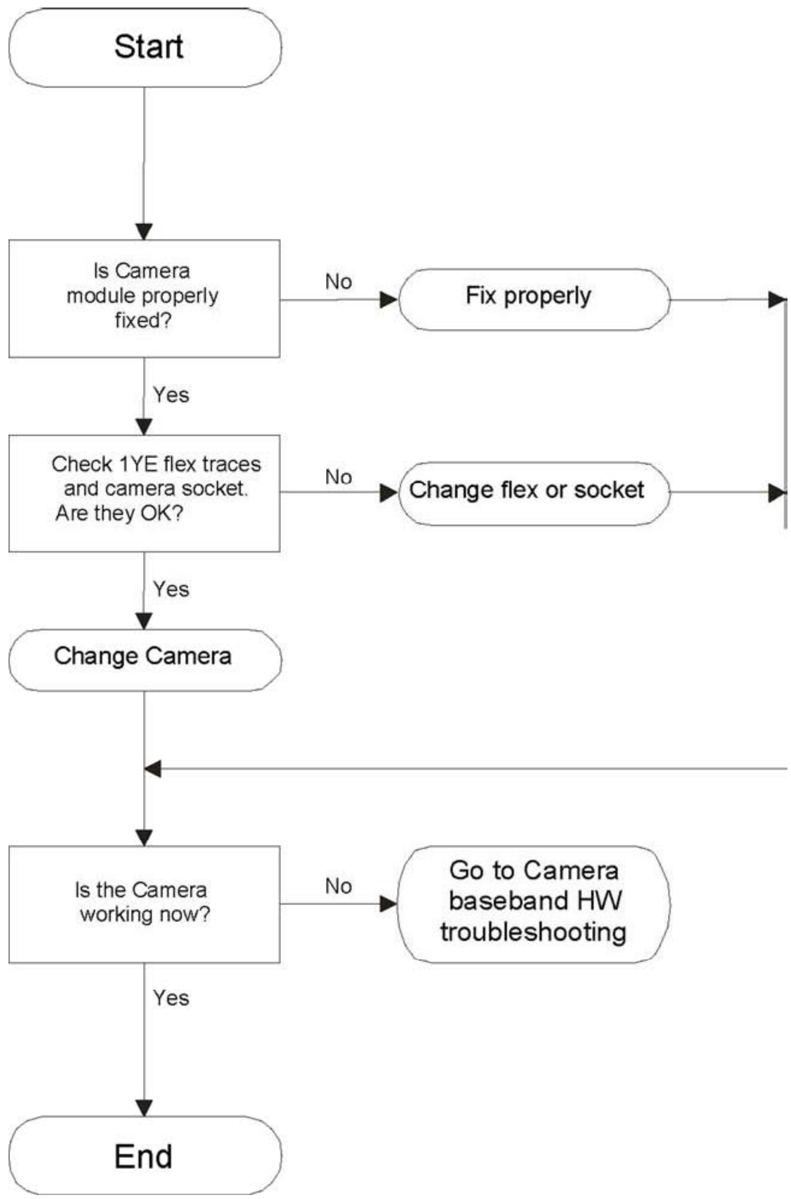
## Camera troubleshooting flowcharts

### Camera hardware failure message troubleshooting

#### Troubleshooting flow





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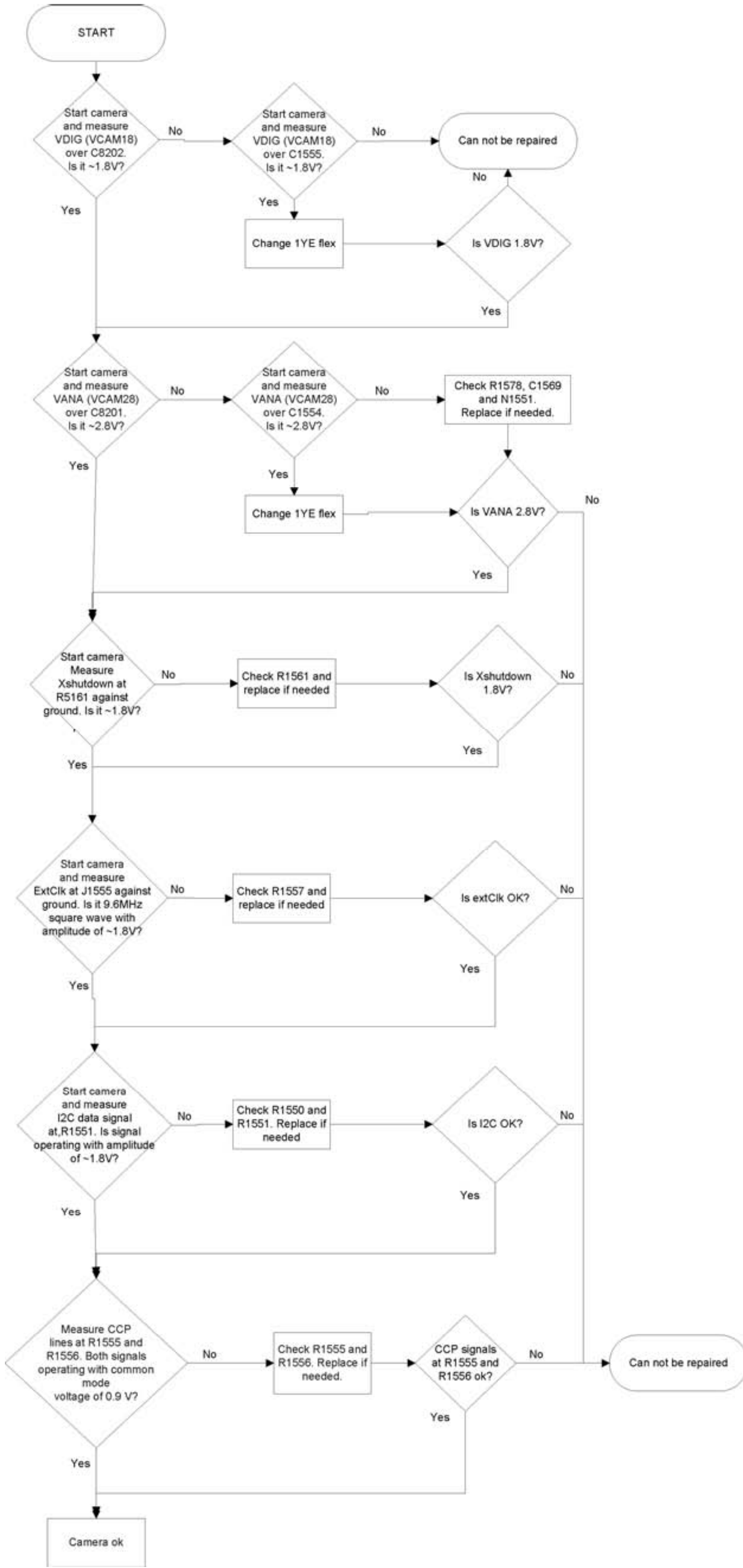
## Camera baseband hardware troubleshooting

### Troubleshooting flow





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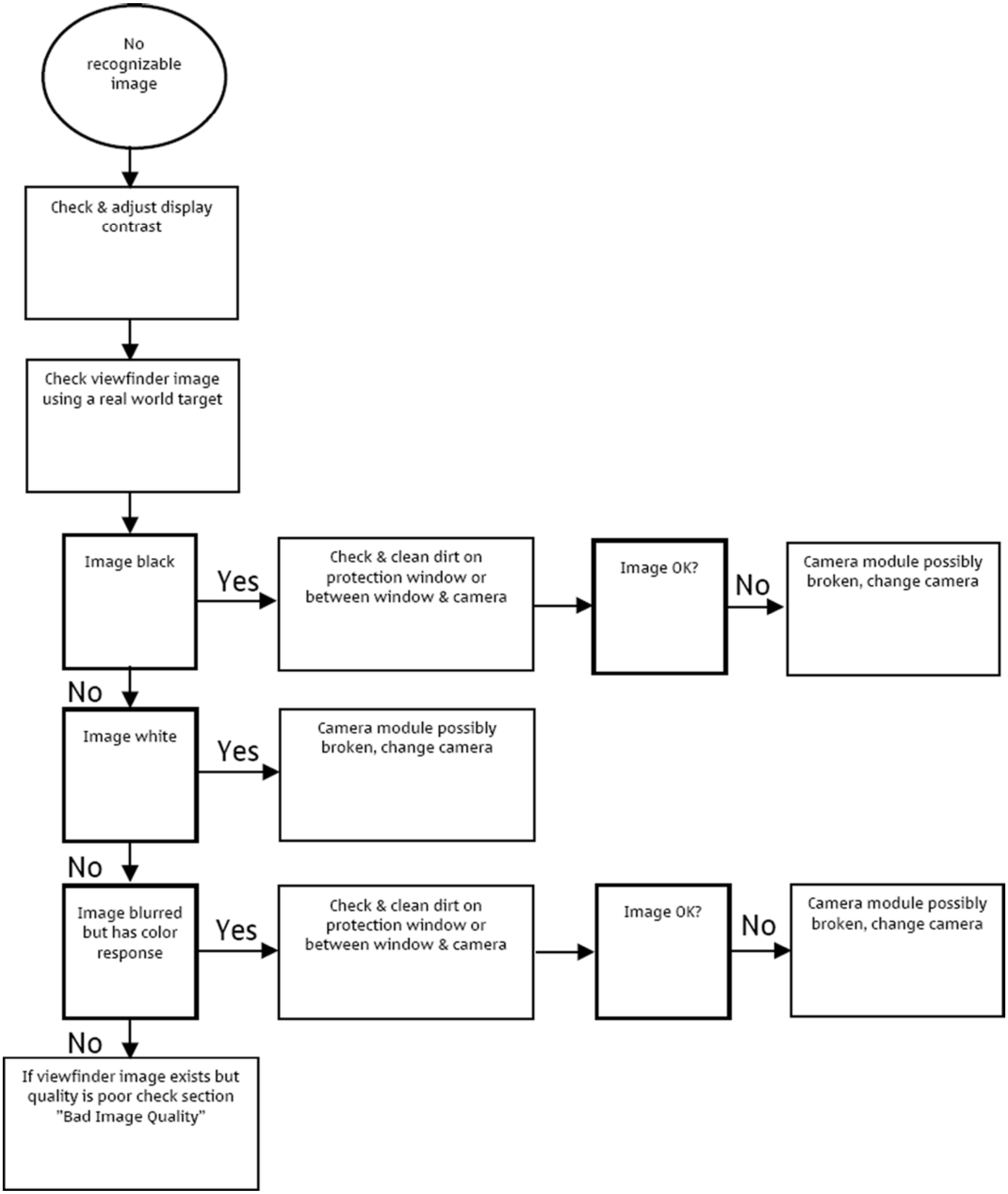
## Front camera viewfinder troubleshooting

### Troubleshooting flow





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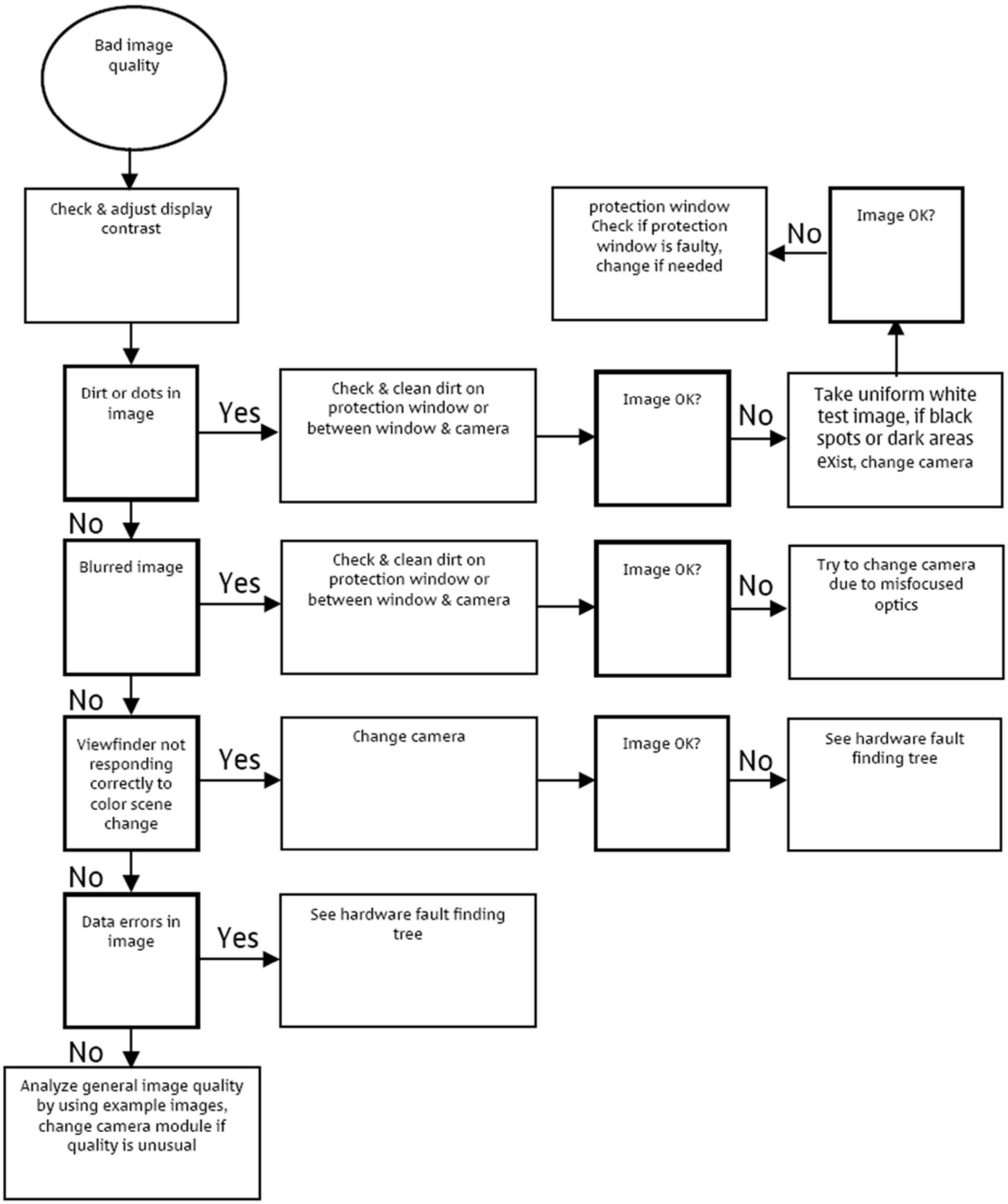
## Front camera bad image quality troubleshooting

### Troubleshooting flow





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# 9 — System Module


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## Baseband description

### System module block diagram

The device consists of 5 modules: 1yb engine module, 1yc Ui flex module, 1yd T9 flex module, 1ye camera sidekey flex module and 1yf SIM card flex module. The transceiver board consists of baseband and RF components.

The UI flex module consists of S60 keypad and backlight, ALS, display connector, earpiece pads and power switch. T9 flex module consists of T9 keypad and EL illumination. Camera sidekey flex module consist of Camera, 4 sidekeys and IHF speaker pads. SIM card flex module consists of SIM and uSD card connectors.

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

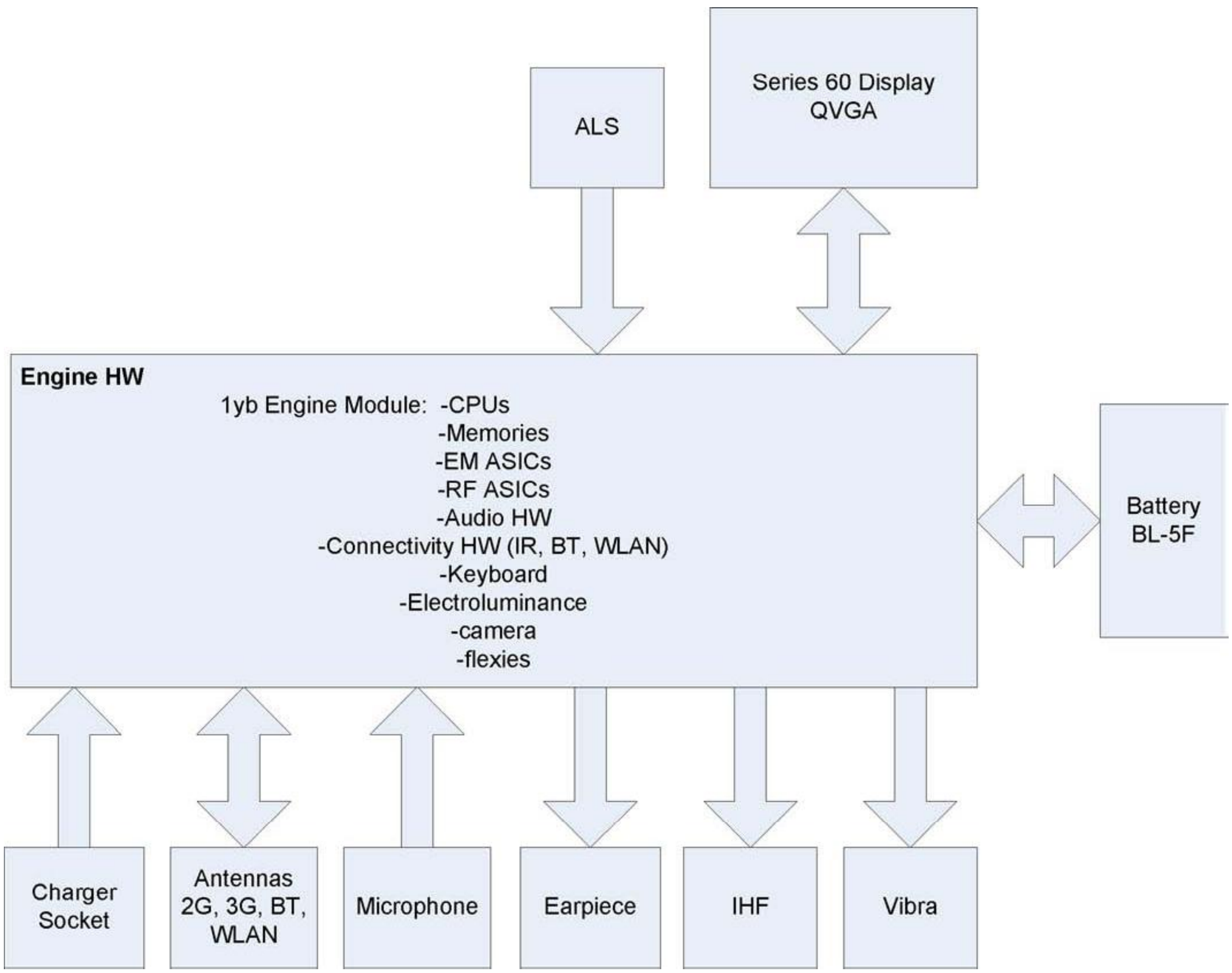


**Figure 63 System level block diagram**

### Baseband functional description

Digital baseband consists of ISA based modem and SYMBIAN based application sections. Modem functionality is in RAP3GS and application processor acts as a platform for SYMBIAN applications.


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Modem section consists of RAP3GS ASIC with NOR FLASH and DDRAM memory as the core. Memory package POP2 is stacked on to RAP3GS. RAP3GS supports cellular protocols of WCDMA (3GPP R-4) and GSM (minimum EDGE glass 10, GPRS phase2). Modem DDRAM memory have 128Mbits of memory and NOR flash have 128Mbits of memory. RAP3G operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

Application section includes application processor ASIC with DDR/NAND combo memory as the core. Application processor uses 19.2MHz clock, which comes from the RAP3GS divided by two from the 38.4 MHz system clock.

Application processor (OMAP1710) is also called as an application ASIC because it is processing application SW and handles the UI SW. It consists of OMAP3.3 and peripheral subsystems like display- and keyboard driver blocks.

## 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 4 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 VILMA master reset threshold) and that the back-up battery voltage is too low. |
| BACK_UP | The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on). |
| PWR_OFF | In this mode (warm), the main battery is present and its voltage is over VILMA master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator are off. |
| RESET | RESET mode is a synonym for start-up sequence. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms). |
| SLEEP | SLEEP mode is entered only from PWR_ON mode with the aid of SW when the systems activity is low. There are in principle three different sleep modes:<br>• Helen3 sleep<br>• RAP3GS sleep<br>• Helen3 and RAP3GS sleep (deep sleep) |


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| Mode | Description |
|---|---|
| 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

Power supply components:

- EM ASIC N2200
- EM ASIC N2300
- Application processor VCORE SMPS
- BT
- LDO
- backlight SMPS
- EL-driver
- MicroSD level shifters
- Camera regulators

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA & WCDMA PA) and for RF ASIC (N7590, AHNEUS).

Discrete power supplies are used to generate 2.8V to BT, 1.8 V and 2.8 V for camera HW accelerator and camera, 1.05V/1.4V for Application processor and 18V for the backlight LEDs.

The device supports both 1.8V/3V SIM cards which are powered by EM ASIC N2200 / VSIM1. Level shifters are used to power microSD. USB accessories which need power from the device are powered by EM ASIC N2300 / VOUT.


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External LED SMPS is still controlled by EM ASIC N2300 PWM300 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:

- T0: Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

### 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 a different BT/WLAN VCTCXO G6030 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.


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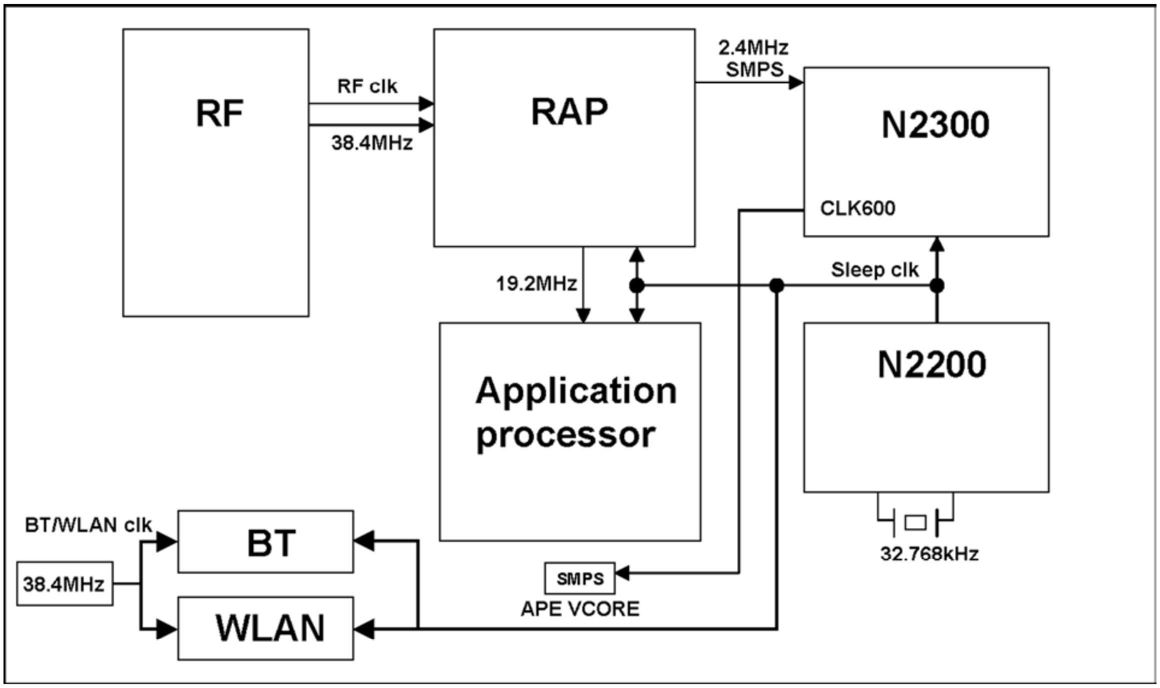


**Figure 64 Clocking scheme**

## IrDA

IrDA specifies a low-cost, reliable, fully digital peer-to-peer data link between IrDA units at data rates from 9600 bits/s to 115 kbit/s. The link is based on the serial transmission of data as pulses of infra red light at the wave length of 870nm and angles of +-15degrees at the range 0 - 50 to 100 cm. Because these restrictions and the optical nature of the link, the transmission is not omnidirectional but focused and only reaches a peer at a limited line-of-sight distance from the transmitter thus not disturbing any other units in the neighbourhood.

Baud rates in the range 9600 bit/s to 115 kbit/s are known as SIR (Slow IR); this data is sent asynchronously. The protocol and speed are only changed after successful negotiation. IrDA connectivity includes IrCOMM, IrOBEX, IrTran-P, IrMC and PhoNet.

IR communication is half-duplex e.g. the IR receiver sees its own transmission, and the IR interface is either transmitting or receiving, but not both at once. IrDa modules consume current when the IR detector is active and therefore modules have to be set to the shutdown mode (SD-mode).

## 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.

## Hall sensor

HALL sensor is used to monitor the position of the upper block in slide construction.

The function of a Hall sensor is based on the physical principle of the Hall effect. Hall voltage is generated over sensor when magnetic field traverses the sensor.

There is an integrated comparator and switches in Hall switches. When sensor is in magnetic field, switch is closed and output is connected to GND.


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Hall sensor detects the slide position. There is a magnet in slide mechanics under the display module and when the slide is closed Hall sensor is in magnetic field.

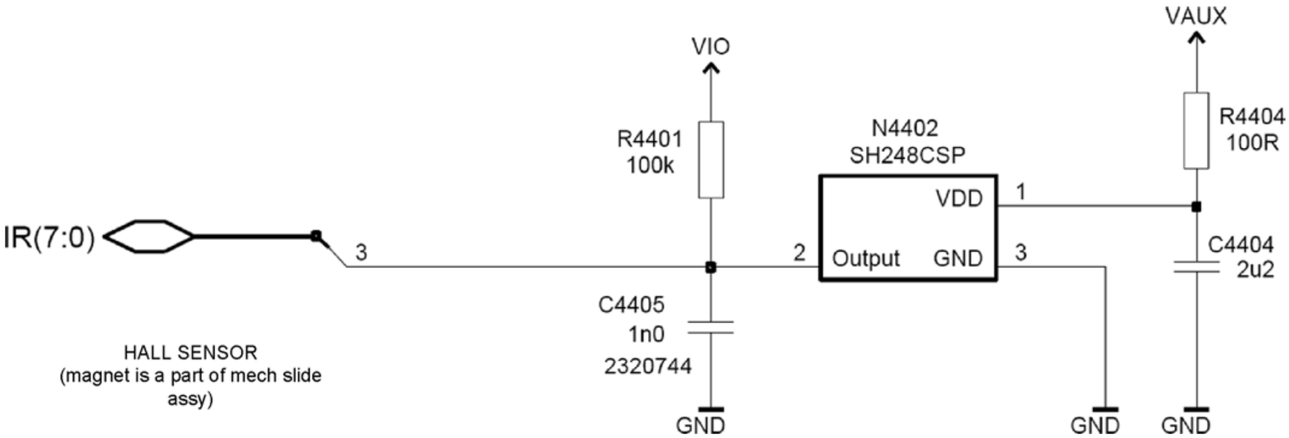


**Figure 65 Hall sensor**

## 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 main SIM interface functionality is in RAP while the EM ASIC takes care of power up/down, card detection, ATR (Answer To Reset) counting and level shifting.

The SIM IF is shown in the following figure:

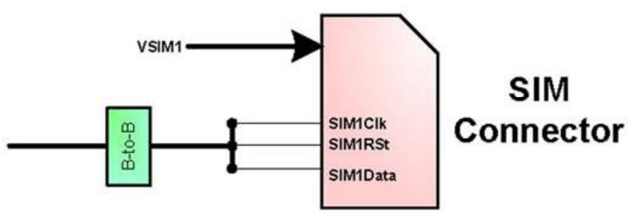


**Figure 66 SIM interface**

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.

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


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## 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.

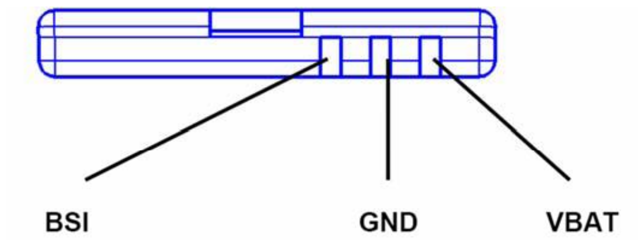


**Figure 67 Battery pin order**

## MicroSD interface

The MicroSD card interface is electrically and functionally compatible with SD card interface.

MicroSD card interface is a 4-bit serial IF connected to application processor. IF includes 1.8V-2.85V level shifter, 2.85V LDO regulator and ASIP (combined into one package) . There is an internal switch in the card reader for card presence and removal detection.

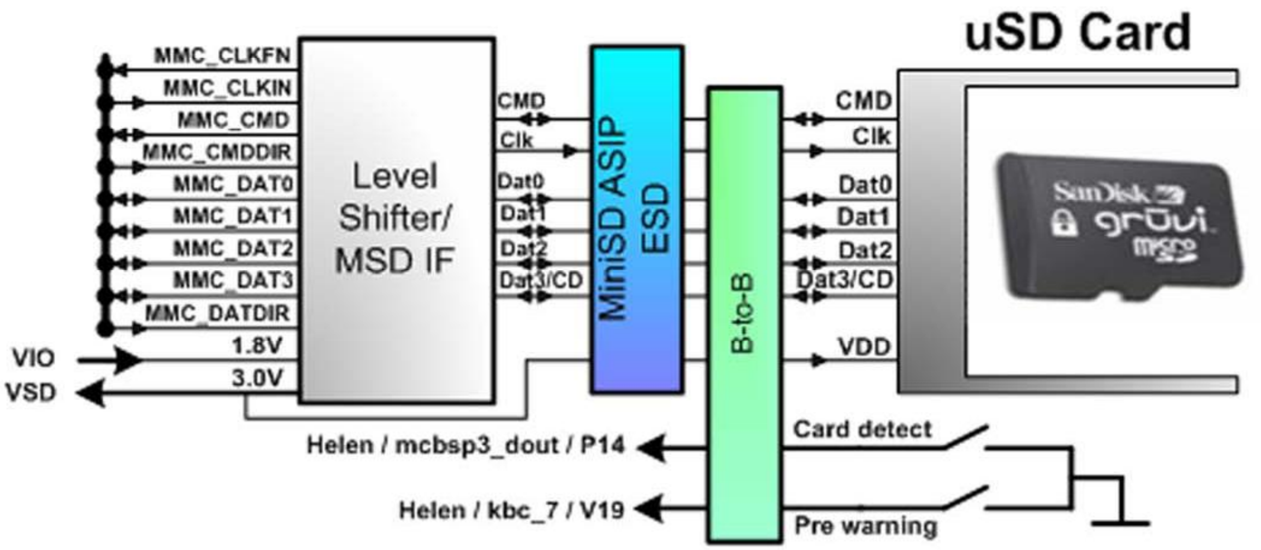


**Figure 68 MicroSD card interface**

**Table 19 MicroSD interface**

| Pin | signal | I/O | Engine connection | Notes |
|---|---|---|---|---|
| 1 | DAT2 | <-> | N5200 | |
| 2 | CD/DAT3 | <-> | N5200 | |
| 3 | CMD | <-> | N5200 | |
| 4 | VDD | -> | N5200 | |
| 5 | CLK | <-> | N5200 | |


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| Pin | signal | I/O | Engine connection | Notes |
|---|---|---|---|---|
| 6 | GND | | | |
| 7 | DAT0 | <-> | N5200 | |
| 8 | DAT1 | <-> | N5200 | |
| 9 | SW1 | -> | Application processor | Card presence |
| 10 | GND | | | Card removal switch ground |
| 10 | SW2 | -> | Helen3 | Card insertion/ removal |

## Camera interface

Camera is located on camera flex and camera HW accelerator is located on engine module.

HWA is connected to OMAP 1710 and the data is transferred from camera using CCP bus.

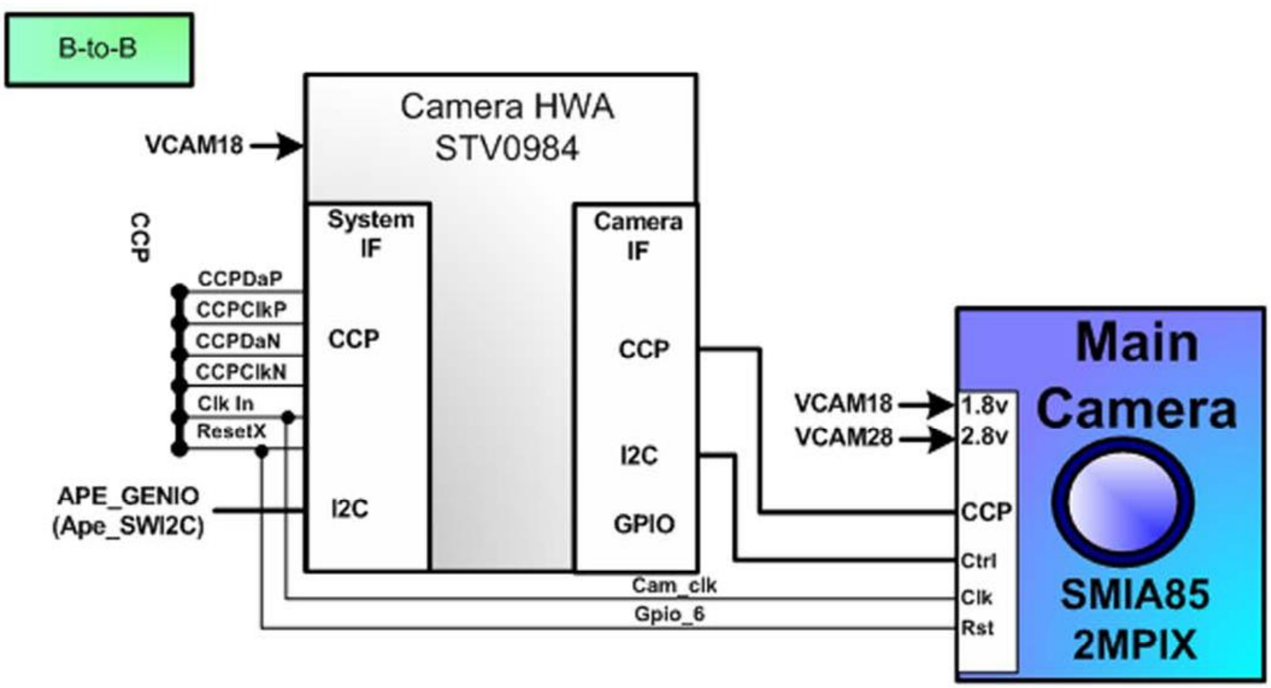


**Figure 69 Camera interface**

## Bluetooth

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 BC3 BT ASIC.


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The UART1 interface handles the transfer of control and data information between the application processor and the BT system.

The PCM interface is used for audio data transfer between RAP and the BT system.

TI BRF 6150 ROM is a low power Bluetooth RF-tranceiver module meeting Bluetooth compatibility standards (Class 2 Bluetooth v1.2 compliant pre-qualified tranceiver system) and has the BTH/WLAN physical co-existence interface for Nokia application.

BRF 6150 is a single chip Bluetooth device appropriate for use in Nokia mobile phone applications, where the Nokia BB acts as a Bluetooth host interface.

## Interface to RAP3G

The baseband uses RAP3G as the cellular ASIC and Helen3 as the Application processor.

This is because the BT application program runs on the Application processor in Symbian OS environment. Audio (PCM Interface) is still connected to the cellular ASIC such that cellular audio delay is kept minimum.

The Nokia BB and BRF 6150 interface can be logically divided into audio, user data and control Interfaces.

## Audio interface

Audio data is transferred using a separate interface based on PCM (Sync, In, Out, Clk).

The interface is configured by MCU software but the data transfer is done by the DSP.

Audio data is based on 8kHz sampling data – same as that used in the cellular system. The used configuration is as shown below:

| Master/Slave | TI as Slave |
|---|---|
| Clock | Nokia BB ASIC generates PCM_CLK |
| Data width | 16 bits PCM_out |
| Sync. Frame | Short PCM_Sync |
| Coding | PCM Linear |

## WLAN interface CXS

Coexistence Signaling Interface [CXS] between BTH and WLAN modules is to facilitate collocation in a terminal that has BTH and WLAN.


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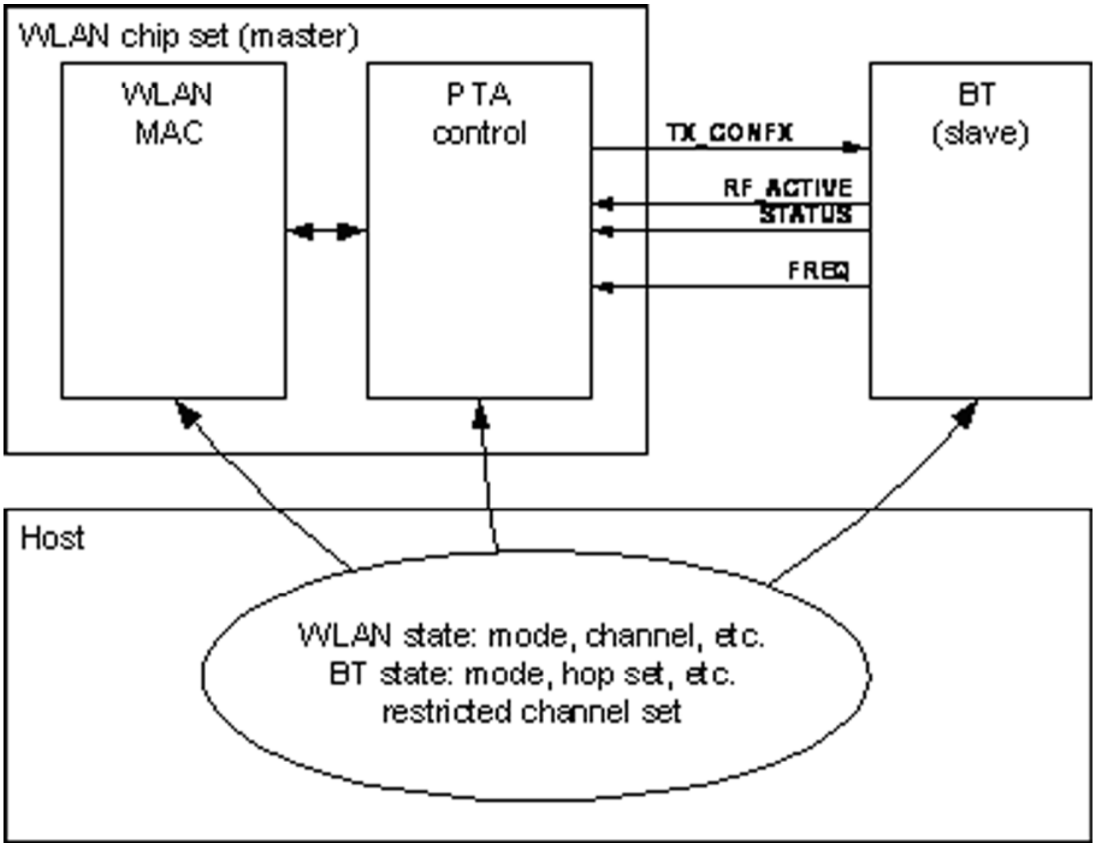


**Figure 70 BT-WLAN coexistence framework**

## System partitioning

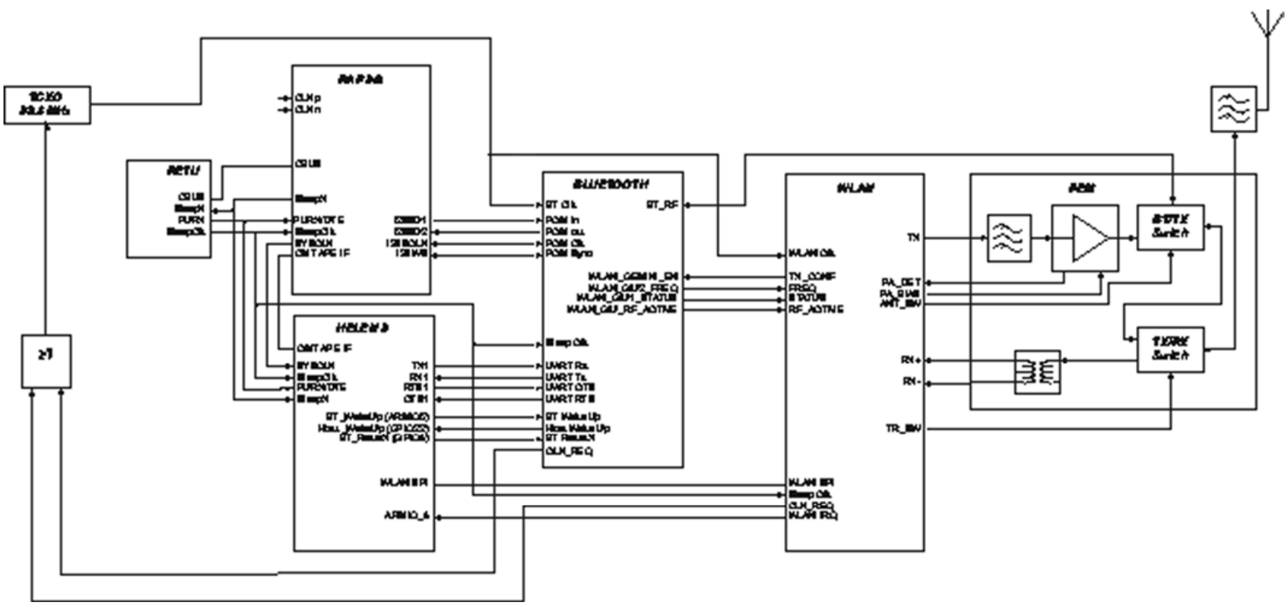


**Figure 71 BT-WLAN system partitioning**


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The interface between BRF 6150 and Nokia BB assumes that all higher layers above the HCI (host controller interface) are implemented in Nokia BB and all other layers (BB, Link Manager, Link Control, and component RF) below the HCI are implemented in BRF 6150.

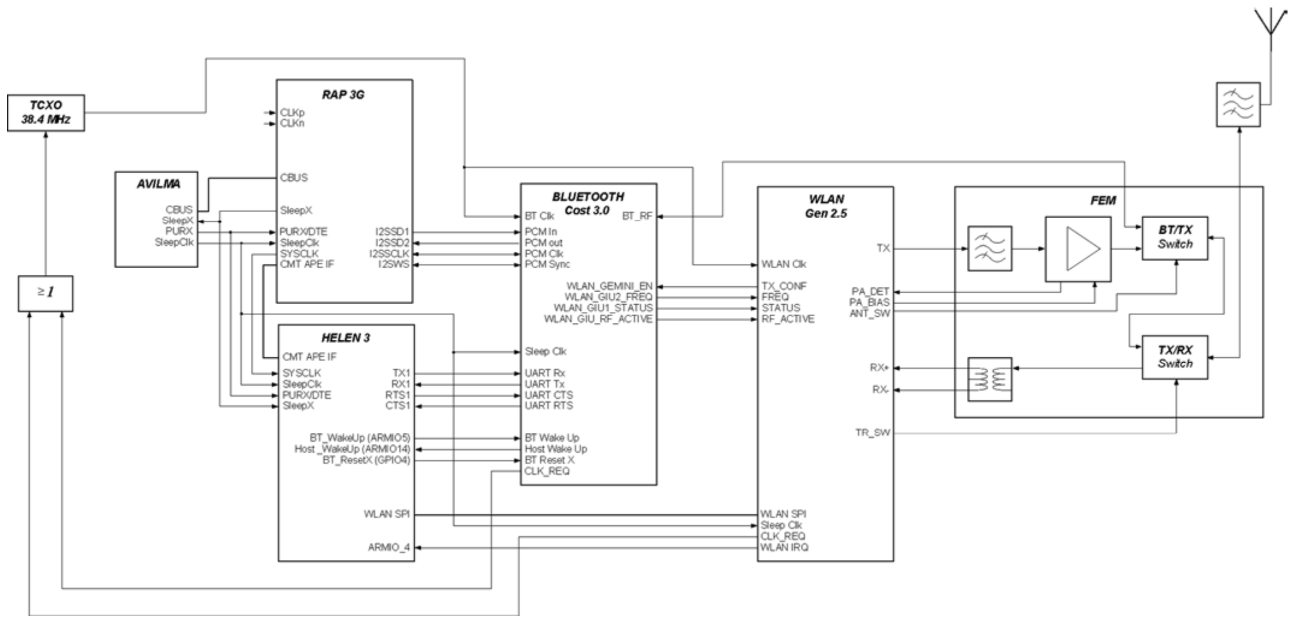
## Clock signals

BRF 6150 requires a system clock, which it uses to derive all its internal timing. The clock may be sinusoidal or square and the frequency tolerance is +/-20 ppm. The external TCXO clock oscillator is used for the system clock with a sinusoidal output.

### WLAN

STMicroelectronics STLC4550 implements 802.11b/g WLAN radio for embedded, low-power and small form factor mobile applications.

RFMD RF5924 Front-End Module (FEM) is a single integrated module. The FEM has integrated b/g power amplifier, power detector, RX balun and TX filtering.




### WLAN BB/MAC

The baseband chip implements OFDM/CCK digital baseband processor and ARM9-based MAC with internal SRAM memories.

## Regulators

Switching stepdown regulator generates the MAC/BB digital core supply at 1.2 V.

Two separate LDOs at 1.8 V output supply the VCO and the transceiver. The main 1.8 V supply is used for transceiver analog parts, ADC/DAC and digital circuits inside the transceiver.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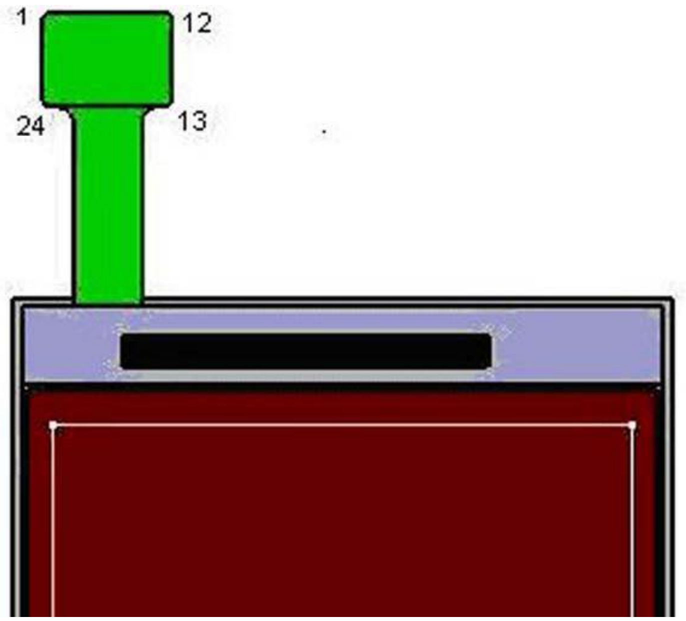
# User interface

## *Display interface*

### Display module mechanical concept - front




Display features:

The display is an S60 display module CG-Siligon Active matrix color LCD. It is capable of showing 16,777,216 colours. It incorporates a backlight system with 2 +2 LED serial (display leds are connected in two two-led series).

- Partial display function power saving by pausing display process on part of the screen.
- Built-in RAM capacity 240lines x 320rows x 24bits = 184320bits.

The display has two different operating modes:

1 Normal mode, Full screen, 16M colours

2 Partial mode, 8 colours but only part of the display is active

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

Display is controlled via MeSSi-8 interface by Helen3. All MeSSi-8 signals go through the EMC filtering ASIPs.

The display module does not require any tunings in service.

## *Display and keyboard backlight*

The device has one LED driver (SMPS) that is used to drive 4 display LEDs and 3 S60 keypad LEDs. The display LEDs are connected in to two LED series.

The TP keyboard backlight is made with Electroluminance. Current adjustment of the driver is done from the display LED branch, and keyboard and function current also depends on the display brightness. In a typical use case, keyboard LEDs are turned ON only in dark ambient lighting conditions.

Control signals for LED driver are:


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**Table 20 LED driver control signals**

| | From | Voltage | Function |
|---|---|---|---|
| GenOut1 | EM ASIC N2300 | 0V / 1.8V | EL ON (1.8V)/OFF (0V) |
| PWM | EM ASIC N2300 | PWM 0%-100%, 1.8V | Current PWM control (16 steps) |

## ALS interface

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

- lightguide (part of the front cover)
- photo detector (V8004 in 1YC)

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 IC, which is internally temperature-compensated.

The supply voltage for the ambient light sensor is coming from VAUX via a switch N4404 controlled by EM ASIC N2300 Genio2 GenOUT2.

The output from ALS is current, which is fed to the resistor R2206. N2200 reads the light sensor (LS) results, voltage over resistor R2206 ALS calibration is not possible in the service points.

ALS is serviced by replacing faulty phototransistors.

See **ALS interface** figure.


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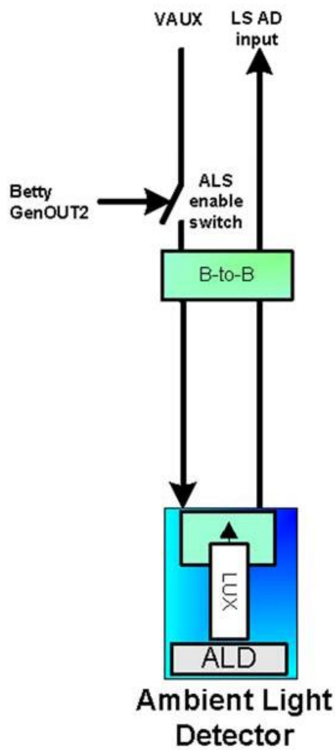


**Figure 72 ALS interface**

## ASICs

### *RAP ASIC*

RAP ASIC is a 3G Radio Application Processor. RAM memory is integrated into RAP.

### *EM ASIC N2200*

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

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


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- Regulators
- Vibra interface
- Digital interface (CBUS)

### *EM ASIC N2300*

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

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

## Device memories

### *RAP3GS memory POP2 stacked NOR flash and DDRAM*

Modem memory consists of 128 Mbit DDRAM and 128 Mbit NOR flash memories. Memories are in same POP2 package and it is stacked on to RAP3GS.

DDRAM is a dynamic memory for ISA 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 Mbit of DDR memory and 1024 Mbit of flash memory.

# Audio concept

## Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAP 3G CMT engine ASIC and the mixed-signal ASIC EM ASIC N2200.

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

There are three audio transducers:

- 7x11mm dynamic earpiece
- 20mm dynamic speaker
- electret microphone module

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

All galvanic audio accessories are connected to the Pop-Port™ accessory connector.

A Bluetooth audio module (BC02 BRF 6150) that is connected to RAP3GS supports Bluetooth audio functionality.

There is a separate application ASIC, OMAP 1710, for Symbian applications.


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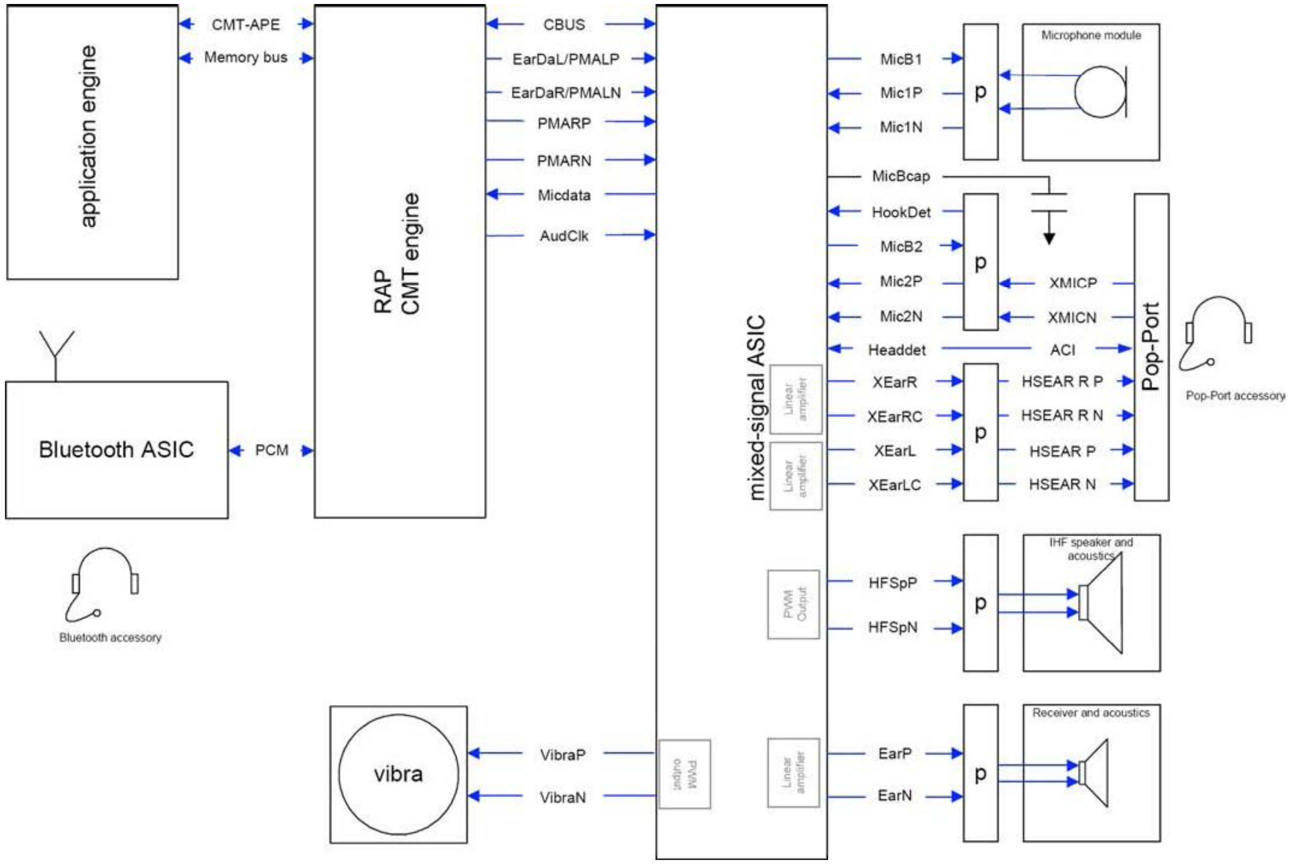


**Figure 73 Audio block diagram**

## Internal microphone

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

An analogue electret microphone is connected to EM ASIC N2200 ASIC's Mic1P and Mic1N is connected ground near EM ASIC N2200.

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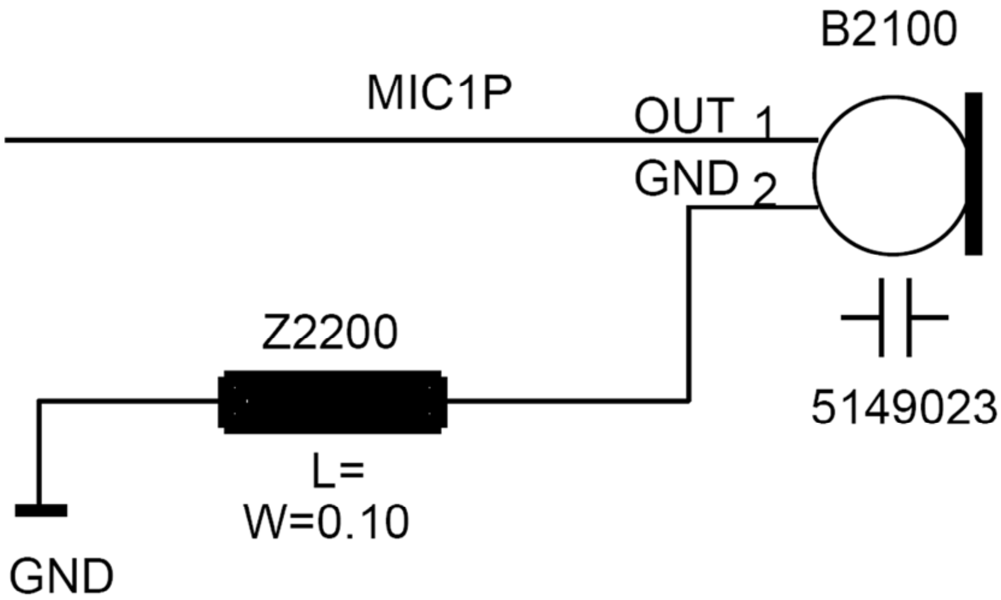


Figure 74 Internal microphone

## External microphone

Galvanic accessories are connected to the system connector (Pop-PortTM).

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

External microphone circuitry is biased by EM ASIC N2200 ASIC MicB2 bias voltage (inside EM ASIC N2200 ASIP). The circuitry provides a symmetrical connection for the microphone from the Pop-PortTMconnections, XMICN and XMICP, to EM ASIC N2200 ASIC inputs, Mic2P and Mic2N.

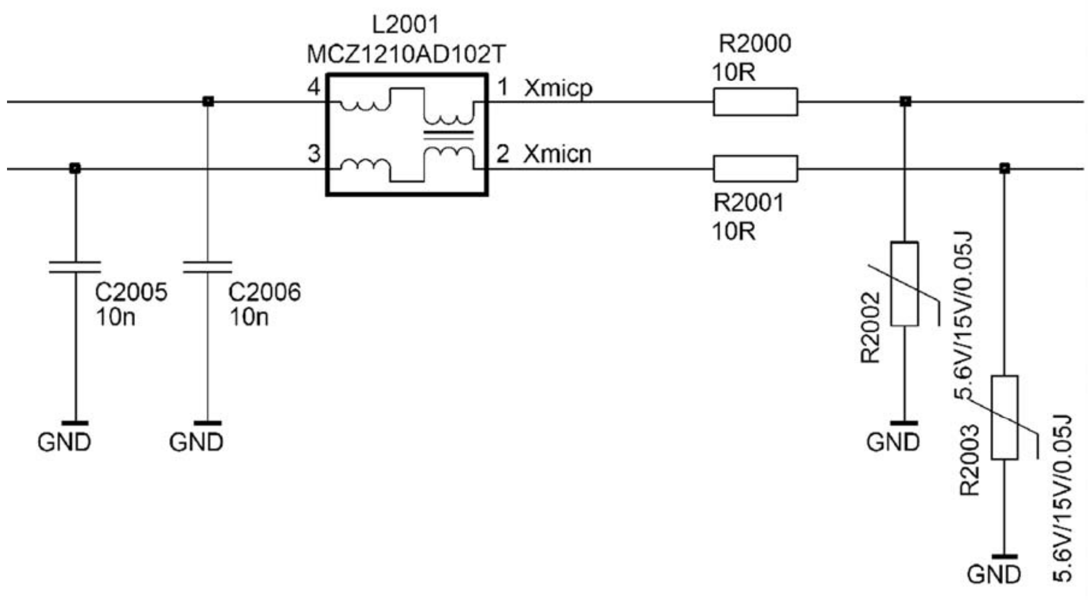


Figure 75 External microphone


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## Internal earpiece

The internal earpiece is used in the HandPortable (HP) call mode. A dynamic 7x11 mm earpiece capsule is connected to EM ASIC N2200 ASIC's differential outputs EarP and EarN.

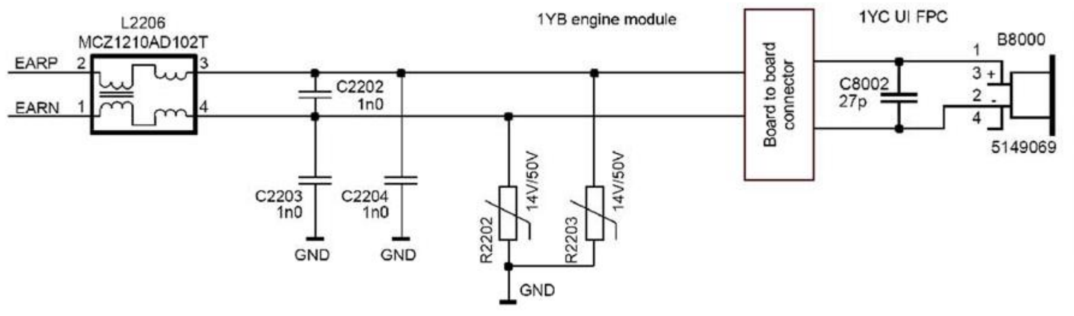


**Figure 76 Internal earpiece**

## Internal speaker

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

A dynamic 20 mm speaker is connected to N2200 ASIC's outputs HFSpP and HFSpN.

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

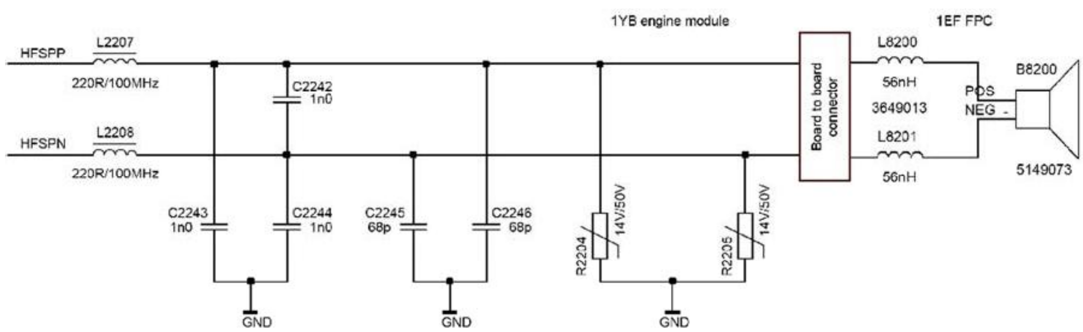


**Figure 77 Internal speaker**

## External earpiece

All galvanic accessories are connected to the system connector (Pop-Port™).

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


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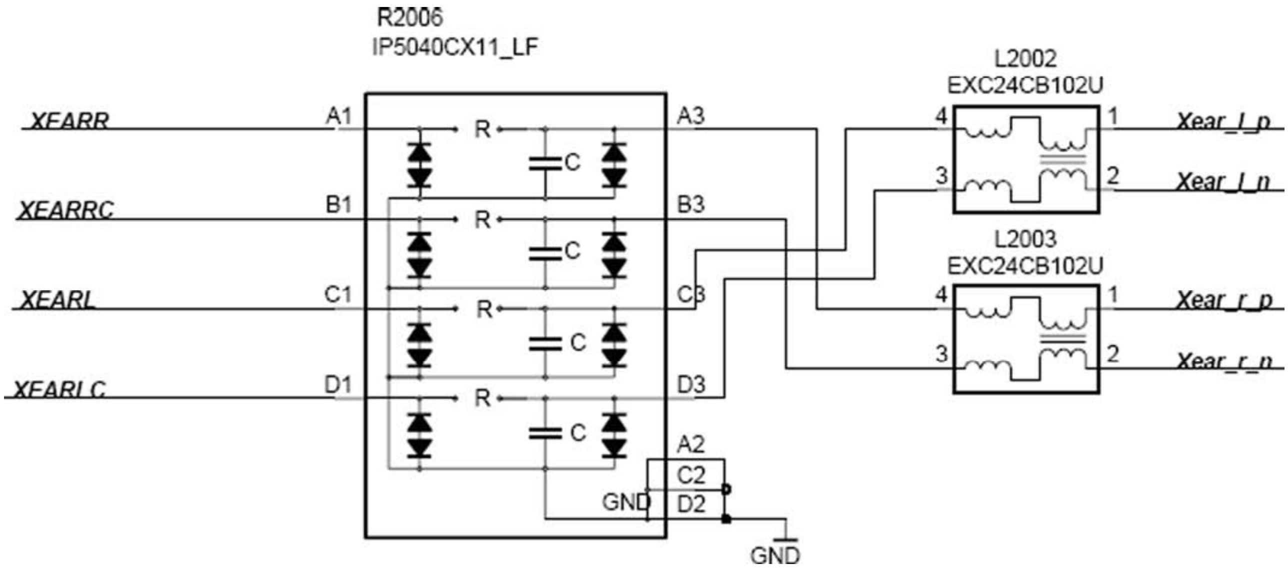


**Figure 78 External earpiece circuitry (Pop-Port connected on the right)**

## Vibra circuitry

Vibra is used for vibra-alarm function.

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

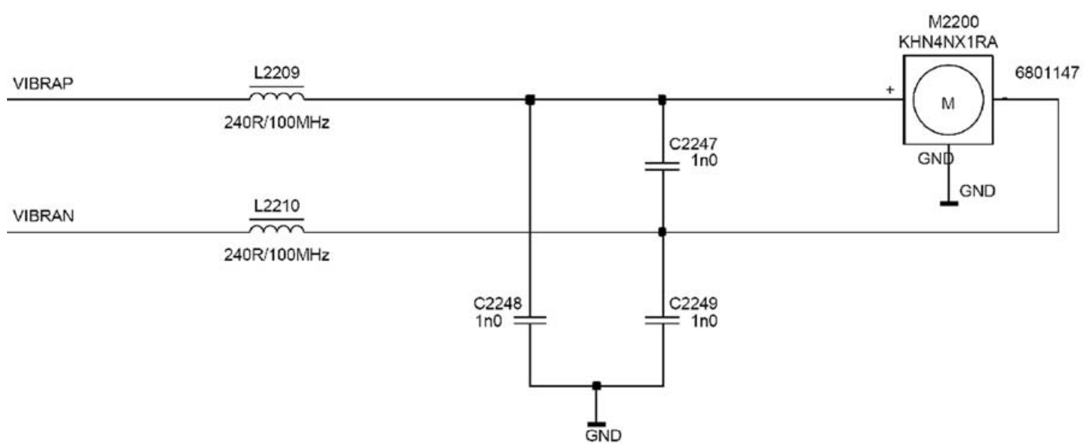


**Figure 79 Vibra circuitry**

## 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 Vilma 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.


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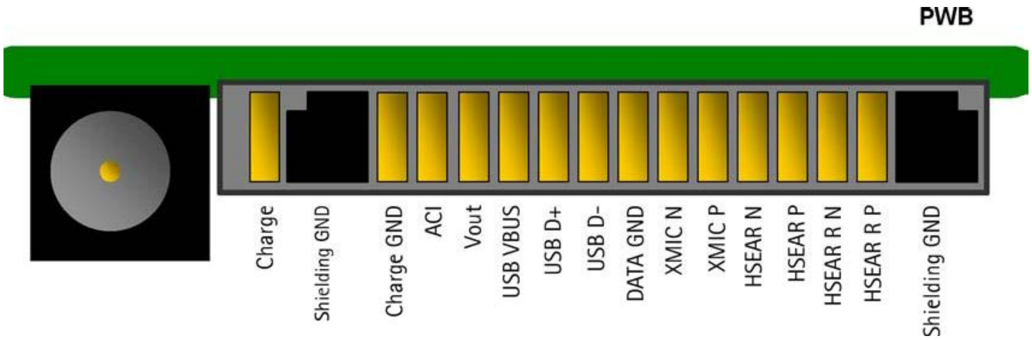


**Figure 80 External audio connector**

**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/ 2.5V-2.78V | 47Ω | Insertion & removal detection |
| 4/ Vout | DC out | DC | 2.5V 90mA | 100mΩ (PWB+ conn.) | 200mW |
| 9 / XMIC N | Audio in | 300-8k | $1V_{pp}$ &2.5-2.78VDC | | |
| 10 / XMIC P | Audio in | 300-8k | $1V_{pp}$ &2.5-2.78VDC | | |
| 11 / HSEAR N | Audio out | 20-20k | $1.25V_{pp}$ | 10Ω | |
| 12 / HSEAR P | Audio out | 20-20k | $1.25V_{pp}$ | 10Ω | |
| 13 / HSEAR R N | Audio out | 20-20k | $1.25V_{pp}$ | 10Ω | Not conn. in mono |
| 14 / HSEAR R P | Audio out | 20-20k | $1.25V_{pp}$ | 10Ω | Not conn. in mono |

## Baseband technical specifications

### External interfaces

| Name of Connection | Connector reference |
|---|---|
| USB | X2001 |
| Charger | X2000 |
| Headset | X2001 |
| SIM | X8302 |


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| Name of Connection | Connector reference |
|---|---|
| MicroSD | X8301 |
| Battery connector | X2070 |

## 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 |

## 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 |

## Charger connector and charging interface connections & electrical characteristics

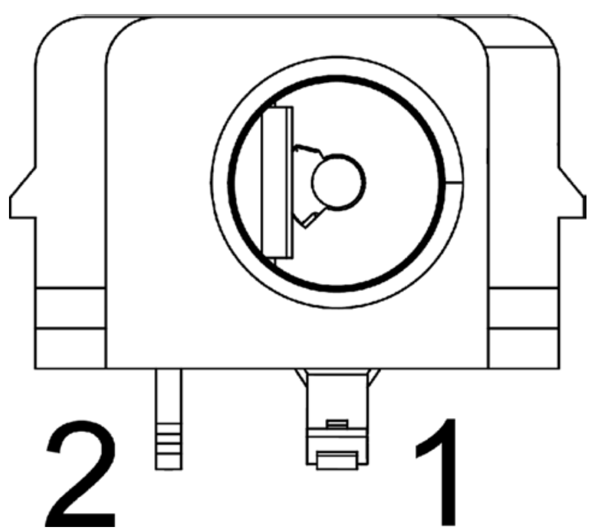


Figure 81 Charger connector


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**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 | 20 | 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 |
| Threshold for charging, falling (N2300) | $V_{MSTR-}$ | 1.9 | | V | Typical value |

## 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.

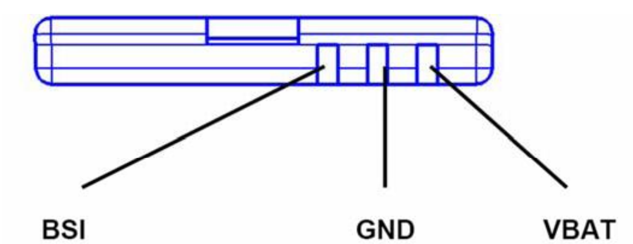


**Figure 82 Battery pin order**

**Table 24 Battery interface connections**

| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 1 | VBAT | -> | EM ASIC N2200 | VBAT | Battery voltage |
| 2 | GND | -> | GND | GND | Ground |


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| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 3 | BSI | -> | EM ASIC N2200 | BSI | Battery size indication (fixed resistor inside the battery pack) |

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.

## Internal interfaces

| Name of Connection | Connector reference |
|---|---|
| Display | X8001 in 1YC FPC |
| ALS | V8004 |
| Vibra | M2200 |
| Microphone | B2100 |
| Earpiece | B8000 in 1YC FPC |
| IHF speaker | B8200 in 1YC FPC |
| Side keys | X1550 |

## Display connector and interface connections

**Table 25 Display interface connections**

| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 1 | VLED1 - | <- | N2301 | VLEDout | N2301 is controlled by EM ASIC N2300 |
| 2 | VLED2- | <- | N2301 | VLEDout | N2301 is controlled by EM ASIC N2300 |
| 3 | VDDI | <- | EM ASIC N2200 | VAUX | Core Voltage |
| 4 | GND | | | | |
| 5 | WRX | <- | Application processor | Lcdrdx | Read Enable (active low) |
| 6 | DO | <- | Application processor | Lcdrmd | Data/ Command select<br>(high = data<br>low = command) |


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| Pin | Signal | I/O | Engine connection | | Notes |
|---|---|---|---|---|---|
| 7 | GND | <-> | Application processor | Lcdda1 | Data |
| 8 | D2 | <-> | Application processor | Lcdda3 | Data |
| 9 | D4 | | | | |
| 10 | D6 | <-> | Application processor | Lcdda5 | Data |
| 11 | CSX | <-> | Application processor | Lcdda7 | Data |
| 12 | RESX | -> | Application processor | Te | Tearing Effect |
| 13 | TE | <- | Application processor | Gpio60 | Reset (active low) |
| 14 | D7 | <- | Application processor | Lcdsx | Chip Select (active low) |
| 15 | D5 | <-> | Application processor | Lcdda6 | Data |
| 16 | GND | <-> | Application processor | Lcdda4 | Data |
| 17 | D3 | <-> | Application processor | Lcdda2 | Data |
| 18 | D1 | | | | |
| 19 | D/CX | <-> | Application processor | Lcdda0 | Data |
| 20 | RDX | -> | Application processor | Lcdwrx | Write Enable (active low) |
| 21 | GND | | | | |
| 22 | VDD | <- | EM ASIC N2200 | VIO | Interface voltage |
| 23 | VLED2+ | -> | R2303 | SETCURR1 | Resistor |
| 24 | VLED1+ | -> | R2303 | SETCURR1 | Resistor |

## Back-up battery interface electrical characteristics

**Table 26 Back-up battery connections**

| Pin name | I/O | Connection | Notes |
|---|---|---|---|
| VBack | -> | N2200, VBack | Back-up battery G2200 is connected to N2200. |


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Table 27 Back-up battery electrical characteristics

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

## RF description

### Introduction to receiver functionality

Receiver functions are implemented in RF ASIC N7500.

The receiver is a linear direct conversion receiver containing LNA, band pass filter and demodulator for each supported system and band. A second band filter is used between the LNA and demodulator in WCDMA.

After the demodulators the signal paths are combined to one common BB path.

### WCDMA receiver

In WCDMA mode the received signal is fed from the antenna to the BAW duplex filter. After the duplex filter the signal goes via balun to the integrated LNA in N7500. After the LNA the signal goes trough band pass filter.

After filtering the signal goes to the down conversion mixer, which converts the signal into baseband I and Q signals (90 degrees phase shift). After the demodulator output there is a RC low pass filter with f0 of ca. 1.5 MHz.

The Rx channel filter must be calibrated with an automatic routine whenever N7500 IC is changed to a phone.

In WCDMA mode the corner frequency of the filter is set to ca. 2.1MHz. The filter is followed by an AGC amplifier with adjustable gain. Signal is further amplified before it is fed to balanced analog IQ output pins. Analog output pins are accompanied by reference voltage output, which sets the DC level for the AD converter in BB ASIC.

### GSM receiver

As GSM850, GSM900, GSM1800 and GSM1900 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 band and RX/TX. The antenna switch module is followed by integrated LNA stages in the RF ASIC. The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

In the BB-chain there are two adjustable gain stages and one mode specific gain. The first one called BB-gain is just after the demodulator. It has a 12 dB gain range with 6dB steps. After the BB-gain there is the channel select filter.

Main AGC amplifier proceeds the channel selection filter. It has 30 dB of gain control range with 3 dB steps. Final amplifier stage is used as an output buffer for IQ signals. This stage is set to 0 dB gain in GSM mode.


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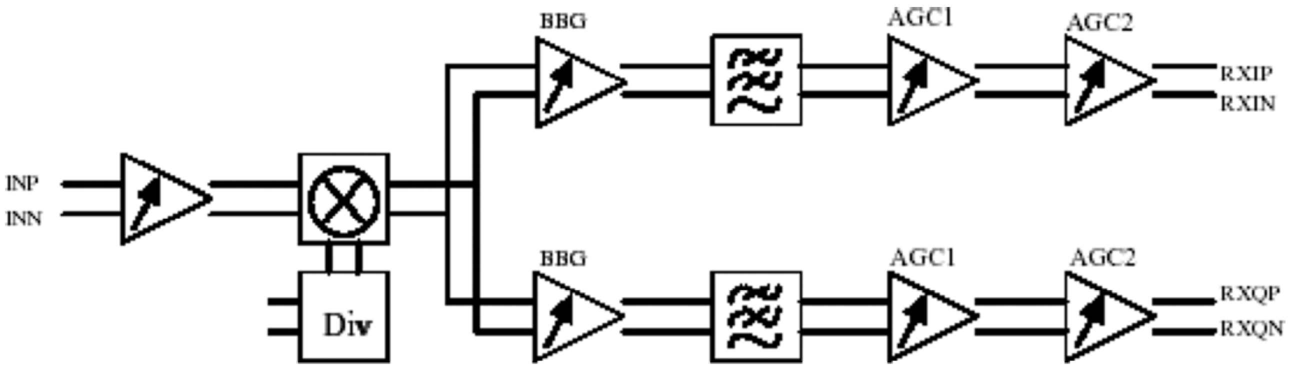


**Figure 83 GSM receiver after the antenna switch**

## Introduction to transmitter functionality

Transmitter functions are implemented in the ASIC N7500. It contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use. In addition N7500 contain three separate RF paths (GSM850/900, GSM1800/1900 and WCDMA1900/2100) comprising of a final frequency IQ modulator and VGA amplifiers.

## WCDMA transmitter

In the transmitter side, an analogue I/Q modulated signal is received from the digital baseband into N7500 and fed through the low pass filter. The corner frequency of the filter is set to approximately 3 MHz.

After the filter the signal is fed to the IQ modulator, which converts the signal to final Tx frequency. There are two separate I/Q modulators:.one for WCDMA and another for GSM850/EGSM900 and DCS1800/PCS1900 signals.

The WCDMA branch is selected by biasing the appropriate modulator. The modulator is followed by two VGA stages giving (85 dB) of gain control range. The signal then exits N7500 via a balanced line.

After the PA the transmitted WCDMA signal is fed through a duplex filter to the antenna.

### WCDMA power control

WCDMA TX power control is done by the two VGA stages in N7500 ASIC. The VGA have a common temperature compensation circuit and one voltage mode analog input for gain control (TXC).

The gain of the VGA amplifier chain is controlled by a DA converter in BB. The same DA converter is shared by GSM Tx power control function.

### WCDMA PA module

The WCDMA PA is housed in a separate module having:

- a variable supply voltage input for the amplifier stages (Vcc11),
- a battery supply voltage for the bias circuits (Vcc12),
- one bias current inputs.

Bias currents are generated by 5-bit DA (DAC201) converter in N7500 RF ASIC. The converter is controlled via RFBus.

### PA DCDC converter

A 5 bit DA (DAC101) converter in N7500 RF ASIC controls the DC-DC converter. The converter is controlled via RFBus. The DCDC converter limits the lowest supply voltage to 1.3 V. At highest power levels the DCDC converter output settles nominally to 3.1 V.


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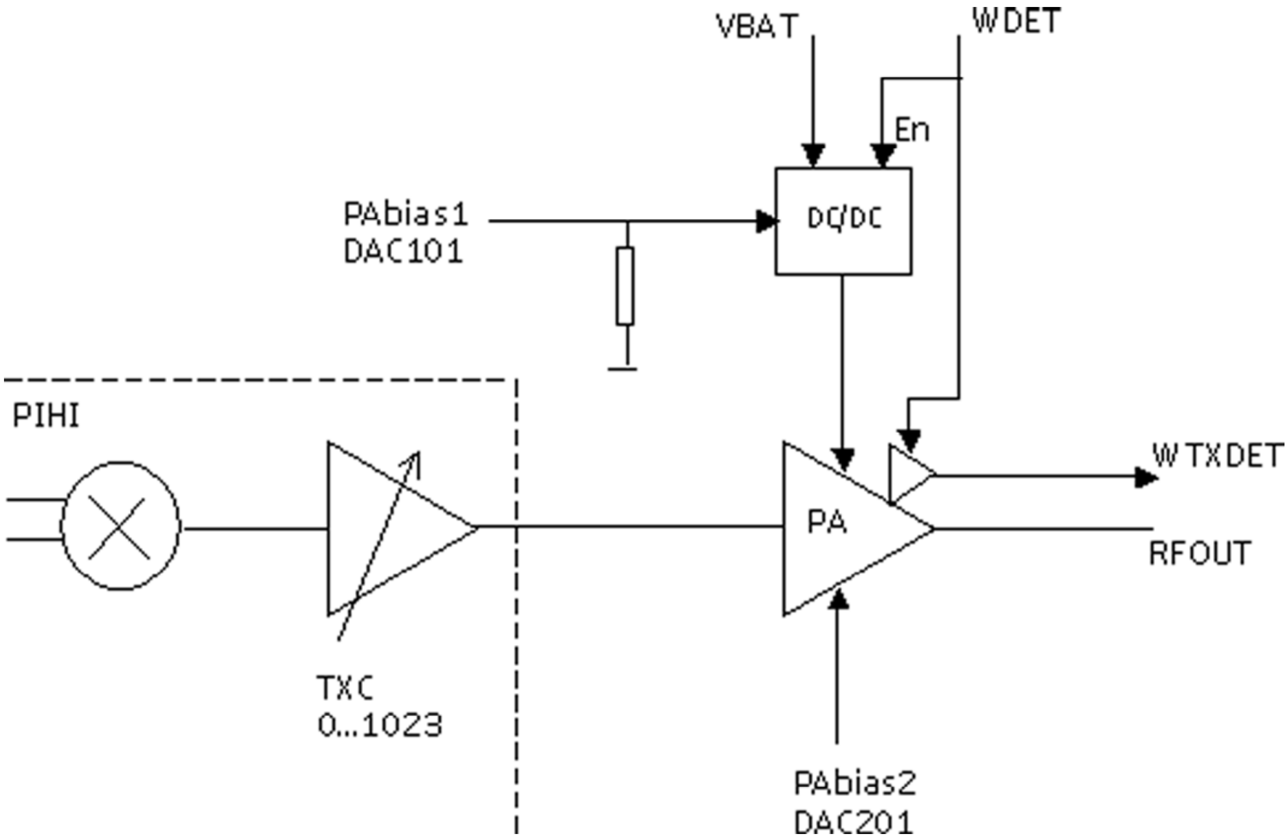


**Figure 84 Block diagram of DCDC converter and WCDMA PA**

## GSM transmitter

An analog IQ modulated signal is fed to N7500 from Digital BB in current form. It is first low pass filtered with filter corner frequency set to ca. 200 kHz. After the filter the signal is routed to the GSM modulator. The appropriate routing after the modulator is selected by biasing either GSM850/EGSM900 or DCS1800/PCS1900 variable gain amplifier. The amplifier gives 55 dB of power control dynamic range.

After the VGA stage the signal exits N7500. In case of DCS1800/PCS1900 the signal goes directly to the GSM PA module. In case of GSM850/EGSM900 the PA module is preceded by a switch able SAW filter. After the filter, the signal is fed to GSM TX front-end module (TXFEM), which also contains antenna switch.

## GSM power control

A closed control loop comprising of an integrated power detector (in PA module) and an error amplifier, which is integrated in N7500, controls GSM transmitter power. Detector output from the PA gives a DC level proportional to the output power.

**Note:** Timings are not shown accurately in the previous figure.

## GSM PA module

TXFEM module contains two separate amplifier chains, one for GSM850/EGSM900 and another for DCS1800/PCS1900. Both amplifiers have a battery supply connection and two bias current inputs.

## Frequency synthesizers

RF have separate synthesizers for WCDMA RX and WCDMA TX / one for GSM TX / RX.


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## Reference oscillators

As a reference oscillator for the frequency synthesizers a 38.4MHz VCTCXO (voltage controlled temperature compensated crystal oscillator) is used.

### Regulators

RF is combined with mixed mode ASIC Betty that contains the DA converters for power control and AFC functions, a slow AD converter for WCDMA power detection and other measurements. It also contains a regulator for VCTXCO and it's peripherals.

N7500 contain integrated regulators to supply regulated voltages for their internal circuitry and other RF parts.

## Antenna connections

Device includes two different PIFA type antennas. WCDMA antenna has one feed and one ground contact. GSM antenna is like normal dual band PIFA antenna (one feed and one ground point) but then there is also extra ground point, which is connected certain point of the PIFA element. That point has been grounded via PHEMT switch to certain load so that antenna resonance will spread. This way it is possible to have two different dual band antennas (900/1800 or 850/1900). All contacts are made with C-clips springs. BT/WLAN antenna consists of a ceramic resonator.


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## Frequency mappings

### GSM850 frequencies

| CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX | CH | TX | RX | VCO TX | VCO RX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 128 | 824.2 | 869.2 | 3296.8 | 3476.8 | 170 | 832.6 | 877.6 | 3330.4 | 3510.4 | 212 | 841.0 | 886.0 | 3364.0 | 3544.0 |
| 129 | 824.4 | 869.4 | 3297.6 | 3477.6 | 171 | 832.8 | 877.8 | 3331.2 | 3511.2 | 213 | 841.2 | 886.2 | 3364.8 | 3544.8 |
| 130 | 824.6 | 869.6 | 3298.4 | 3478.4 | 172 | 833.0 | 878.0 | 3332.0 | 3512.0 | 214 | 841.4 | 886.4 | 3365.6 | 3545.6 |
| 131 | 824.8 | 869.8 | 3299.2 | 3479.2 | 173 | 833.2 | 878.2 | 3332.8 | 3512.8 | 215 | 841.6 | 886.6 | 3366.4 | 3546.4 |
| 132 | 825.0 | 870.0 | 3300.0 | 3480.0 | 174 | 833.4 | 878.4 | 3333.6 | 3513.6 | 216 | 841.8 | 886.8 | 3367.2 | 3547.2 |
| 133 | 825.2 | 870.2 | 3300.8 | 3480.8 | 175 | 833.6 | 878.6 | 3334.4 | 3514.4 | 217 | 842.0 | 887.0 | 3368.0 | 3548.0 |
| 134 | 825.4 | 870.4 | 3301.6 | 3481.6 | 176 | 833.8 | 878.8 | 3335.2 | 3515.2 | 218 | 842.2 | 887.2 | 3368.8 | 3548.8 |
| 135 | 825.6 | 870.6 | 3302.4 | 3482.4 | 177 | 834.0 | 879.0 | 3336.0 | 3516.0 | 219 | 842.4 | 887.4 | 3369.6 | 3549.6 |
| 136 | 825.8 | 870.8 | 3303.2 | 3483.2 | 178 | 834.2 | 879.2 | 3336.8 | 3516.8 | 220 | 842.6 | 887.6 | 3370.4 | 3550.4 |
| 137 | 826.0 | 871.0 | 3304.0 | 3484.0 | 179 | 834.4 | 879.4 | 3337.6 | 3517.6 | 221 | 842.8 | 887.8 | 3371.2 | 3551.2 |
| 138 | 826.2 | 871.2 | 3304.8 | 3484.8 | 180 | 834.6 | 879.6 | 3338.4 | 3518.4 | 222 | 843.0 | 888.0 | 3372.0 | 3552.0 |
| 139 | 826.4 | 871.4 | 3305.6 | 3485.6 | 181 | 834.8 | 879.8 | 3339.2 | 3519.2 | 223 | 843.2 | 888.2 | 3372.8 | 3552.8 |
| 140 | 826.6 | 871.6 | 3306.4 | 3486.4 | 182 | 835.0 | 880.0 | 3340.0 | 3520.0 | 224 | 843.4 | 888.4 | 3373.6 | 3553.6 |
| 141 | 826.8 | 871.8 | 3307.2 | 3487.2 | 183 | 835.2 | 880.2 | 3340.8 | 3520.8 | 225 | 843.6 | 888.6 | 3374.4 | 3554.4 |
| 142 | 827.0 | 872.0 | 3308.0 | 3488.0 | 184 | 835.4 | 880.4 | 3341.6 | 3521.6 | 226 | 843.8 | 888.8 | 3375.2 | 3555.2 |
| 143 | 827.2 | 872.2 | 3308.8 | 3488.8 | 185 | 835.6 | 880.6 | 3342.4 | 3522.4 | 227 | 844.0 | 889.0 | 3376.0 | 3556.0 |
| 144 | 827.4 | 872.4 | 3309.6 | 3489.6 | 186 | 835.8 | 880.8 | 3343.2 | 3523.2 | 228 | 844.2 | 889.2 | 3376.8 | 3556.8 |
| 145 | 827.6 | 872.6 | 3310.4 | 3490.4 | 187 | 836.0 | 881.0 | 3344.0 | 3524.0 | 229 | 844.4 | 889.4 | 3377.6 | 3557.6 |
| 146 | 827.8 | 872.8 | 3311.2 | 3491.2 | 188 | 836.2 | 881.2 | 3344.8 | 3524.8 | 230 | 844.6 | 889.6 | 3378.4 | 3558.4 |
| 147 | 828.0 | 873.0 | 3312.0 | 3492.0 | 189 | 836.4 | 881.4 | 3345.6 | 3525.6 | 231 | 844.8 | 889.8 | 3379.2 | 3559.2 |
| 148 | 828.2 | 873.2 | 3312.8 | 3492.8 | 190 | 836.6 | 881.6 | 3346.4 | 3526.4 | 232 | 845.0 | 890.0 | 3380.0 | 3560.0 |
| 149 | 828.4 | 873.4 | 3313.6 | 3493.6 | 191 | 836.8 | 881.8 | 3347.2 | 3527.2 | 233 | 845.2 | 890.2 | 3380.8 | 3560.8 |
| 150 | 828.6 | 873.6 | 3314.4 | 3494.4 | 192 | 837.0 | 882.0 | 3348.0 | 3528.0 | 234 | 845.4 | 890.4 | 3381.6 | 3561.6 |
| 151 | 828.8 | 873.8 | 3315.2 | 3495.2 | 193 | 837.2 | 882.2 | 3348.8 | 3528.8 | 235 | 845.6 | 890.6 | 3382.4 | 3562.4 |
| 152 | 829.0 | 874.0 | 3316.0 | 3496.0 | 194 | 837.4 | 882.4 | 3349.6 | 3529.6 | 236 | 845.8 | 890.8 | 3383.2 | 3563.2 |
| 153 | 829.2 | 874.2 | 3316.8 | 3496.8 | 195 | 837.6 | 882.6 | 3350.4 | 3530.4 | 237 | 846.0 | 891.0 | 3384.0 | 3564.0 |
| 154 | 829.4 | 874.4 | 3317.6 | 3497.6 | 196 | 837.8 | 882.8 | 3351.2 | 3531.2 | 238 | 846.2 | 891.2 | 3384.8 | 3564.8 |
| 155 | 829.6 | 874.6 | 3318.4 | 3498.4 | 197 | 838.0 | 883.0 | 3352.0 | 3532.0 | 239 | 846.4 | 891.4 | 3385.6 | 3565.6 |
| 156 | 829.8 | 874.8 | 3319.2 | 3499.2 | 198 | 838.2 | 883.2 | 3352.8 | 3532.8 | 240 | 846.6 | 891.6 | 3386.4 | 3566.4 |
| 157 | 830.0 | 875.0 | 3320.0 | 3500.0 | 199 | 838.4 | 883.4 | 3353.6 | 3533.6 | 241 | 846.8 | 891.8 | 3387.2 | 3567.2 |
| 158 | 830.2 | 875.2 | 3320.8 | 3500.8 | 200 | 838.6 | 883.6 | 3354.4 | 3534.4 | 242 | 847.0 | 892.0 | 3388.0 | 3568.0 |
| 159 | 830.4 | 875.4 | 3321.6 | 3501.6 | 201 | 838.8 | 883.8 | 3355.2 | 3535.2 | 243 | 847.2 | 892.2 | 3388.8 | 3568.8 |
| 160 | 830.6 | 875.6 | 3322.4 | 3502.4 | 202 | 839.0 | 884.0 | 3356.0 | 3536.0 | 244 | 847.4 | 892.4 | 3389.6 | 3569.6 |
| 161 | 830.8 | 875.8 | 3323.2 | 3503.2 | 203 | 839.2 | 884.2 | 3356.8 | 3536.8 | 245 | 847.6 | 892.6 | 3390.4 | 3570.4 |
| 162 | 831.0 | 876.0 | 3324.0 | 3504.0 | 204 | 839.4 | 884.4 | 3357.6 | 3537.6 | 246 | 847.8 | 892.8 | 3391.2 | 3571.2 |
| 163 | 831.2 | 876.2 | 3324.8 | 3504.8 | 205 | 839.6 | 884.6 | 3358.4 | 3538.4 | 247 | 848.0 | 893.0 | 3392.0 | 3572.0 |
| 164 | 831.4 | 876.4 | 3325.6 | 3505.6 | 206 | 839.8 | 884.8 | 3359.2 | 3539.2 | 248 | 848.2 | 893.2 | 3392.8 | 3572.8 |
| 165 | 831.6 | 876.6 | 3326.4 | 3506.4 | 207 | 840.0 | 885.0 | 3360.0 | 3540.0 | 249 | 848.4 | 893.4 | 3393.6 | 3573.6 |
| 166 | 831.8 | 876.8 | 3327.2 | 3507.2 | 208 | 840.2 | 885.2 | 3360.8 | 3540.8 | 250 | 848.6 | 893.6 | 3394.4 | 3574.4 |
| 167 | 832.0 | 877.0 | 3328.0 | 3508.0 | 209 | 840.4 | 885.4 | 3361.6 | 3541.6 | 251 | 848.8 | 893.8 | 3395.2 | 3575.2 |


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## 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 |


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## 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 | | | | | | | | | | |


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## 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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## WCDMA 2100 Rx frequencies

| Ch | RX | VCO RX | Ch | RX | VCO RX | Ch | RX | VCO RX | Ch | RX | VCO RX | Ch | RX | VCO RX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10562 | 2112.4 | 4224.8 | 10625 | 2125 | 4250 | 10688 | 2137.6 | 4275.2 | 10751 | 2150.2 | 4300.4 | 10814 | 2162.8 | 4325.6 |
| 10563 | 2112.6 | 4225.2 | 10626 | 2125.2 | 4250.4 | 10689 | 2137.8 | 4275.6 | 10752 | 2150.4 | 4300.8 | 10815 | 2163 | 4326 |
| 10564 | 2112.8 | 4225.6 | 10627 | 2125.4 | 4250.8 | 10690 | 2138 | 4276 | 10753 | 2150.6 | 4301.2 | 10816 | 2163.2 | 4326.4 |
| 10565 | 2113 | 4226 | 10628 | 2125.6 | 4251.2 | 10691 | 2138.2 | 4276.4 | 10754 | 2150.8 | 4301.6 | 10817 | 2163.4 | 4326.8 |
| 10566 | 2113.2 | 4226.4 | 10629 | 2125.8 | 4251.6 | 10692 | 2138.4 | 4276.8 | 10755 | 2151 | 4302 | 10818 | 2163.6 | 4327.2 |
| 10567 | 2113.4 | 4226.8 | 10630 | 2126 | 4252 | 10693 | 2138.6 | 4277.2 | 10756 | 2151.2 | 4302.4 | 10819 | 2163.8 | 4327.6 |
| 10568 | 2113.6 | 4227.2 | 10631 | 2126.2 | 4252.4 | 10694 | 2138.8 | 4277.6 | 10757 | 2151.4 | 4302.8 | 10820 | 2164 | 4328 |
| 10569 | 2113.8 | 4227.6 | 10632 | 2126.4 | 4252.8 | 10695 | 2139 | 4278 | 10758 | 2151.6 | 4303.2 | 10821 | 2164.2 | 4328.4 |
| 10570 | 2114 | 4228 | 10633 | 2126.6 | 4253.2 | 10696 | 2139.2 | 4278.4 | 10759 | 2151.8 | 4303.6 | 10822 | 2164.4 | 4328.8 |
| 10571 | 2114.2 | 4228.4 | 10634 | 2126.8 | 4253.6 | 10697 | 2139.4 | 4278.8 | 10760 | 2152 | 4304 | 10823 | 2164.6 | 4329.2 |
| 10572 | 2114.4 | 4228.8 | 10635 | 2127 | 4254 | 10698 | 2139.6 | 4279.2 | 10761 | 2152.2 | 4304.4 | 10824 | 2164.8 | 4329.6 |
| 10573 | 2114.6 | 4229.2 | 10636 | 2127.2 | 4254.4 | 10699 | 2139.8 | 4279.6 | 10762 | 2152.4 | 4304.8 | 10825 | 2165 | 4330 |
| 10574 | 2114.8 | 4229.6 | 10637 | 2127.4 | 4254.8 | 10700 | 2140 | 4280 | 10763 | 2152.6 | 4305.2 | 10826 | 2165.2 | 4330.4 |
| 10575 | 2115 | 4230 | 10638 | 2127.6 | 4255.2 | 10701 | 2140.2 | 4280.4 | 10764 | 2152.8 | 4305.6 | 10827 | 2165.4 | 4330.8 |
| 10576 | 2115.2 | 4230.4 | 10639 | 2127.8 | 4255.6 | 10702 | 2140.4 | 4280.8 | 10765 | 2153 | 4306 | 10828 | 2165.6 | 4331.2 |
| 10577 | 2115.4 | 4230.8 | 10640 | 2128 | 4256 | 10703 | 2140.6 | 4281.2 | 10766 | 2153.2 | 4306.4 | 10829 | 2165.8 | 4331.6 |
| 10578 | 2115.6 | 4231.2 | 10641 | 2128.2 | 4256.4 | 10704 | 2140.8 | 4281.6 | 10767 | 2153.4 | 4306.8 | 10830 | 2166 | 4332 |
| 10579 | 2115.8 | 4231.6 | 10642 | 2128.4 | 4256.8 | 10705 | 2141 | 4282 | 10768 | 2153.6 | 4307.2 | 10831 | 2166.2 | 4332.4 |
| 10580 | 2116 | 4232 | 10643 | 2128.6 | 4257.2 | 10706 | 2141.2 | 4282.4 | 10769 | 2153.8 | 4307.6 | 10832 | 2166.4 | 4332.8 |
| 10581 | 2116.2 | 4232.4 | 10644 | 2128.8 | 4257.6 | 10707 | 2141.4 | 4282.8 | 10770 | 2154 | 4308 | 10833 | 2166.6 | 4333.2 |
| 10582 | 2116.4 | 4232.8 | 10645 | 2129 | 4258 | 10708 | 2141.6 | 4283.2 | 10771 | 2154.2 | 4308.4 | 10834 | 2166.8 | 4333.6 |
| 10583 | 2116.6 | 4233.2 | 10646 | 2129.2 | 4258.4 | 10709 | 2141.8 | 4283.6 | 10772 | 2154.4 | 4308.8 | 10835 | 2167 | 4334 |
| 10584 | 2116.8 | 4233.6 | 10647 | 2129.4 | 4258.8 | 10710 | 2142 | 4284 | 10773 | 2154.6 | 4309.2 | 10836 | 2167.2 | 4334.4 |
| 10585 | 2117 | 4234 | 10648 | 2129.6 | 4259.2 | 10711 | 2142.2 | 4284.4 | 10774 | 2154.8 | 4309.6 | 10837 | 2167.4 | 4334.8 |
| 10586 | 2117.2 | 4234.4 | 10649 | 2129.8 | 4259.6 | 10712 | 2142.4 | 4284.8 | 10775 | 2155 | 4310 | 10838 | 2167.6 | 4335.2 |
| 10587 | 2117.4 | 4234.8 | 10650 | 2130 | 4260 | 10713 | 2142.6 | 4285.2 | 10776 | 2155.2 | 4310.4 | | | |
| 10588 | 2117.6 | 4235.2 | 10651 | 2130.2 | 4260.4 | 10714 | 2142.8 | 4285.6 | 10777 | 2155.4 | 4310.8 | | | |
| 10589 | 2117.8 | 4235.6 | 10652 | 2130.4 | 4260.8 | 10715 | 2143 | 4286 | 10778 | 2155.6 | 4311.2 | | | |
| 10590 | 2118 | 4236 | 10653 | 2130.6 | 4261.2 | 10716 | 2143.2 | 4286.4 | 10779 | 2155.8 | 4311.6 | | | |
| 10591 | 2118.2 | 4236.4 | 10654 | 2130.8 | 4261.6 | 10717 | 2143.4 | 4286.8 | 10780 | 2156 | 4312 | | | |
| 10592 | 2118.4 | 4236.8 | 10655 | 2131 | 4262 | 10718 | 2143.6 | 4287.2 | 10781 | 2156.2 | 4312.4 | | | |
| 10593 | 2118.6 | 4237.2 | 10656 | 2131.2 | 4262.4 | 10719 | 2143.8 | 4287.6 | 10782 | 2156.4 | 4312.8 | | | |
| 10594 | 2118.8 | 4237.6 | 10657 | 2131.4 | 4262.8 | 10720 | 2144 | 4288 | 10783 | 2156.6 | 4313.2 | | | |
| 10595 | 2119 | 4238 | 10658 | 2131.6 | 4263.2 | 10721 | 2144.2 | 4288.4 | 10784 | 2156.8 | 4313.6 | | | |
| 10596 | 2119.2 | 4238.4 | 10659 | 2131.8 | 4263.6 | 10722 | 2144.4 | 4288.8 | 10785 | 2157 | 4314 | | | |
| 10597 | 2119.4 | 4238.8 | 10660 | 2132 | 4264 | 10723 | 2144.6 | 4289.2 | 10786 | 2157.2 | 4314.4 | | | |
| 10598 | 2119.6 | 4239.2 | 10661 | 2132.2 | 4264.4 | 10724 | 2144.8 | 4289.6 | 10787 | 2157.4 | 4314.8 | | | |
| 10599 | 2119.8 | 4239.6 | 10662 | 2132.4 | 4264.8 | 10725 | 2145 | 4290 | 10788 | 2157.6 | 4315.2 | | | |
| 10600 | 2120 | 4240 | 10663 | 2132.6 | 4265.2 | 10726 | 2145.2 | 4290.4 | 10789 | 2157.8 | 4315.6 | | | |
| 10601 | 2120.2 | 4240.4 | 10664 | 2132.8 | 4265.6 | 10727 | 2145.4 | 4290.8 | 10790 | 2158 | 4316 | | | |
| 10602 | 2120.4 | 4240.8 | 10665 | 2133 | 4266 | 10728 | 2145.6 | 4291.2 | 10791 | 2158.2 | 4316.4 | | | |
| 10603 | 2120.6 | 4241.2 | 10666 | 2133.2 | 4266.4 | 10729 | 2145.8 | 4291.6 | 10792 | 2158.4 | 4316.8 | | | |
| 10604 | 2120.8 | 4241.6 | 10667 | 2133.4 | 4266.8 | 10730 | 2146 | 4292 | 10793 | 2158.6 | 4317.2 | | | |
| 10605 | 2121 | 4242 | 10668 | 2133.6 | 4267.2 | 10731 | 2146.2 | 4292.4 | 10794 | 2158.8 | 4317.6 | | | |
| 10606 | 2121.2 | 4242.4 | 10669 | 2133.8 | 4267.6 | 10732 | 2146.4 | 4292.8 | 10795 | 2159 | 4318 | | | |
| 10607 | 2121.4 | 4242.8 | 10670 | 2134 | 4268 | 10733 | 2146.6 | 4293.2 | 10796 | 2159.2 | 4318.4 | | | |
| 10608 | 2121.6 | 4243.2 | 10671 | 2134.2 | 4268.4 | 10734 | 2146.8 | 4293.6 | 10797 | 2159.4 | 4318.8 | | | |
| 10609 | 2121.8 | 4243.6 | 10672 | 2134.4 | 4268.8 | 10735 | 2147 | 4294 | 10798 | 2159.6 | 4319.2 | | | |
| 10610 | 2122 | 4244 | 10673 | 2134.6 | 4269.2 | 10736 | 2147.2 | 4294.4 | 10799 | 2159.8 | 4319.6 | | | |
| 10611 | 2122.2 | 4244.4 | 10674 | 2134.8 | 4269.6 | 10737 | 2147.4 | 4294.8 | 10800 | 2160 | 4320 | | | |
| 10612 | 2122.4 | 4244.8 | 10675 | 2135 | 4270 | 10738 | 2147.6 | 4295.2 | 10801 | 2160.2 | 4320.4 | | | |
| 10613 | 2122.6 | 4245.2 | 10676 | 2135.2 | 4270.4 | 10739 | 2147.8 | 4295.6 | 10802 | 2160.4 | 4320.8 | | | |
| 10614 | 2122.8 | 4245.6 | 10677 | 2135.4 | 4270.8 | 10740 | 2148 | 4296 | 10803 | 2160.6 | 4321.2 | | | |
| 10615 | 2123 | 4246 | 10678 | 2135.6 | 4271.2 | 10741 | 2148.2 | 4296.4 | 10804 | 2160.8 | 4321.6 | | | |
| 10616 | 2123.2 | 4246.4 | 10679 | 2135.8 | 4271.6 | 10742 | 2148.4 | 4296.8 | 10805 | 2161 | 4322 | | | |
| 10617 | 2123.4 | 4246.8 | 10680 | 2136 | 4272 | 10743 | 2148.6 | 4297.2 | 10806 | 2161.2 | 4322.4 | | | |
| 10618 | 2123.6 | 4247.2 | 10681 | 2136.2 | 4272.4 | 10744 | 2148.8 | 4297.6 | 10807 | 2161.4 | 4322.8 | | | |
| 10619 | 2123.8 | 4247.6 | 10682 | 2136.4 | 4272.8 | 10745 | 2149 | 4298 | 10808 | 2161.6 | 4323.2 | | | |
| 10620 | 2124 | 4248 | 10683 | 2136.6 | 4273.2 | 10746 | 2149.2 | 4298.4 | 10809 | 2161.8 | 4323.6 | | | |
| 10621 | 2124.2 | 4248.4 | 10684 | 2136.8 | 4273.6 | 10747 | 2149.4 | 4298.8 | 10810 | 2162 | 4324 | | | |
| 10622 | 2124.4 | 4248.8 | 10685 | 2137 | 4274 | 10748 | 2149.6 | 4299.2 | 10811 | 2162.2 | 4324.4 | | | |
| 10623 | 2124.6 | 4249.2 | 10686 | 2137.2 | 4274.4 | 10749 | 2149.8 | 4299.6 | 10812 | 2162.4 | 4324.8 | | | |
| 10624 | 2124.8 | 4249.6 | 10687 | 2137.4 | 4274.8 | 10750 | 2150 | 4300 | 10813 | 2162.6 | 4325.2 | | | |


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## WCDMA 2100 Tx frequencies

| Ch | Tx | VCO Tx | Ch | Tx | VCO Tx | Ch | Tx | VCO Tx | Ch | Tx | VCO Tx | Ch | Tx | VCO Tx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9612 | 1922.4 | 3844.8 | 9671 | 1934.2 | 3868.4 | 9730 | 1946 | 3892 | 9789 | 1957.8 | 3915.6 | 9848 | 1969.6 | 3939.2 |
| 9613 | 1922.6 | 3845.2 | 9672 | 1934.4 | 3868.8 | 9731 | 1946.2 | 3892.4 | 9790 | 1958 | 3916 | 9849 | 1969.8 | 3939.6 |
| 9614 | 1922.8 | 3845.6 | 9673 | 1934.6 | 3869.2 | 9732 | 1946.4 | 3892.8 | 9791 | 1958.2 | 3916.4 | 9850 | 1970 | 3940 |
| 9615 | 1923 | 3846 | 9674 | 1934.8 | 3869.6 | 9733 | 1946.6 | 3893.2 | 9792 | 1958.4 | 3916.8 | 9851 | 1970.2 | 3940.4 |
| 9616 | 1923.2 | 3846.4 | 9675 | 1935 | 3870 | 9734 | 1946.8 | 3893.6 | 9793 | 1958.6 | 3917.2 | 9852 | 1970.4 | 3940.8 |
| 9617 | 1923.4 | 3846.8 | 9676 | 1935.2 | 3870.4 | 9735 | 1947 | 3894 | 9794 | 1958.8 | 3917.6 | 9853 | 1970.6 | 3941.2 |
| 9618 | 1923.6 | 3847.2 | 9677 | 1935.4 | 3870.8 | 9736 | 1947.2 | 3894.4 | 9795 | 1959 | 3918 | 9854 | 1970.8 | 3941.6 |
| 9619 | 1923.8 | 3847.6 | 9678 | 1935.6 | 3871.2 | 9737 | 1947.4 | 3894.8 | 9796 | 1959.2 | 3918.4 | 9855 | 1971 | 3942 |
| 9620 | 1924 | 3848 | 9679 | 1935.8 | 3871.6 | 9738 | 1947.6 | 3895.2 | 9797 | 1959.4 | 3918.8 | 9856 | 1971.2 | 3942.4 |
| 9621 | 1924.2 | 3848.4 | 9680 | 1936 | 3872 | 9739 | 1947.8 | 3895.6 | 9798 | 1959.6 | 3919.2 | 9857 | 1971.4 | 3942.8 |
| 9622 | 1924.4 | 3848.8 | 9681 | 1936.2 | 3872.4 | 9740 | 1948 | 3896 | 9799 | 1959.8 | 3919.6 | 9858 | 1971.6 | 3943.2 |
| 9623 | 1924.6 | 3849.2 | 9682 | 1936.4 | 3872.8 | 9741 | 1948.2 | 3896.4 | 9800 | 1960 | 3920 | 9859 | 1971.8 | 3943.6 |
| 9624 | 1924.8 | 3849.6 | 9683 | 1936.6 | 3873.2 | 9742 | 1948.4 | 3896.8 | 9801 | 1960.2 | 3920.4 | 9860 | 1972 | 3944 |
| 9625 | 1925 | 3850 | 9684 | 1936.8 | 3873.6 | 9743 | 1948.6 | 3897.2 | 9802 | 1960.4 | 3920.8 | 9861 | 1972.2 | 3944.4 |
| 9626 | 1925.2 | 3850.4 | 9685 | 1937 | 3874 | 9744 | 1948.8 | 3897.6 | 9803 | 1960.6 | 3921.2 | 9862 | 1972.4 | 3944.8 |
| 9627 | 1925.4 | 3850.8 | 9686 | 1937.2 | 3874.4 | 9745 | 1949 | 3898 | 9804 | 1960.8 | 3921.6 | 9863 | 1972.6 | 3945.2 |
| 9628 | 1925.6 | 3851.2 | 9687 | 1937.4 | 3874.8 | 9746 | 1949.2 | 3898.4 | 9805 | 1961 | 3922 | 9864 | 1972.8 | 3945.6 |
| 9629 | 1925.8 | 3851.6 | 9688 | 1937.6 | 3875.2 | 9747 | 1949.4 | 3898.8 | 9806 | 1961.2 | 3922.4 | 9865 | 1973 | 3946 |
| 9630 | 1926 | 3852 | 9689 | 1937.8 | 3875.6 | 9748 | 1949.6 | 3899.2 | 9807 | 1961.4 | 3922.8 | 9866 | 1973.2 | 3946.4 |
| 9631 | 1926.2 | 3852.4 | 9690 | 1938 | 3876 | 9749 | 1949.8 | 3899.6 | 9808 | 1961.6 | 3923.2 | 9867 | 1973.4 | 3946.8 |
| 9632 | 1926.4 | 3852.8 | 9691 | 1938.2 | 3876.4 | 9750 | 1950 | 3900 | 9809 | 1961.8 | 3923.6 | 9868 | 1973.6 | 3947.2 |
| 9633 | 1926.6 | 3853.2 | 9692 | 1938.4 | 3876.8 | 9751 | 1950.2 | 3900.4 | 9810 | 1962 | 3924 | 9869 | 1973.8 | 3947.6 |
| 9634 | 1926.8 | 3853.6 | 9693 | 1938.6 | 3877.2 | 9752 | 1950.4 | 3900.8 | 9811 | 1962.2 | 3924.4 | 9870 | 1974 | 3948 |
| 9635 | 1927 | 3854 | 9694 | 1938.8 | 3877.6 | 9753 | 1950.6 | 3901.2 | 9812 | 1962.4 | 3924.8 | 9871 | 1974.2 | 3948.4 |
| 9636 | 1927.2 | 3854.4 | 9695 | 1939 | 3878 | 9754 | 1950.8 | 3901.6 | 9813 | 1962.6 | 3925.2 | 9872 | 1974.4 | 3948.8 |
| 9637 | 1927.4 | 3854.8 | 9696 | 1939.2 | 3878.4 | 9755 | 1951 | 3902 | 9814 | 1962.8 | 3925.6 | 9873 | 1974.6 | 3949.2 |
| 9638 | 1927.6 | 3855.2 | 9697 | 1939.4 | 3878.8 | 9756 | 1951.2 | 3902.4 | 9815 | 1963 | 3926 | 9874 | 1974.8 | 3949.6 |
| 9639 | 1927.8 | 3855.6 | 9698 | 1939.6 | 3879.2 | 9757 | 1951.4 | 3902.8 | 9816 | 1963.2 | 3926.4 | 9875 | 1975 | 3950 |
| 9640 | 1928 | 3856 | 9699 | 1939.8 | 3879.6 | 9758 | 1951.6 | 3903.2 | 9817 | 1963.4 | 3926.8 | 9876 | 1975.2 | 3950.4 |
| 9641 | 1928.2 | 3856.4 | 9700 | 1940 | 3880 | 9759 | 1951.8 | 3903.6 | 9818 | 1963.6 | 3927.2 | 9877 | 1975.4 | 3950.8 |
| 9642 | 1928.4 | 3856.8 | 9701 | 1940.2 | 3880.4 | 9760 | 1952 | 3904 | 9819 | 1963.8 | 3927.6 | 9878 | 1975.6 | 3951.2 |
| 9643 | 1928.6 | 3857.2 | 9702 | 1940.4 | 3880.8 | 9761 | 1952.2 | 3904.4 | 9820 | 1964 | 3928 | 9879 | 1975.8 | 3951.6 |
| 9644 | 1928.8 | 3857.6 | 9703 | 1940.6 | 3881.2 | 9762 | 1952.4 | 3904.8 | 9821 | 1964.2 | 3928.4 | 9880 | 1976 | 3952 |
| 9645 | 1929 | 3858 | 9704 | 1940.8 | 3881.6 | 9763 | 1952.6 | 3905.2 | 9822 | 1964.4 | 3928.8 | 9881 | 1976.2 | 3952.4 |
| 9646 | 1929.2 | 3858.4 | 9705 | 1941 | 3882 | 9764 | 1952.8 | 3905.6 | 9823 | 1964.6 | 3929.2 | 9882 | 1976.4 | 3952.8 |
| 9647 | 1929.4 | 3858.8 | 9706 | 1941.2 | 3882.4 | 9765 | 1953 | 3906 | 9824 | 1964.8 | 3929.6 | 9883 | 1976.6 | 3953.2 |
| 9648 | 1929.6 | 3859.2 | 9707 | 1941.4 | 3882.8 | 9766 | 1953.2 | 3906.4 | 9825 | 1965 | 3930 | 9884 | 1976.8 | 3953.6 |
| 9649 | 1929.8 | 3859.6 | 9708 | 1941.6 | 3883.2 | 9767 | 1953.4 | 3906.8 | 9826 | 1965.2 | 3930.4 | 9885 | 1977 | 3954 |
| 9650 | 1930 | 3860 | 9709 | 1941.8 | 3883.6 | 9768 | 1953.6 | 3907.2 | 9827 | 1965.4 | 3930.8 | 9886 | 1977.2 | 3954.4 |
| 9651 | 1930.2 | 3860.4 | 9710 | 1942 | 3884 | 9769 | 1953.8 | 3907.6 | 9828 | 1965.6 | 3931.2 | 9887 | 1977.4 | 3954.8 |
| 9652 | 1930.4 | 3860.8 | 9711 | 1942.2 | 3884.4 | 9770 | 1954 | 3908 | 9829 | 1965.8 | 3931.6 | 9888 | 1977.6 | 3955.2 |
| 9653 | 1930.6 | 3861.2 | 9712 | 1942.4 | 3884.8 | 9771 | 1954.2 | 3908.4 | 9830 | 1966 | 3932 | | | |
| 9654 | 1930.8 | 3861.6 | 9713 | 1942.6 | 3885.2 | 9772 | 1954.4 | 3908.8 | 9831 | 1966.2 | 3932.4 | | | |
| 9655 | 1931 | 3862 | 9714 | 1942.8 | 3885.6 | 9773 | 1954.6 | 3909.2 | 9832 | 1966.4 | 3932.8 | | | |
| 9656 | 1931.2 | 3862.4 | 9715 | 1943 | 3886 | 9774 | 1954.8 | 3909.6 | 9833 | 1966.6 | 3933.2 | | | |
| 9657 | 1931.4 | 3862.8 | 9716 | 1943.2 | 3886.4 | 9775 | 1955 | 3910 | 9834 | 1966.8 | 3933.6 | | | |
| 9658 | 1931.6 | 3863.2 | 9717 | 1943.4 | 3886.8 | 9776 | 1955.2 | 3910.4 | 9835 | 1967 | 3934 | | | |
| 9659 | 1931.8 | 3863.6 | 9718 | 1943.6 | 3887.2 | 9777 | 1955.4 | 3910.8 | 9836 | 1967.2 | 3934.4 | | | |
| 9660 | 1932 | 3864 | 9719 | 1943.8 | 3887.6 | 9778 | 1955.6 | 3911.2 | 9837 | 1967.4 | 3934.8 | | | |
| 9661 | 1932.2 | 3864.4 | 9720 | 1944 | 3888 | 9779 | 1955.8 | 3911.6 | 9838 | 1967.6 | 3935.2 | | | |
| 9662 | 1932.4 | 3864.8 | 9721 | 1944.2 | 3888.4 | 9780 | 1956 | 3912 | 9839 | 1967.8 | 3935.6 | | | |
| 9663 | 1932.6 | 3865.2 | 9722 | 1944.4 | 3888.8 | 9781 | 1956.2 | 3912.4 | 9840 | 1968 | 3936 | | | |
| 9664 | 1932.8 | 3865.6 | 9723 | 1944.6 | 3889.2 | 9782 | 1956.4 | 3912.8 | 9841 | 1968.2 | 3936.4 | | | |
| 9665 | 1933 | 3866 | 9724 | 1944.8 | 3889.6 | 9783 | 1956.6 | 3913.2 | 9842 | 1968.4 | 3936.8 | | | |
| 9666 | 1933.2 | 3866.4 | 9725 | 1945 | 3890 | 9784 | 1956.8 | 3913.6 | 9843 | 1968.6 | 3937.2 | | | |
| 9667 | 1933.4 | 3866.8 | 9726 | 1945.2 | 3890.4 | 9785 | 1957 | 3914 | 9844 | 1968.8 | 3937.6 | | | |
| 9668 | 1933.6 | 3867.2 | 9727 | 1945.4 | 3890.8 | 9786 | 1957.2 | 3914.4 | 9845 | 1969 | 3938 | | | |
| 9669 | 1933.8 | 3867.6 | 9728 | 1945.6 | 3891.2 | 9787 | 1957.4 | 3914.8 | 9846 | 1969.2 | 3938.4 | | | |
| 9670 | 1934 | 3868 | 9729 | 1945.8 | 3891.6 | 9788 | 1957.6 | 3915.2 | 9847 | 1969.4 | 3938.8 | | | |


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# 10 — Schematics


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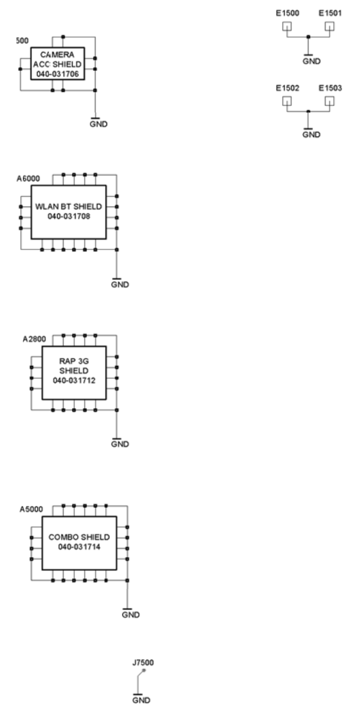
## BB and RF shields





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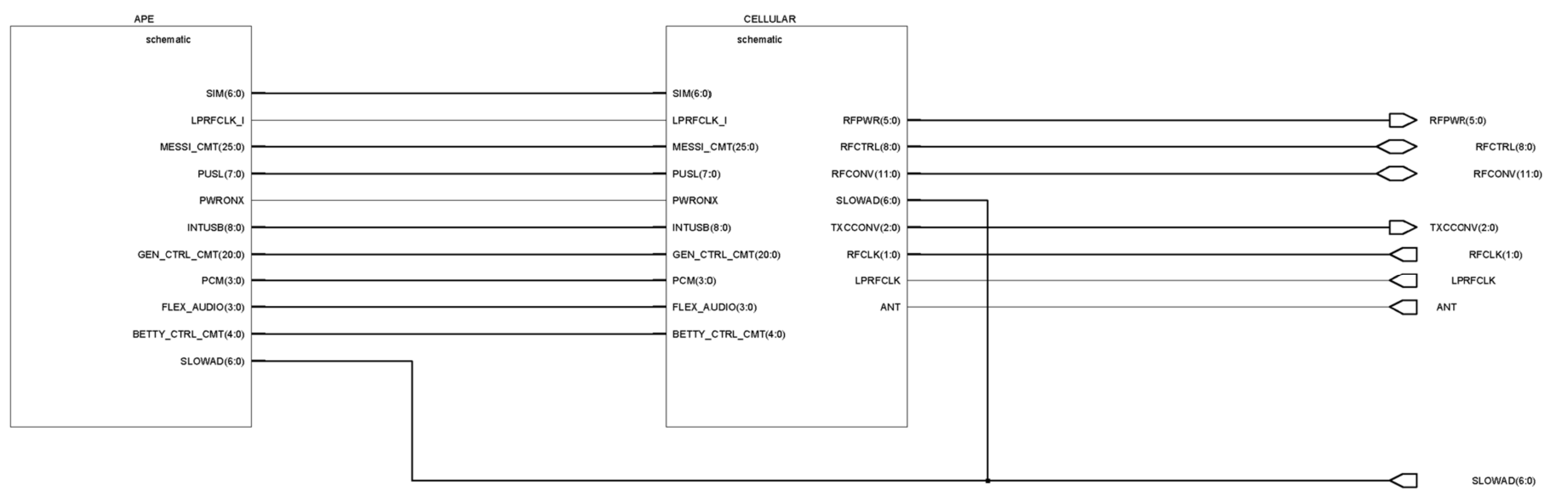
## BB top level





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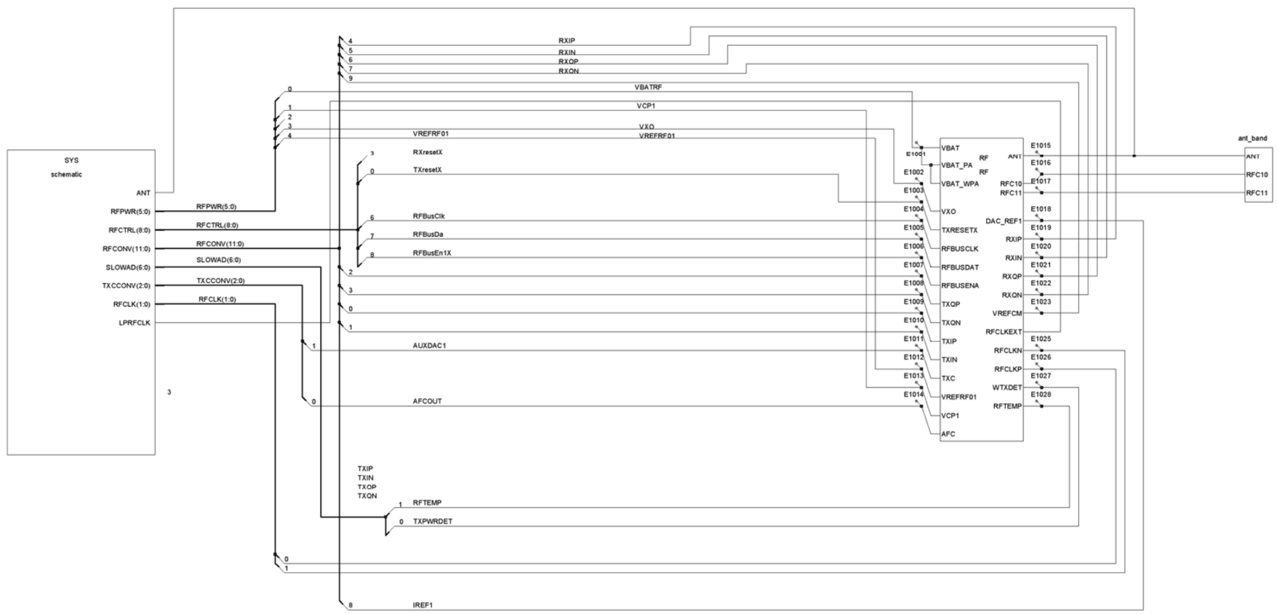
## BB and RF




| CMT SHEET NAME | REF AREA |
|---|---|
| 1yb_hw/cellular/cmt_engine/digi/rap | 2800-2899 |
| 1yb_hw/cellular/cmt_engine/digi/mem_cmt | 3000-3099 |
| 1yb_hw/cellular/cmt_engine/power/retu | 2200-2299 |
| 1yb_hw/cellular/cmt_engine/power/tahvo | 2300-2399 |
| 1yb_hw/cellular/cmt_if/sys_conn | 2000-2059 |
| 1yb_hw/cellular/cmt_if/prod_test_pattern | 2060-2069 |
| 1yb_hw/cellular/cmt_if/battery_conn | 2070-2099 |
| 1yb_hw/cellular/cmt_if/audio | 2100-2199 |
| 1yb_hw/cellular/cmt_if/sim | 2700-2759 |
| | |

| APE SHEET NAME | REF AREA |
|---|---|
| 1yb_hw/ape/ape_engine/mem_ape | 5000-5099 |
| 1yb_hw/ape/ape_engine/cpu | 4800-4899 |
| 1yb_hw/ape/ape_engine/pwr_ape | 4200-4399 |
| 1yb_hw/ape/ape_if/emu_ape | 5100-5199 |
| 1yb_hw/ape/ape_if/bluetooth | 6000-6099 |
| 1yb_hw/ape/ape_if/mmc | 5200-5299 |
| 1yb_hw/ape/ape_if/camera | 1500-1599 |
| 1yb_hw/ape/ape_if/ui | 4400-4599 |
| | |
| | |

| RF SHEET NAME | REF AREA |
|---|---|
| 1yb_hw/RF | 7500-7599 |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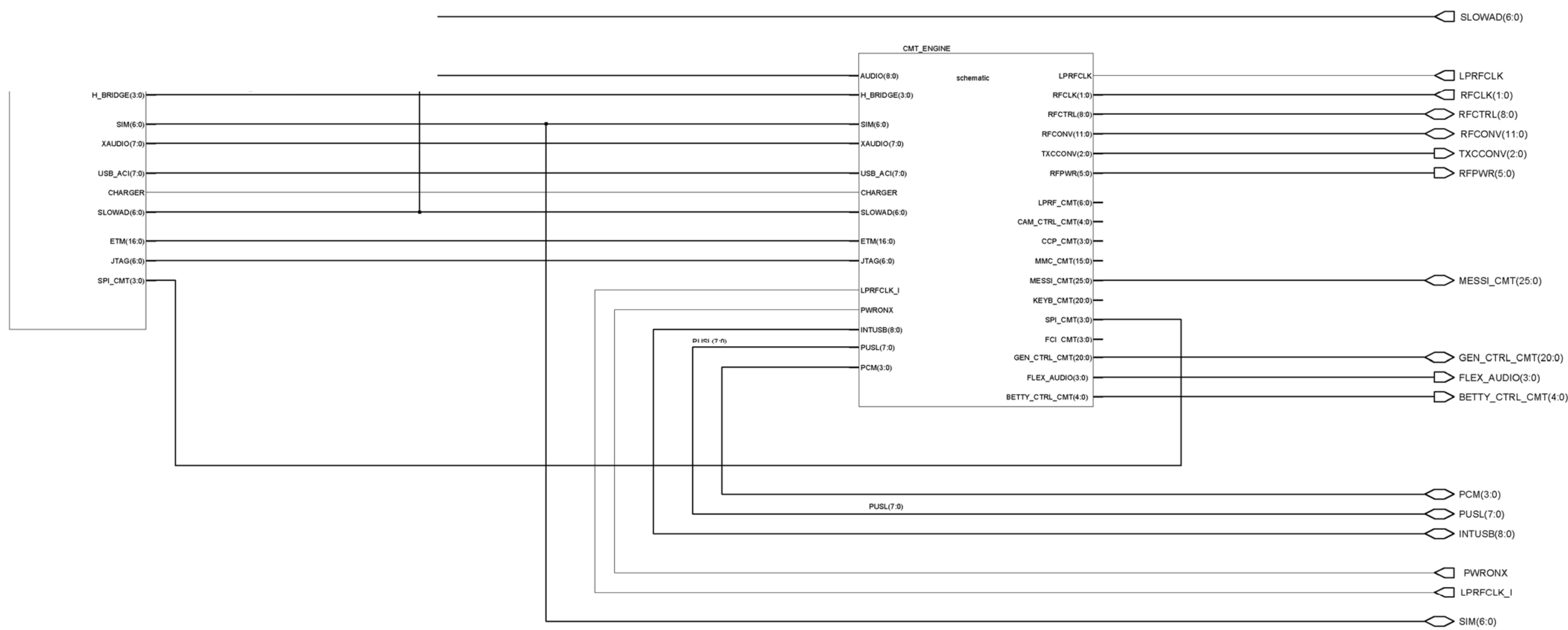
## BB top level 2





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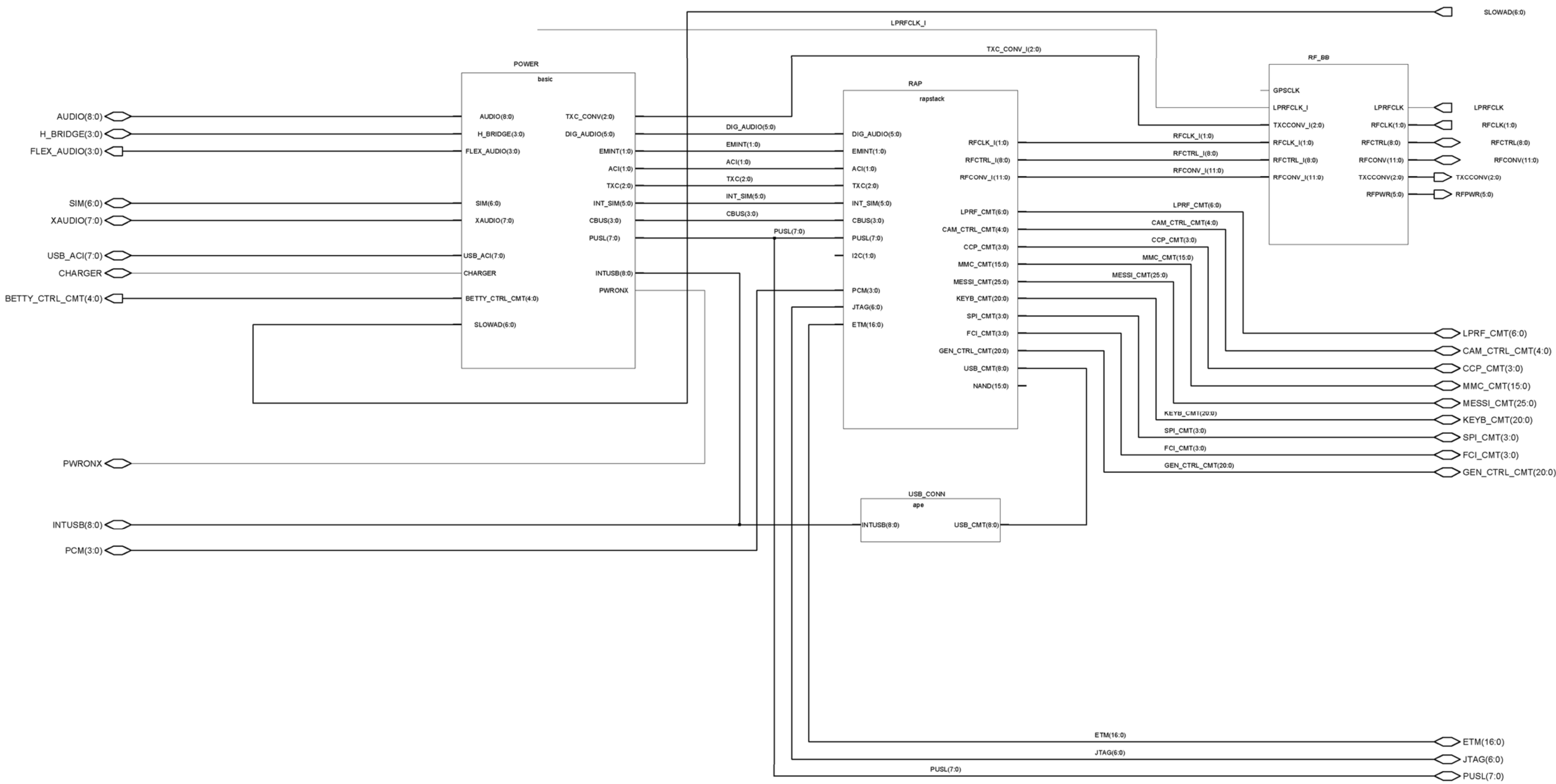
## CMT engine top level





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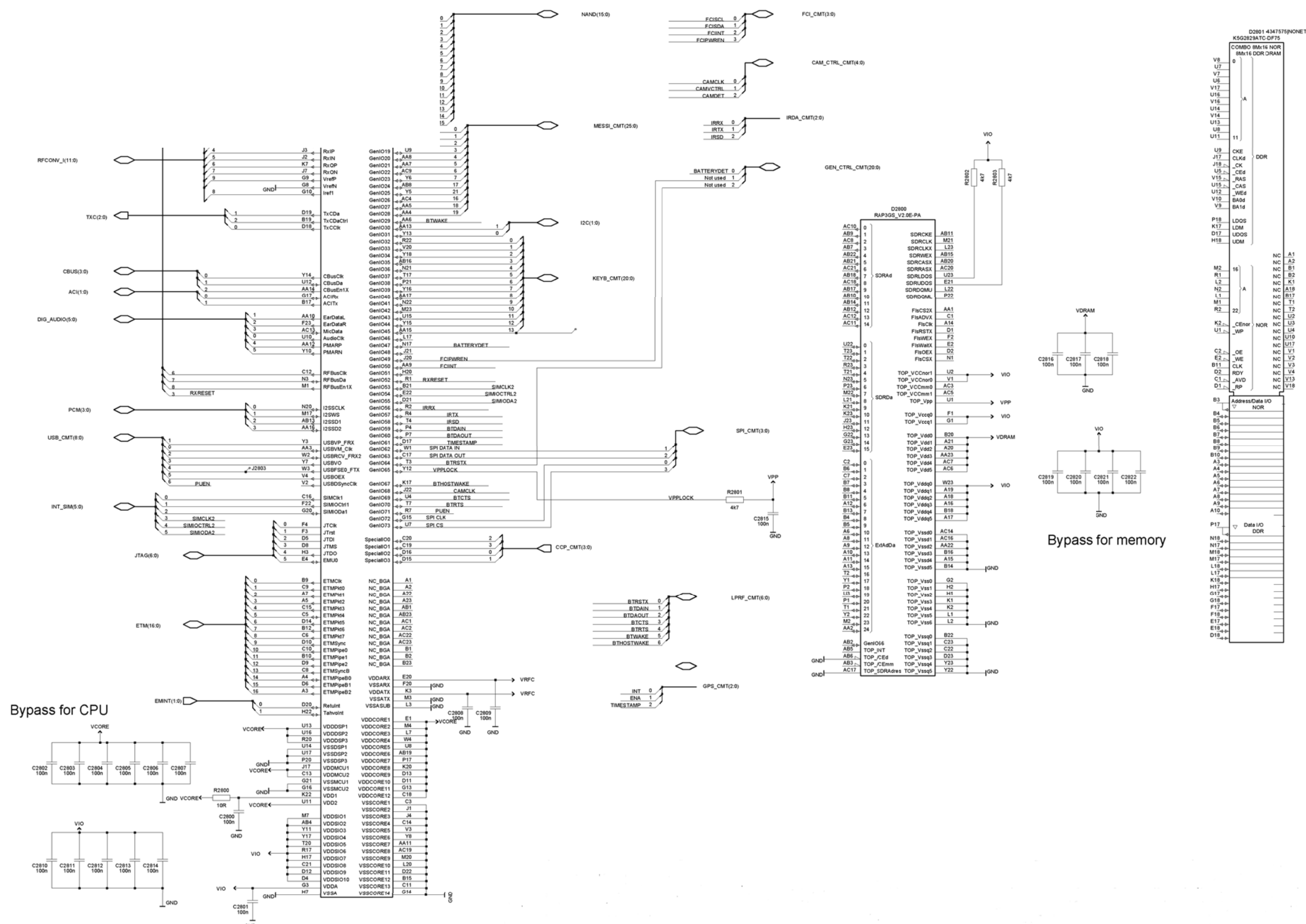
## RAPstack for memory





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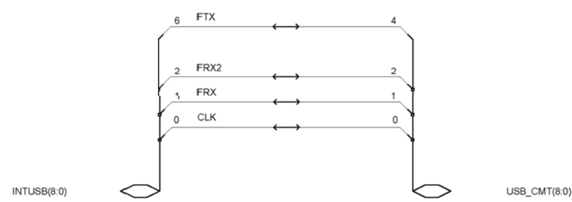
## USB connections with APE





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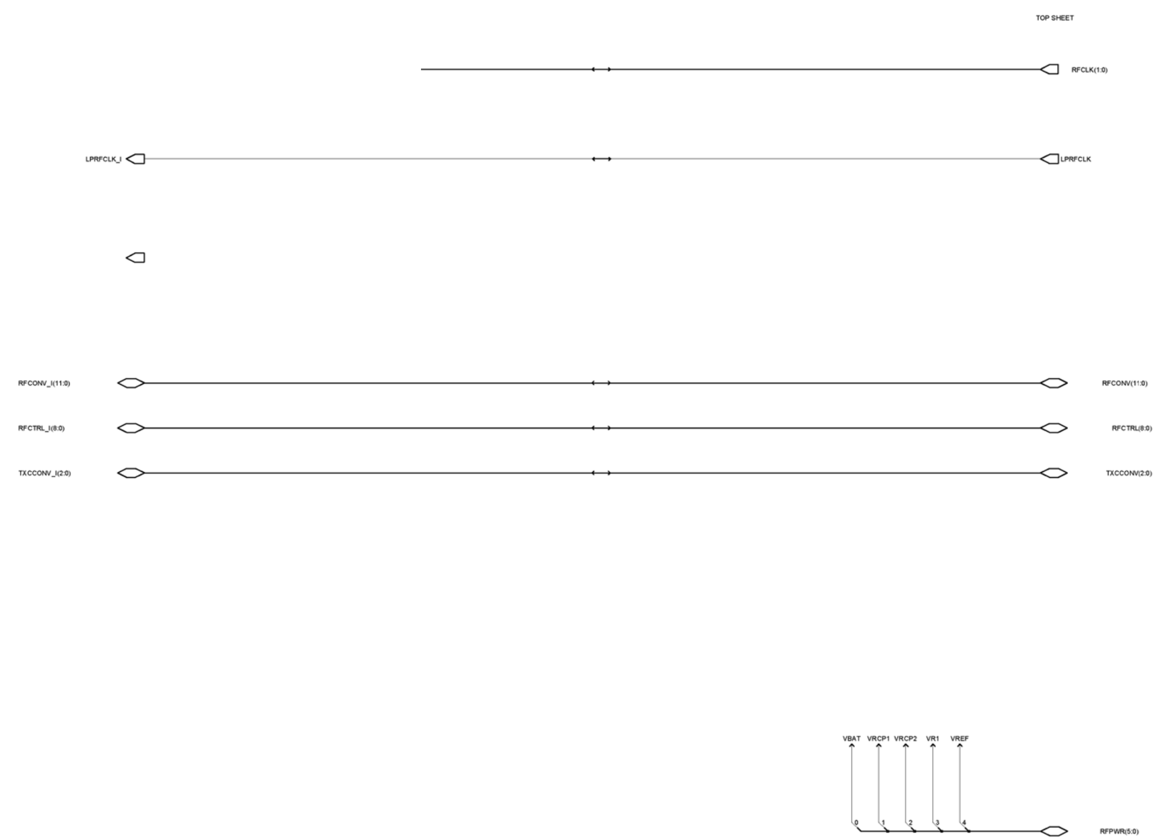
## RF IF





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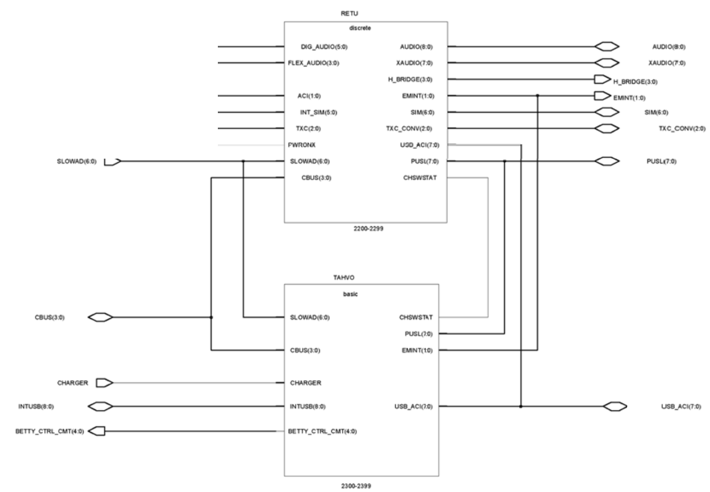
## Energy management





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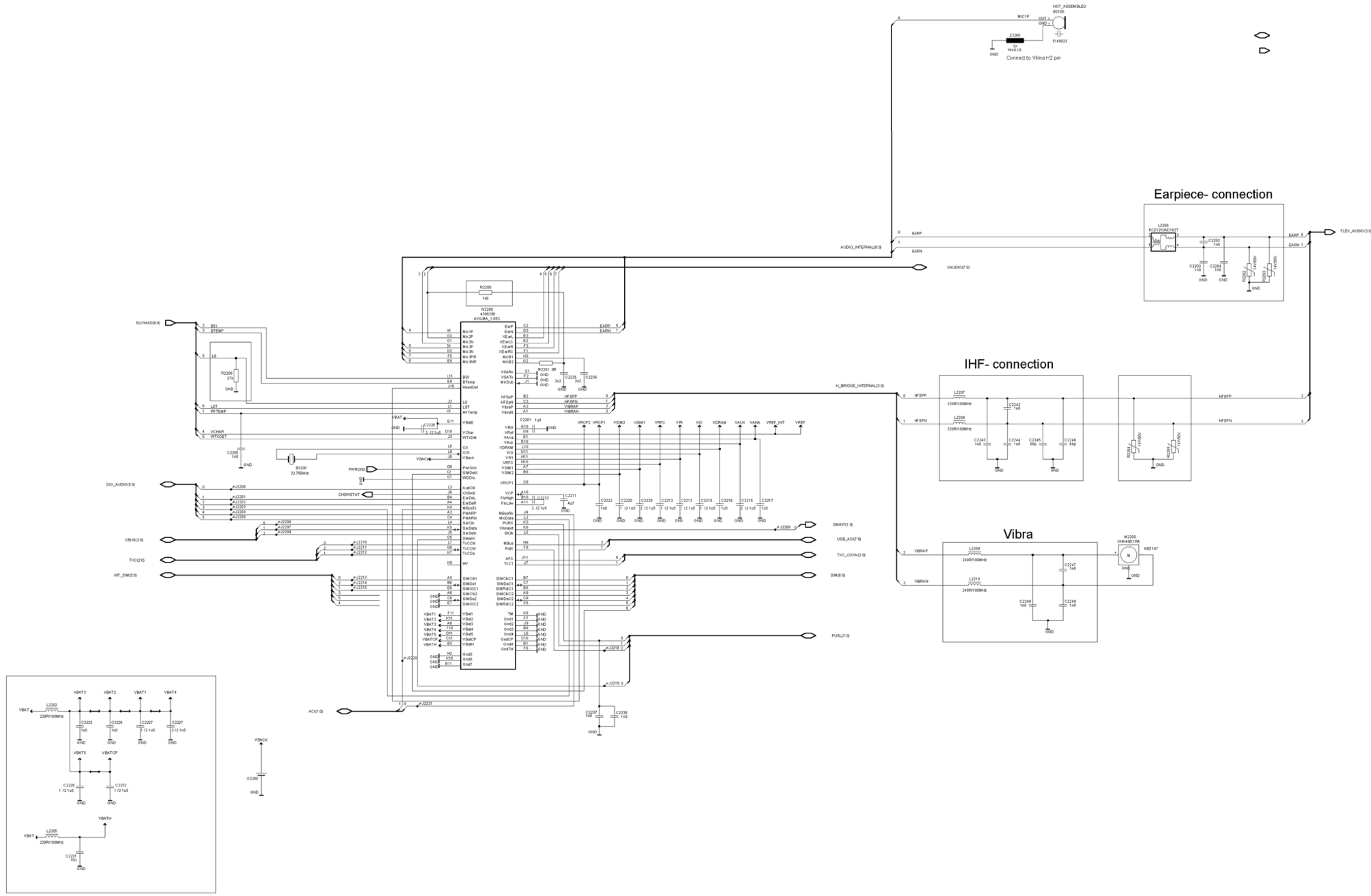
## Vilma





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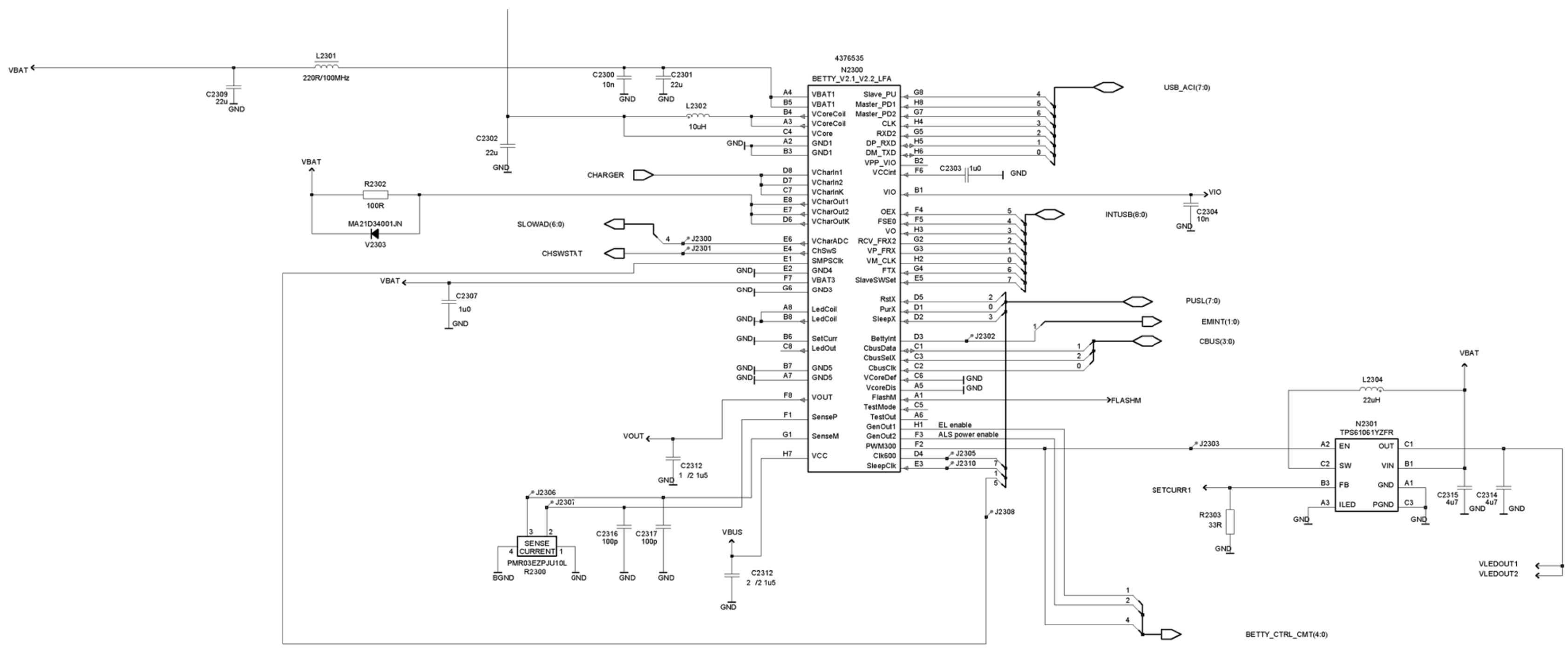
## Betty





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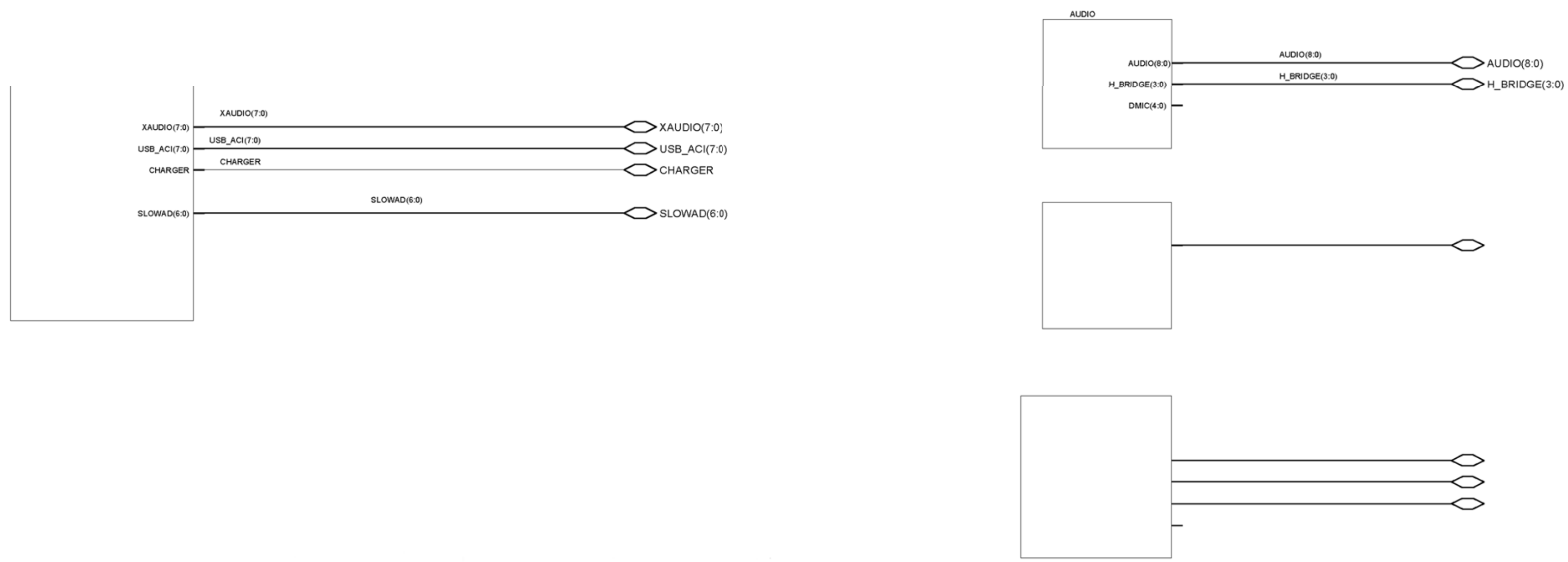
## CMT IF top level





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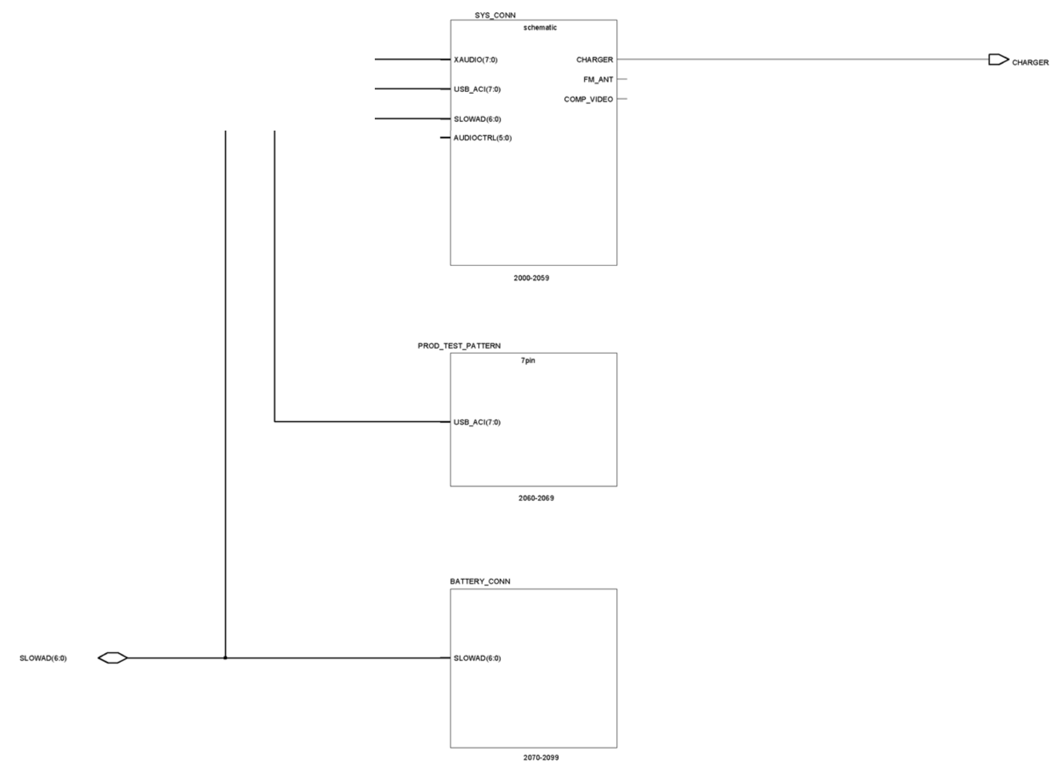
## System and battery connector





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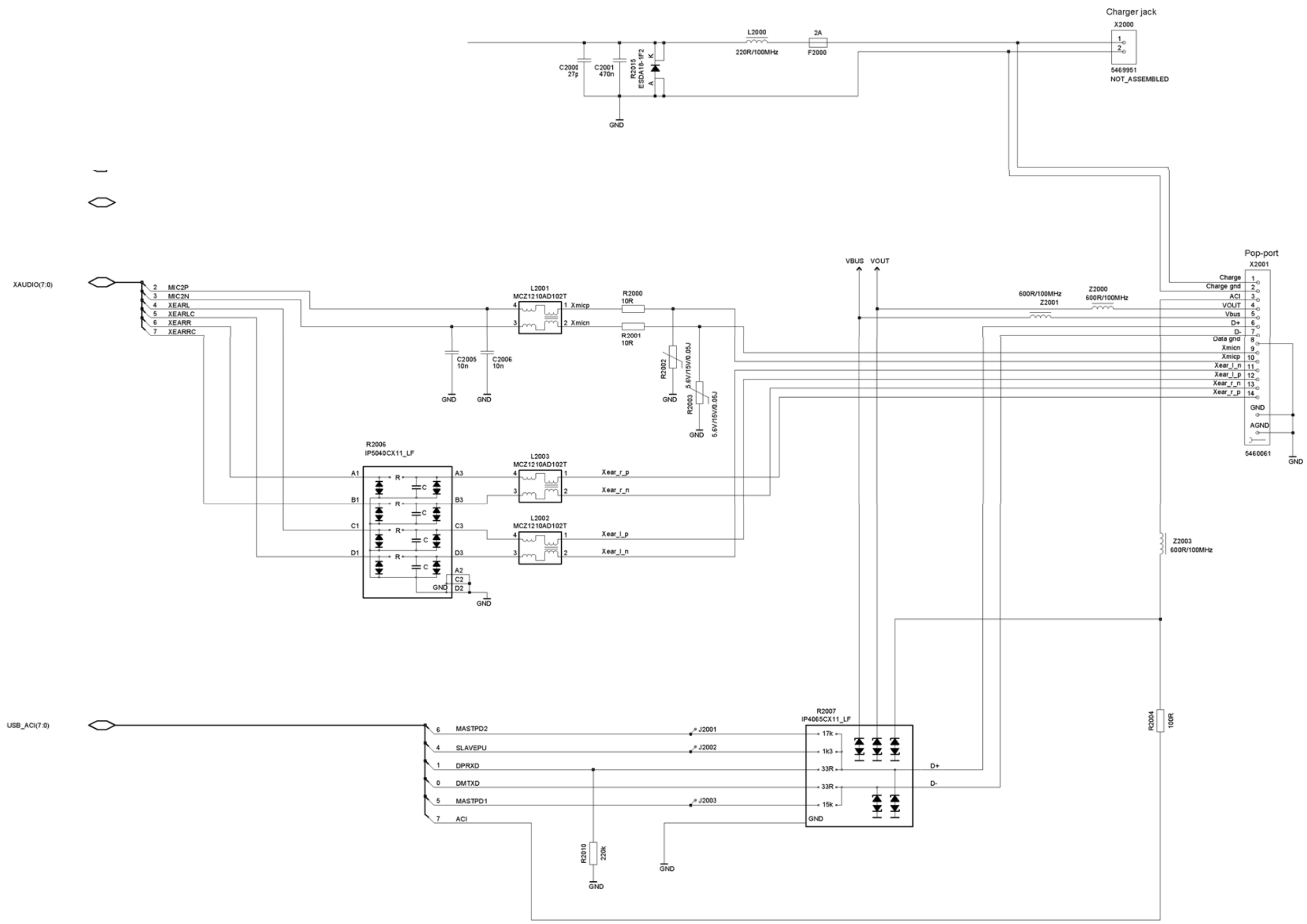
## System connector





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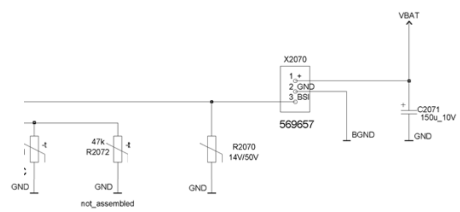
## Battery connector





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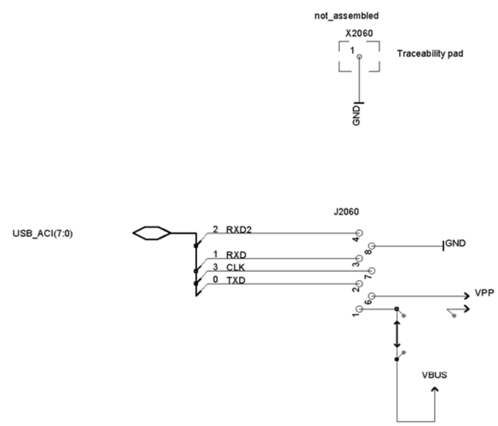
## Test pad





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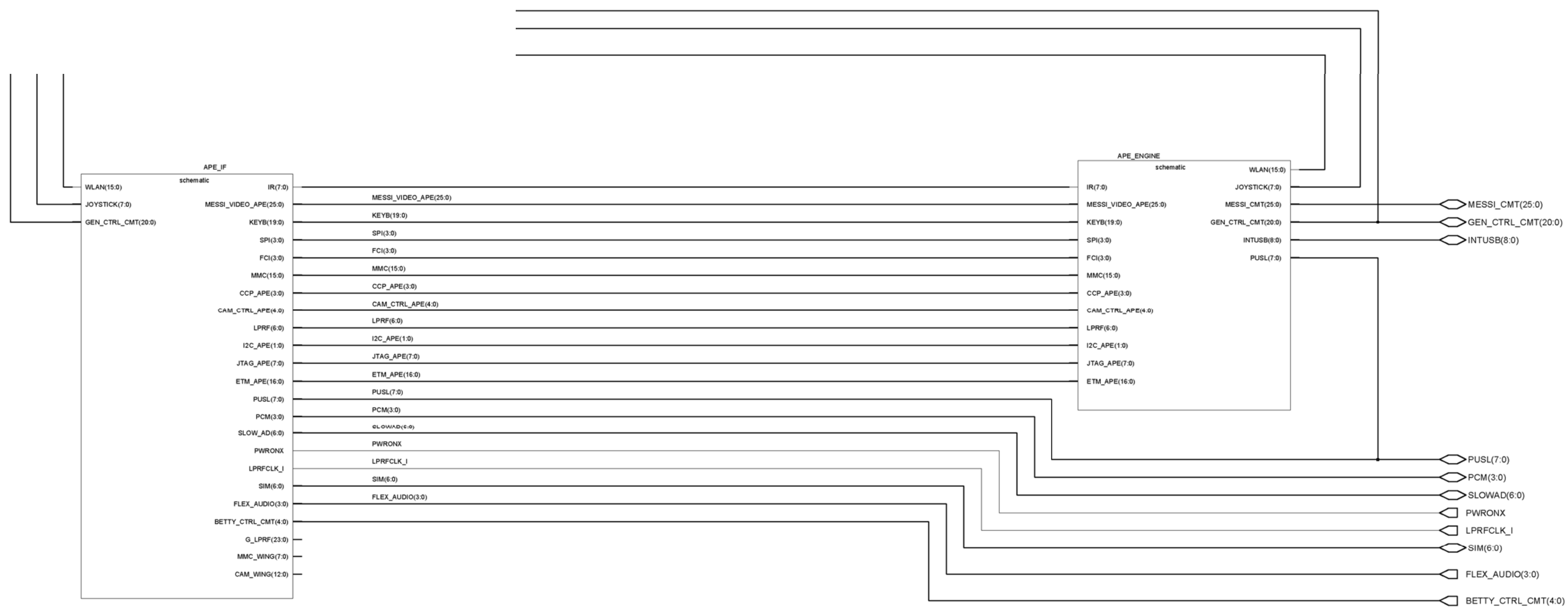
## Application engine top level





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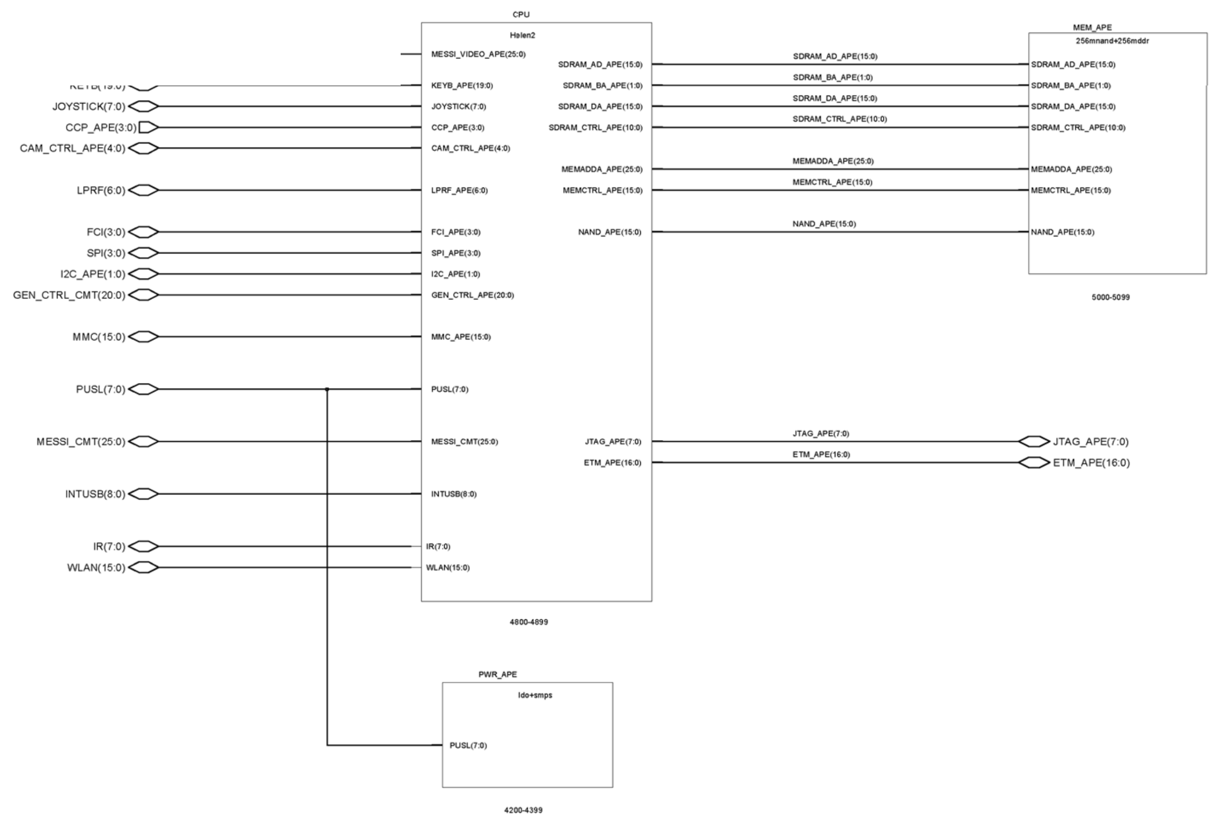
## APE engine





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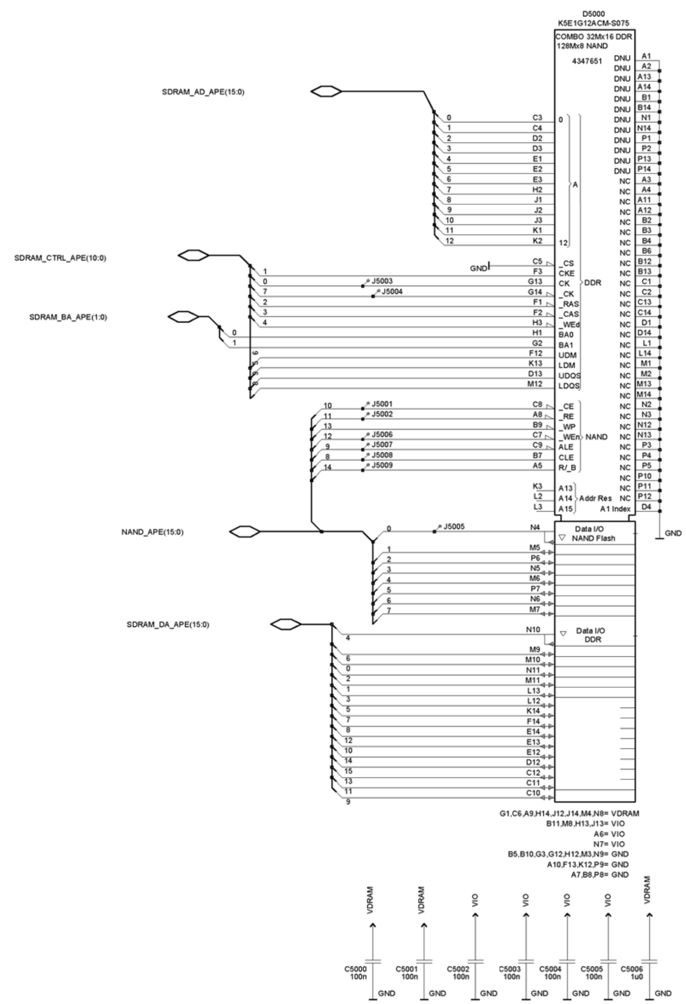
## APE memories





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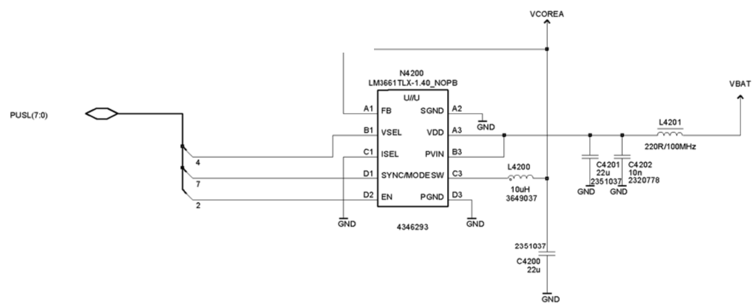
## Regulators





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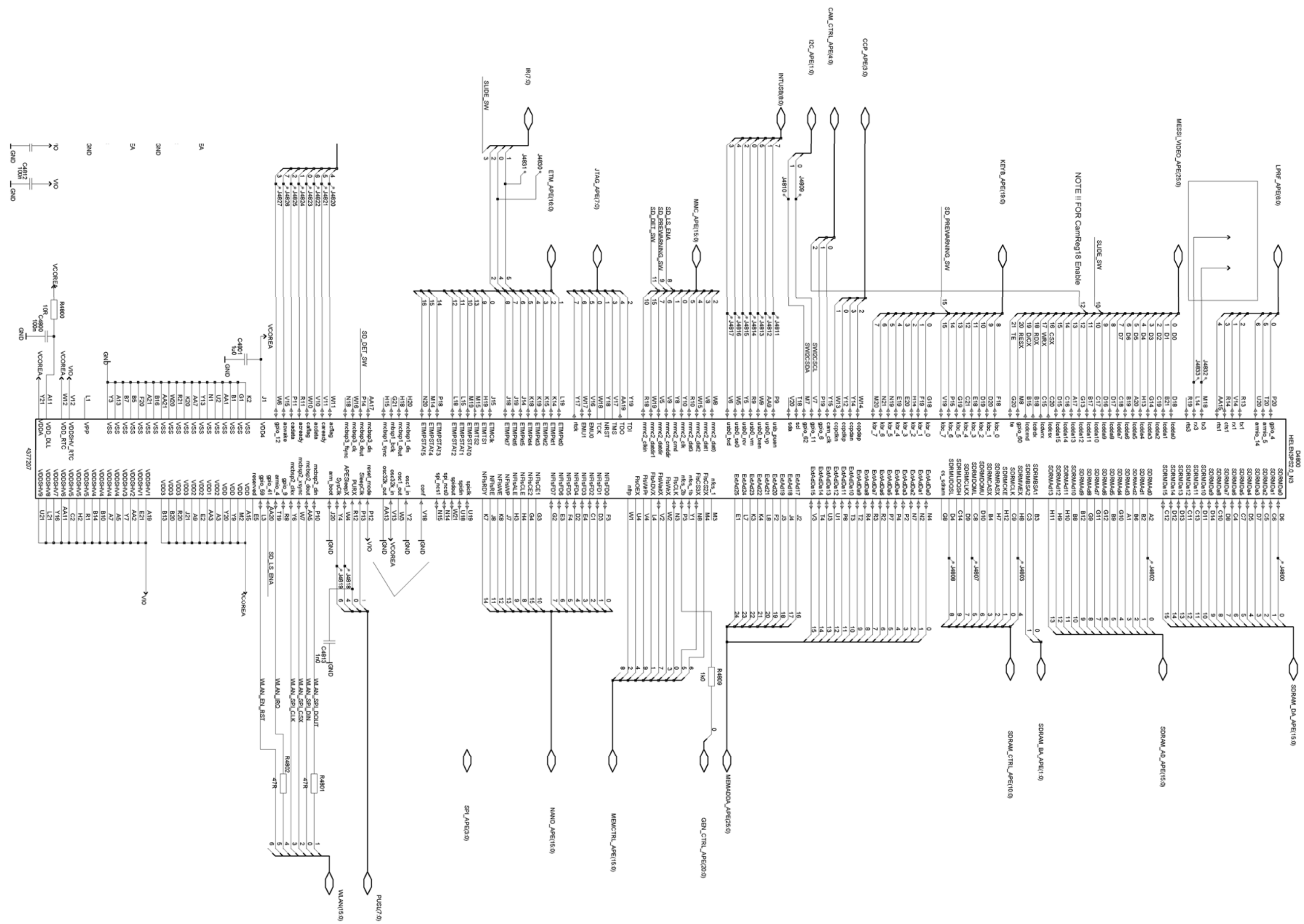
## Helen





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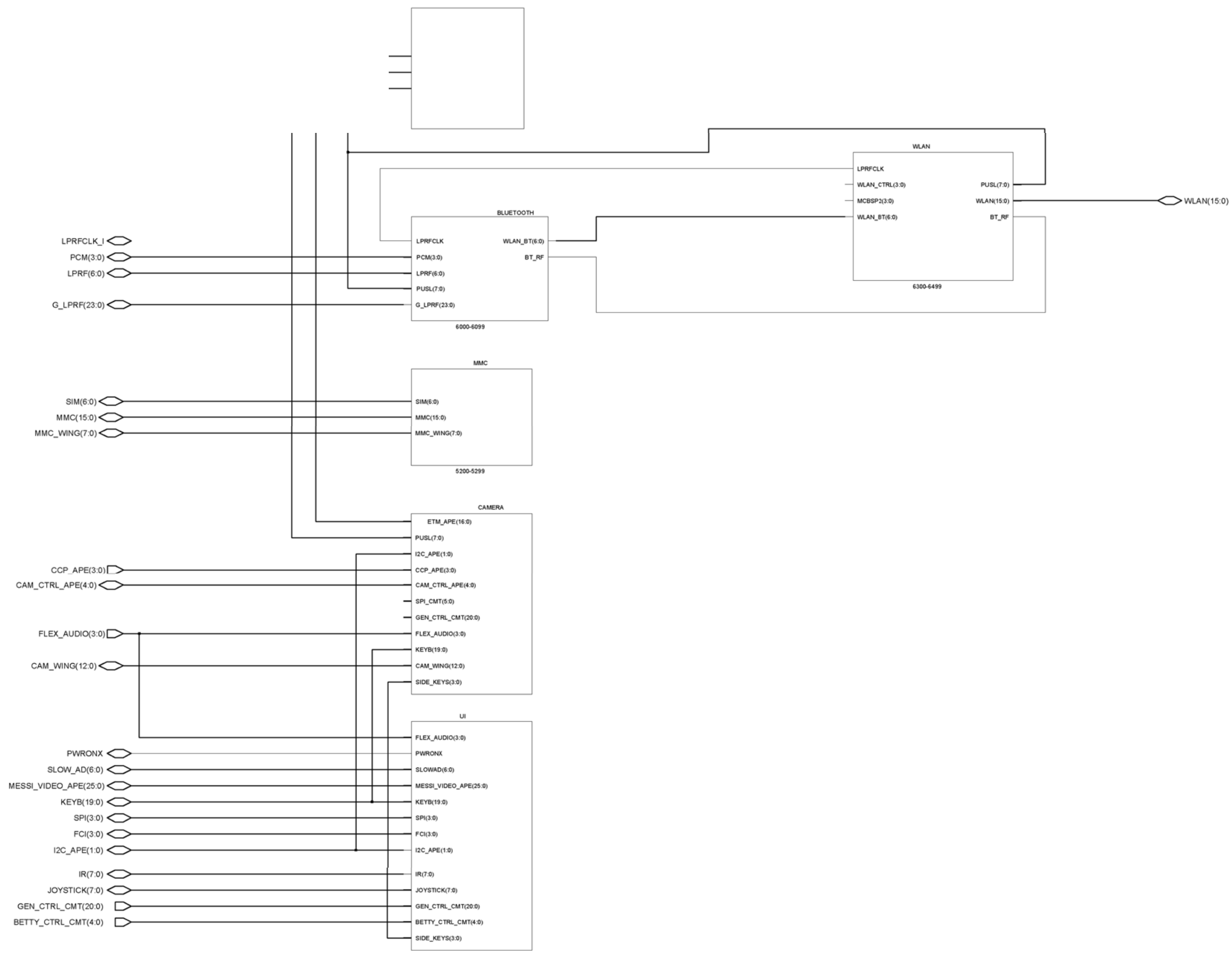
## APE IF





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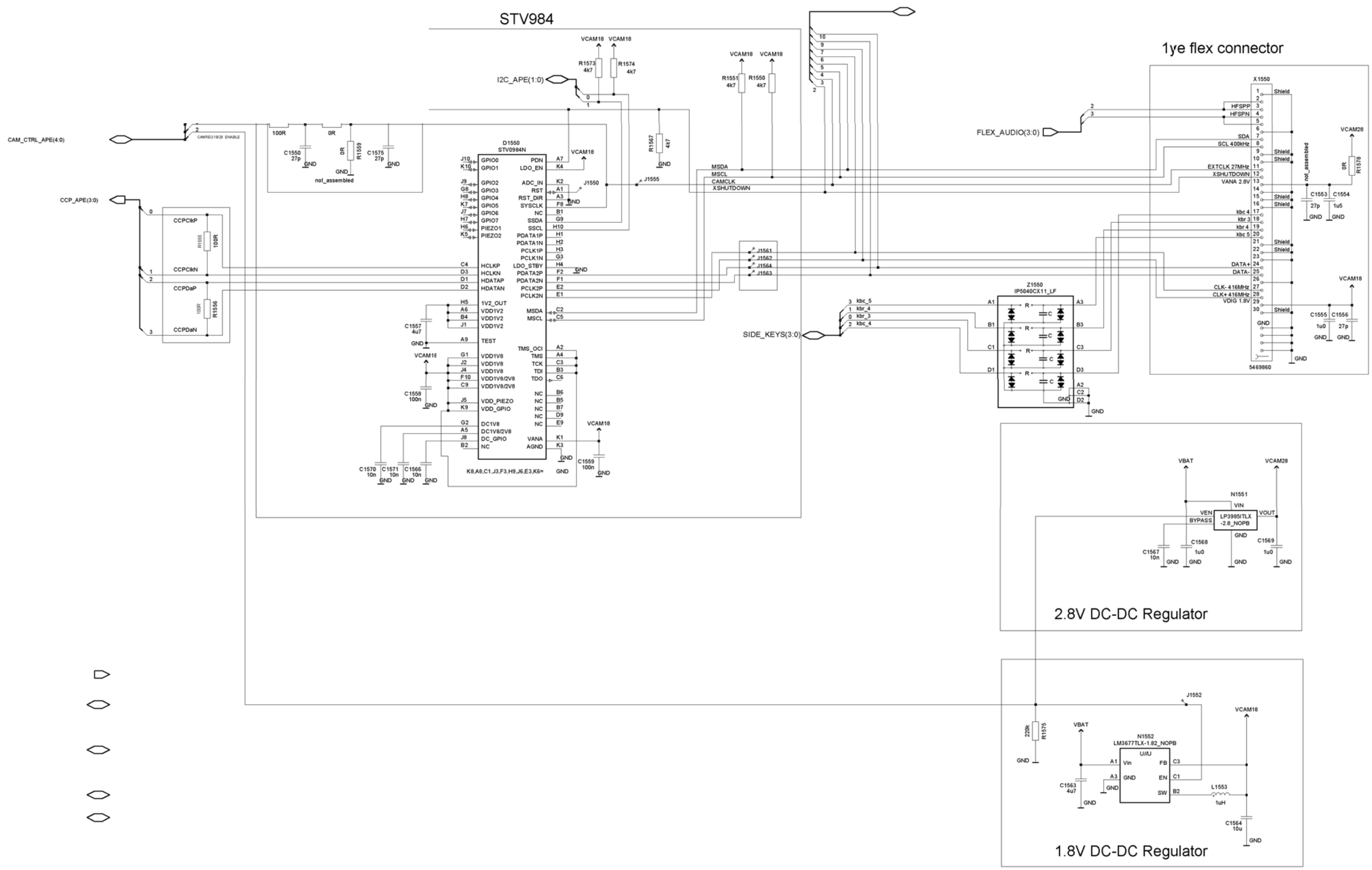
## STV984 + SMIA85





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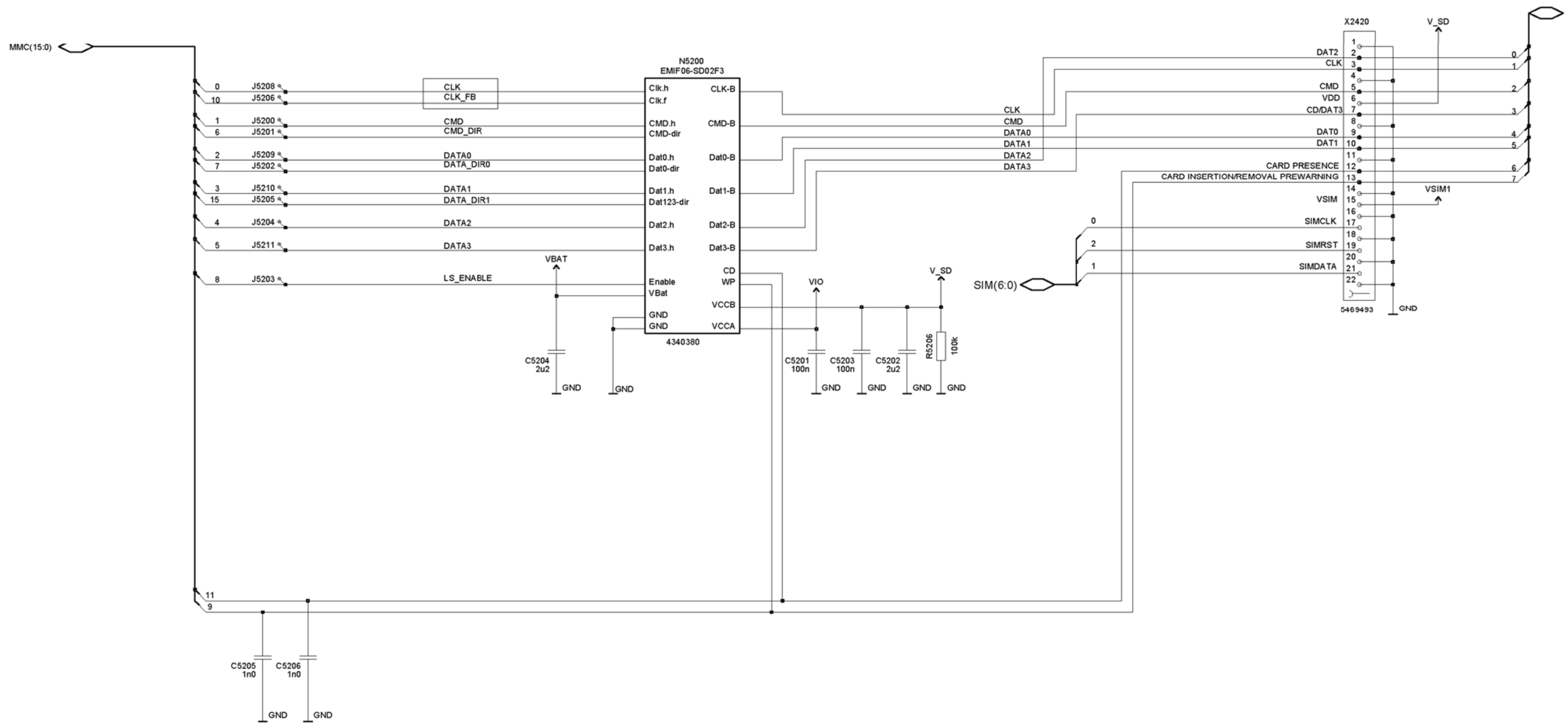
## MMC





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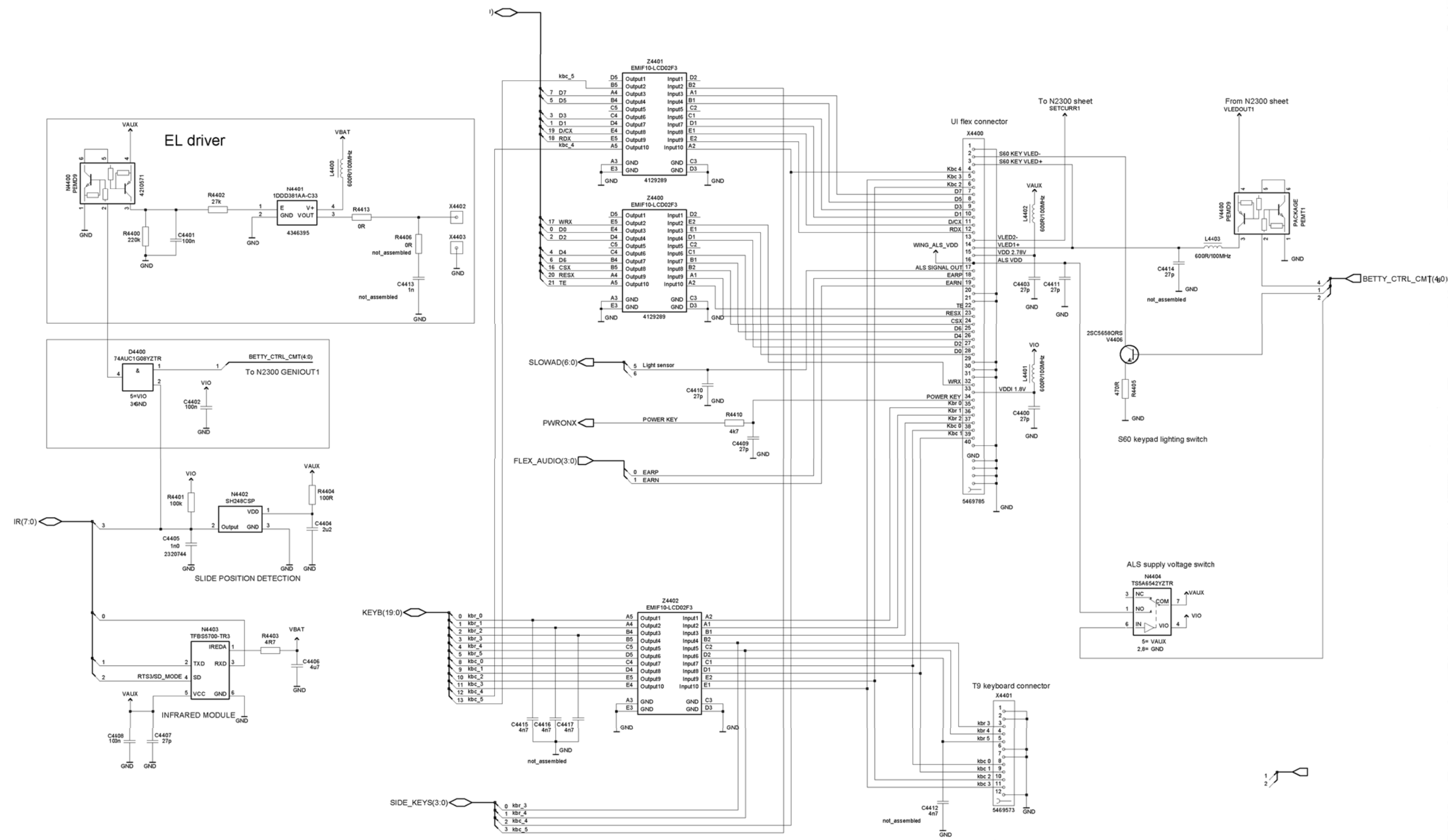
## UI





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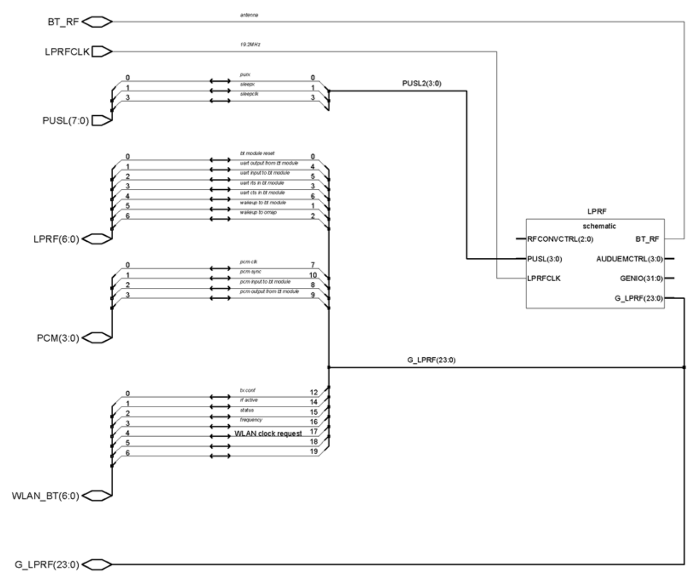
## BT interface





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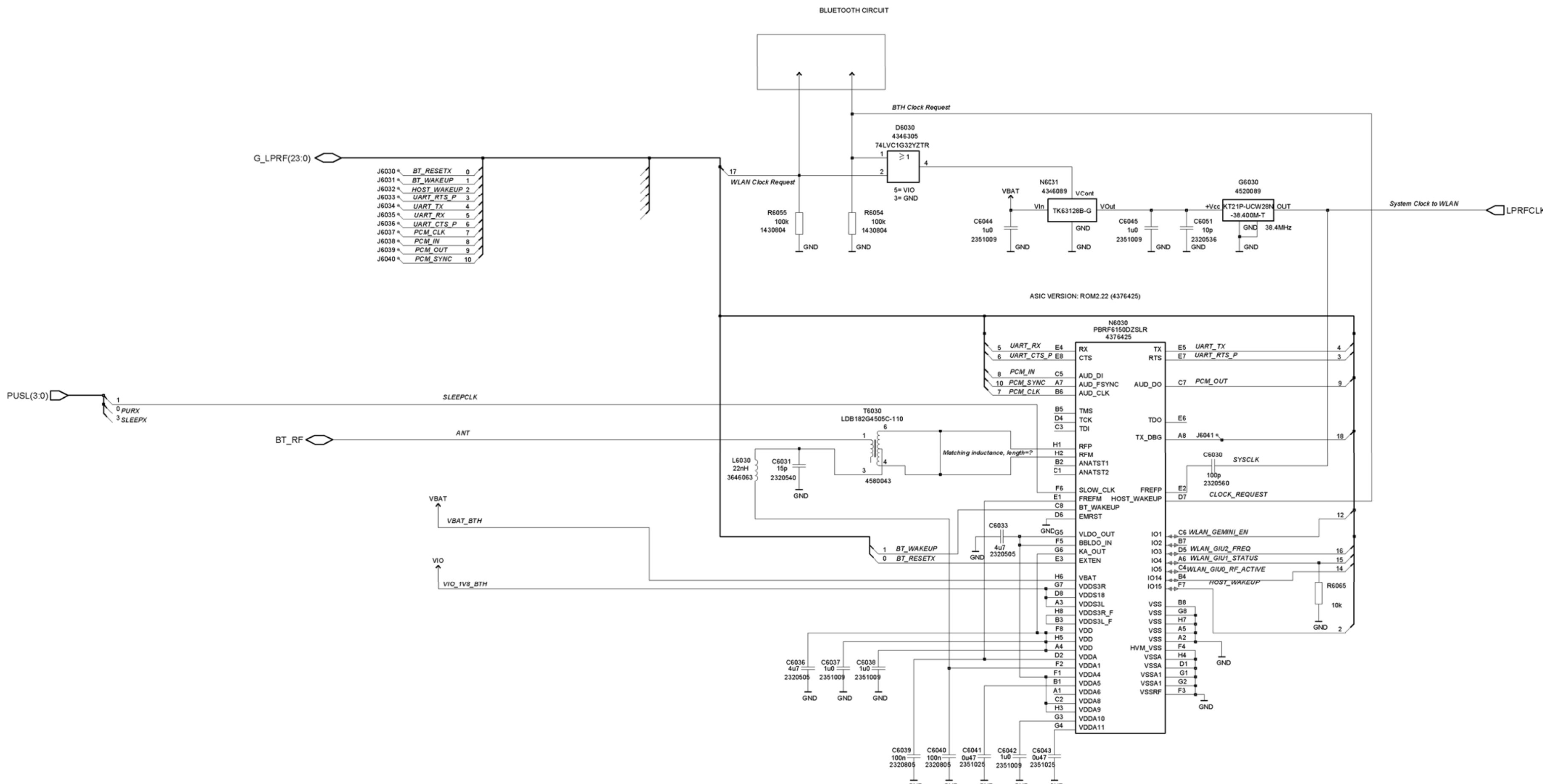
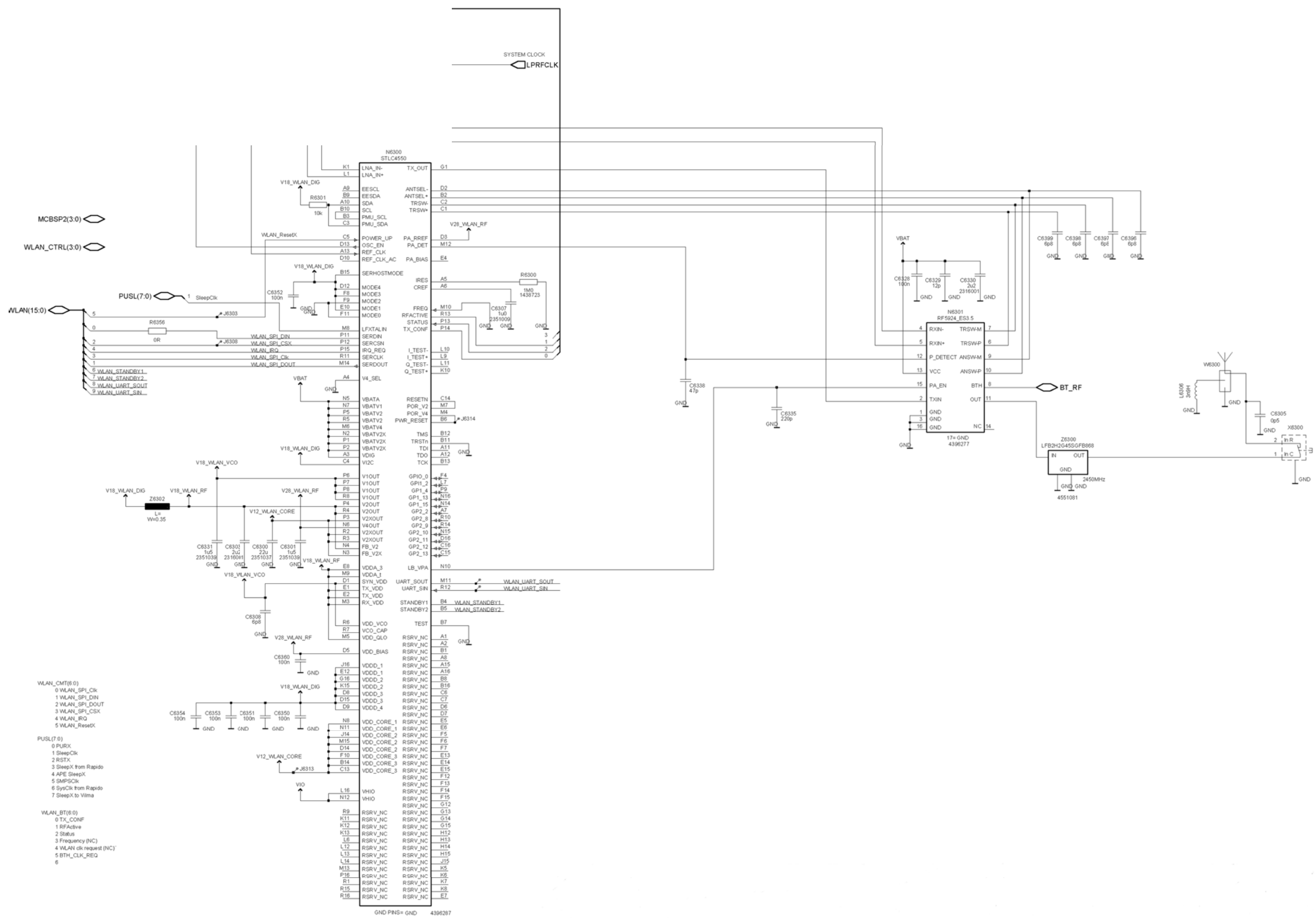
## BTHcost


BLUETOOTH CIRCUIT
BTH Clock Request
WLAN Clock Request
System Clock to WLAN
G_LPRF(23:0)
LPRFCLK
PUSL(3:0)
BT_RF
SLEEPCLK
ANT
VBAT
VBAT_BTH
VIO
VIO_1V8_BTH
D6030
4346305
74LVC1G32YZTR
N6031
4346089
TK63128B-G
G6030
4520089
KT21P-UCW28N
-38.400M-T
38.4MHz
ASIC VERSION: ROM2.22 (4376425)
N6030
PBRF6150DZSLR
4376425
T6030
LDB182G4505C-110
4580043
Matching inductance, length=?
L6030
22nH
3646063
R6054
100k
1430804
R6055
100k
1430804
R6065
10k

## WLAN



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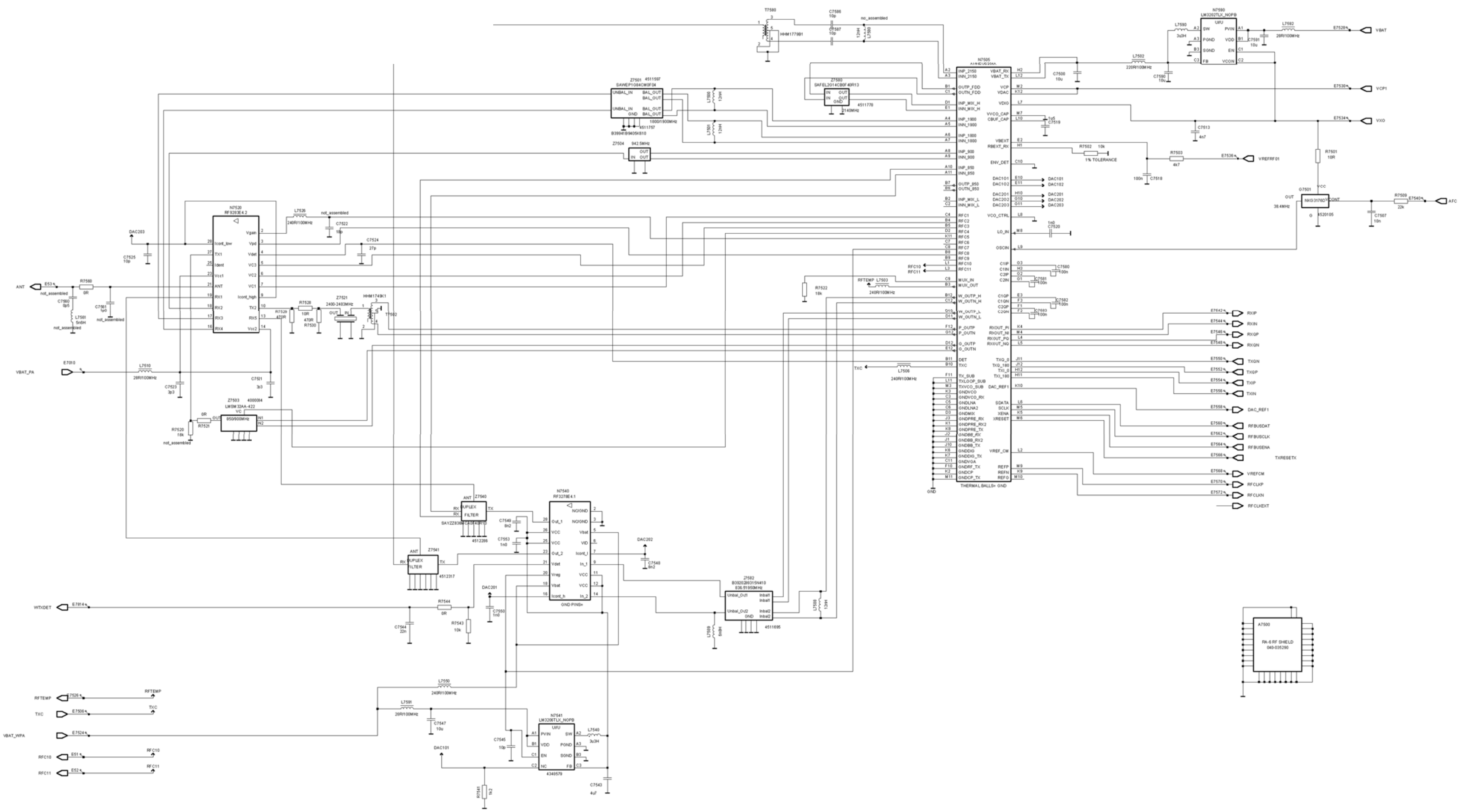
## RF engine





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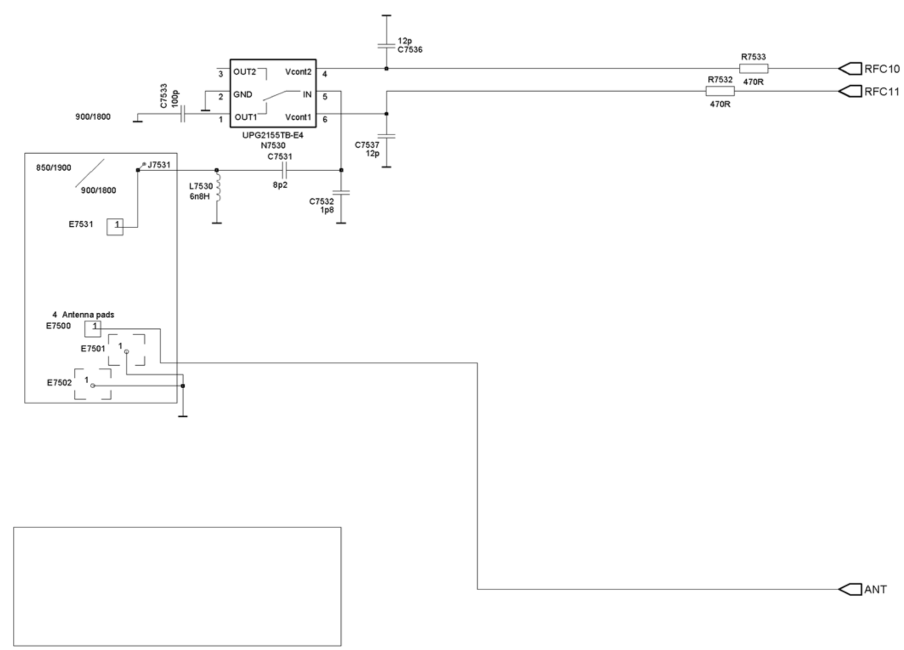
## Antenna interface





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# Glossary


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


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


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


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


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