Debug Guide V980/V975/V1050 – Level 3/4

This document was created to assist analyzers troubleshooting problems on Motorola 3G Phones. All information was collected during the repair in the Repair Entitlement Group Flensburg.

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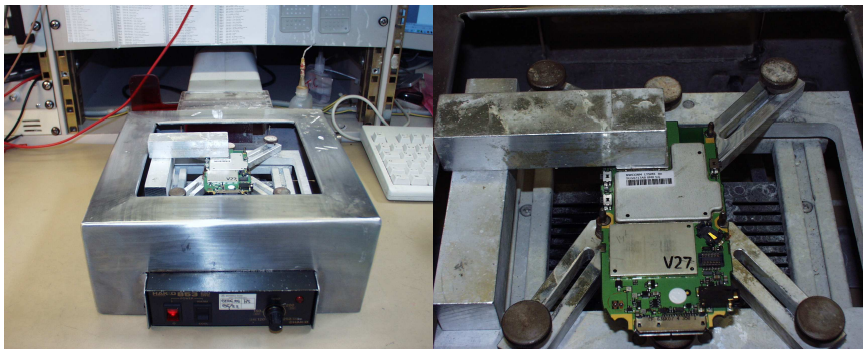
Differences V980/V975
The V980 is exclusively for Vodafone, while the V975 is the version for retail and other customers (H3G...)
PCB Differences between V980 and V975:

- change from 2 discrete Micron Flash to 1 stacked Tyax Flash
- rotation of SDRAM
- EMI/ESD filter under keypad connector moved away from board edge
- WDI resistor moved outside shield for easier access

Differences V975/V1050
The V1050 has a larger main display, a better camera, LED flash light and soft touch housing. The PCB is nearly identical to the V975.

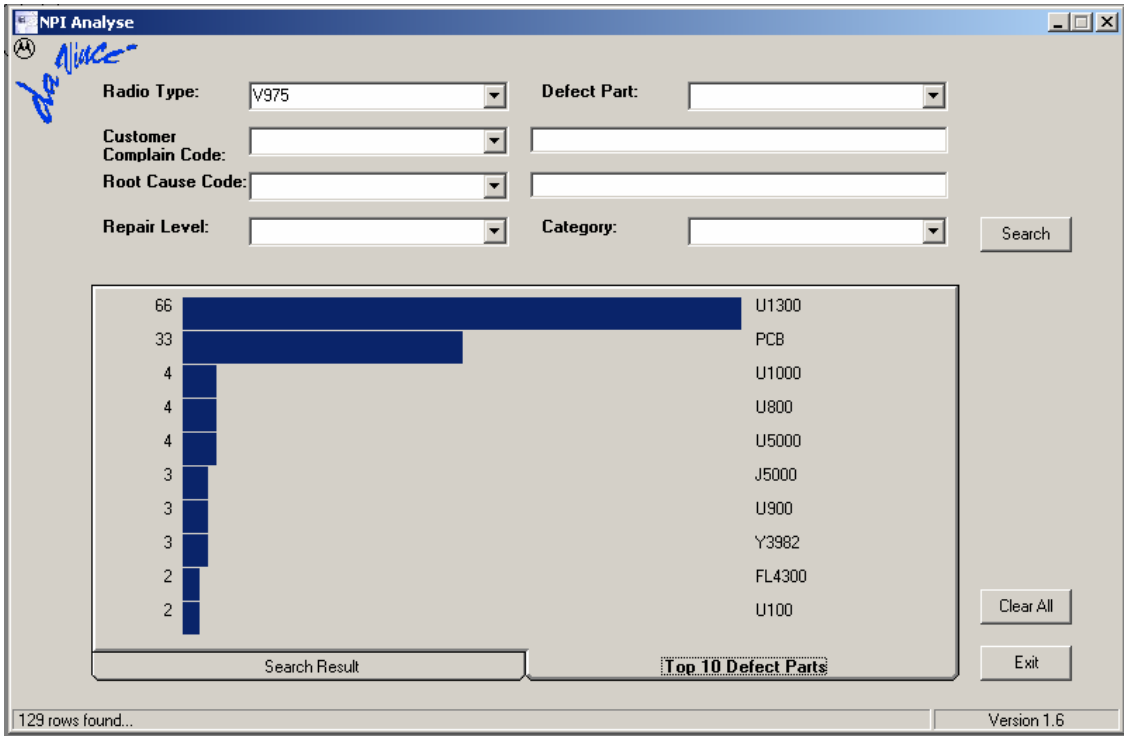
Requirements

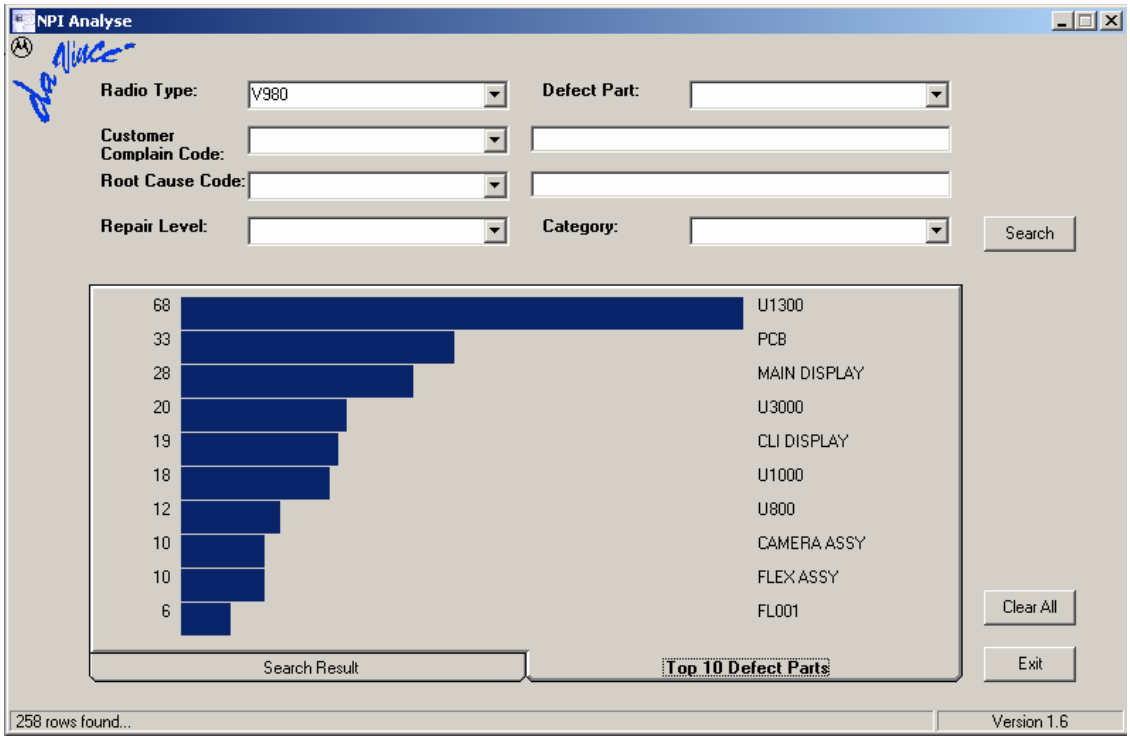
- **System Requirements**
- *Power supplies, Oscilloscope, Spectrum Analyzer, Test Set*
- *preheater for lead free soldering/ solder machine for BGA´s*
- *Microscope*
- *RepairStudio/Radiocomm,*
- *Field Service Bulletins*
- *FASTT*
- *Block diagrams/Schematics*
- *PinNetFinder FLVIEW*
- **Basic information on troubleshooting Motorola 3G Phones**
- *Make sure all contacts are clean, especially the CE-Connector*
- *Use newest approved Software*
- *RESET/MASTERCLEAR can fix some issues*
- *Do a visual inspection on customer abuse/liquid contamination*
- *The POG U1000 is always to be changed together with the flash memory*
- **Advice on working with lead free soldering**
- *Remove RTC battery/microphone before soldering*
- *Work very carefully because of underfilled Harmony*
- *Use protection shields*
- *Use lead free flux*
- *Use preheater (HAKKO 853)*

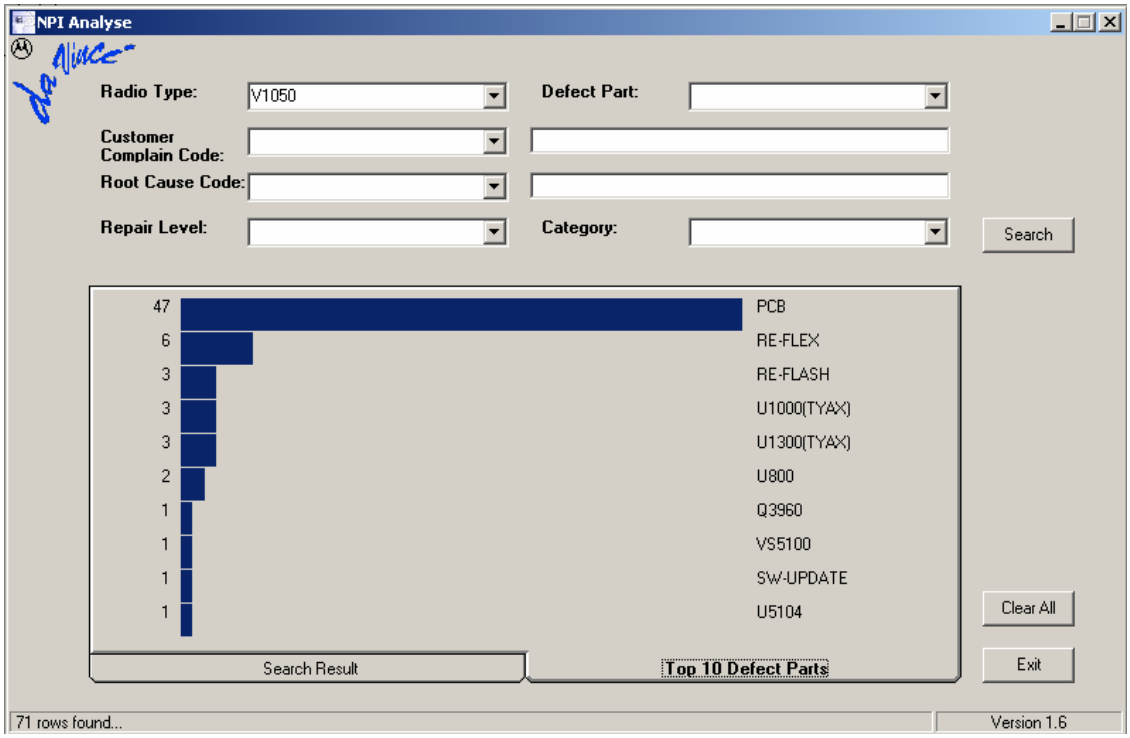


Top Ten defect parts

Following is an analysis summary of the V975, V980 and V1050 repaired during NPI process by the Repair Entitlement Group CSS Flensburg







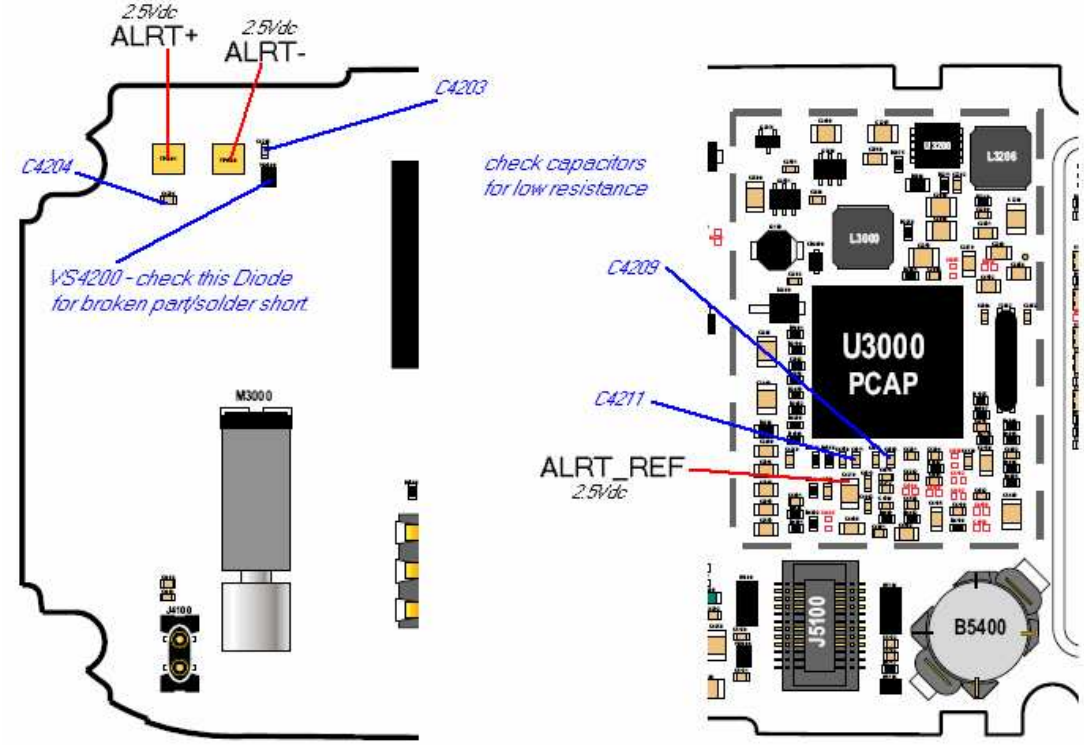
Troubleshooting Guide

First Step
Please make sure on *any* problem, that it is not a software related one by simply doing a 1FF reflash with a Master Reset/Master Clear afterwards. In many cases a simple Master Reset can already fix the problem.
The following section is meant to be a help in troubleshooting problems which are already identified as PCB related problems.

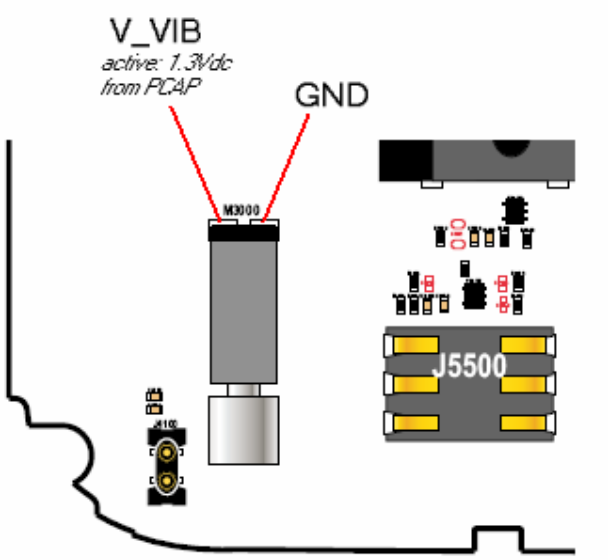
ALT01 Alert – Ring tone, no
ALT02 Alert – Ring tone, low
ALT03 Alert – Ring tone, noise/distortion
Check ALRT- (TP4200) and ALRT+ (TP4201) – both should have around 2.5Vdc

- if not check VS4200 for solder short/broken part, C4203/C4204/C4209/C4211 for low resistance
- check ALRT_REF 2.5Vdc at C4210
- check PCB on open tracks from TP4200 to U3000-F1 / TP4201 to U3000-H1
- if ok, change PCAP2 (U3000)

The alert signal is amplified by the PCAP2 and generated by the POG, so if the PCAP2 alert audio path is ok there could be a problem with the POG not generating the alert signals.

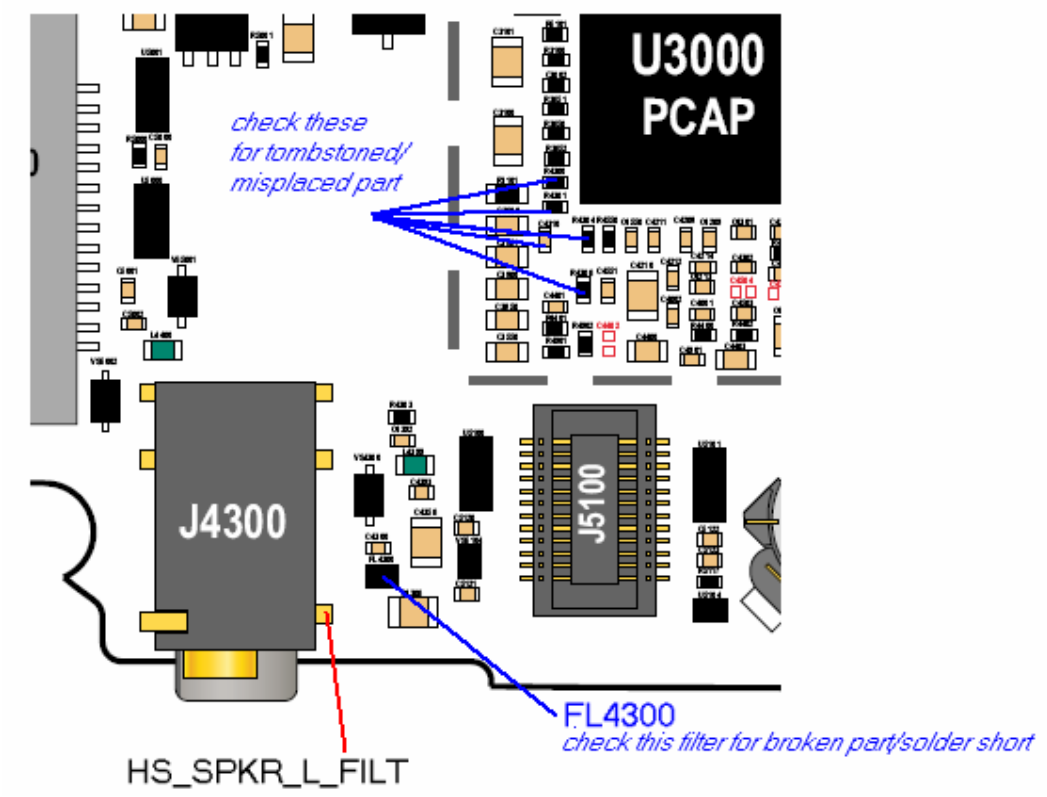


ALT11 Alert – Vibrator, no
ALT12 Alert – Vibrator, weak
Turn on vibrator using Repair Studio/Radiocomm. Measure V_VIB – should be about 1.3 Vdc. V_VIB is provided directly by the PCAP (U3000). To verify if the vibrator is defective a simple method is to provide a supply voltage (1Vdc should be enough) via test probes directly on the vibrator M3000 (radio in off state!). It should be rotating, if not change the vibrator M3000. Otherwise change PCAP (U3000).



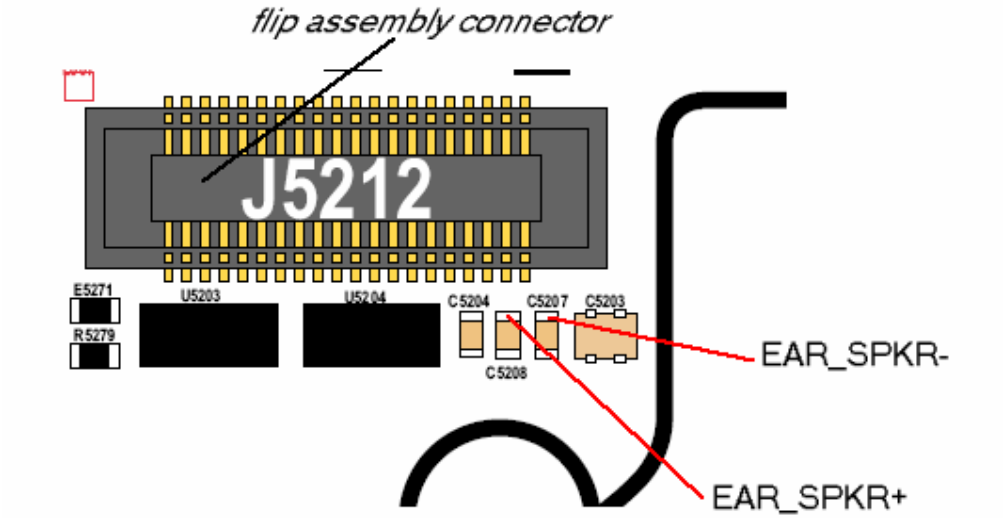
AUDxx Audio problems
First step on every audio related problem is to identify which audio paths are affected.
If audio signals in loop are ok, there could be an audio problem in a network call. Then it is most likely a problem with the POG.

AUDxx Audio –
Headset Detection problem
If the headset detection is not working correctly, there is probably no audio on the selected audio path.
For headset detection HS_SPKR_L_FILT is used. With Headset connected HS_SPKR_L_FILT is LOW, without Headset HS_SPKR_L_FILT should be HIGH (2.8Vdc).



AUD01 Audio – Earpiece, No
AUD02 Audio – Earpiece, Low
Check EAR_SPKR- at C5207 and EAR_SPKR+ at C5208 – both should have around 1.5Vdc

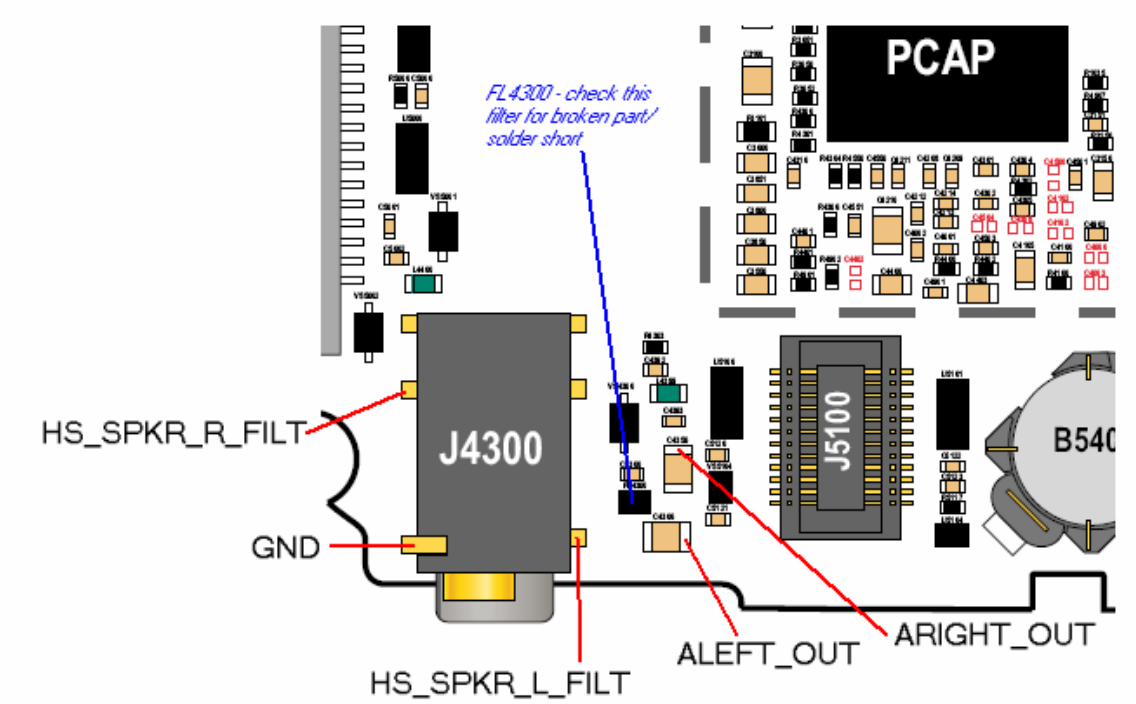
- if not check J5212 for solder shorts, C5207/5208 for low resistance
- (eventually) check PCB on open tracks from C5207 to U3000-J4 / C5208 to U3000-K2
- if ok, change PCAP2 (U3000)



AUD05 Audio – Earpiece, Headset

Set radio in headset audio loop using Repair Studio/Radiocomm and generate tone

- check ALEFT_OUT at C4306/ ARIGHT_OUT at C4356
- if ok change FL4300
- if not ok change PCAP (U3000)

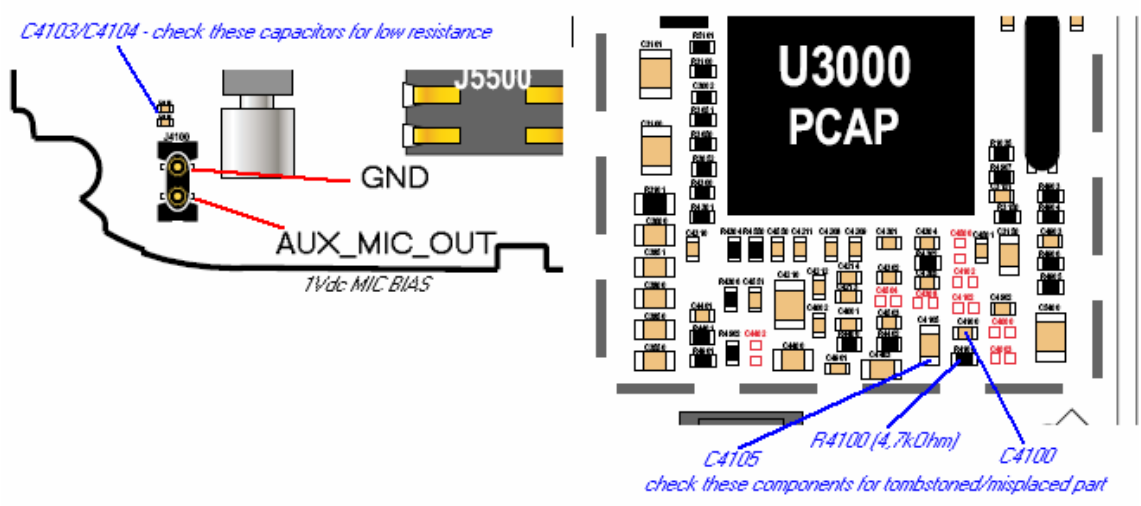


AUD07 Audio – Mic, No

AUD08 Audio – Mic, Low

Set radio in audio loop using Repair Studio/Radiocomm

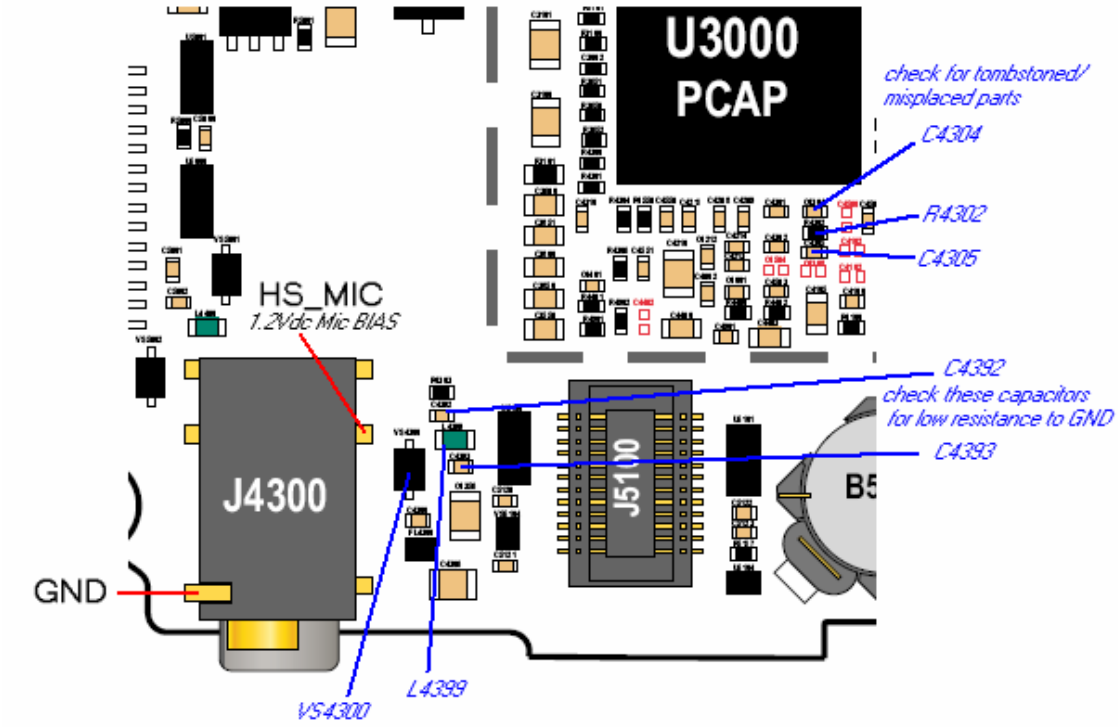
- check Mic BIAS at J4100-2 – should be around 1Vdc
- if not check C4103/C4104 for low resistance
- check R4100 (4,7kOhm), C4100, C4105 for tombstoned/misplaced part
- if ok, change PCAP2 (U3000)



AUD11 Audio – Mic, Headset

Set radio in headset audio loop using Repair Studio/Radiocomm

- check headset Mic BIAS at J4300-4 – should be around 1.2Vdc
- <u>if not</u> check VS4300/C4392/C4393 for low resistance, check R4302 (4,7KOhm), if ok change PCAP (U3000)
- <u>if headset Mic BIAS ok</u>
- whistle in headset microphone and follow signal from J4300-4 through L4399 through C4305 to PCAP
- <u>if ok</u>, change PCAP (U3000)



BAT02 - Battery life short
BAT03 – Battery can't turn on phone
BAT06 – Battery gets hot
CHGxx - Charging problems
TON01 – No Turn On (draws high current)
In probably most cases these problems are caused by an off current. One first look should be to verify whether there is an off current. If there is an off current it should be checked whether the device draws current via battery and/or via external connector.

In case of an off current via battery there should be a low resistance (less than ~200 Ohm)/ or a short from BATT+_RAW (M5400-4) to GND.

To localize the defective part causing the short/ low resistance a simple way is to freeze the board with a coolant spray, supply a battery voltage from a power supply using micro clamp-type test probes, and see which parts are getting warm. **This is a very basic and essential method to troubleshoot off current / high current consumption failures**.

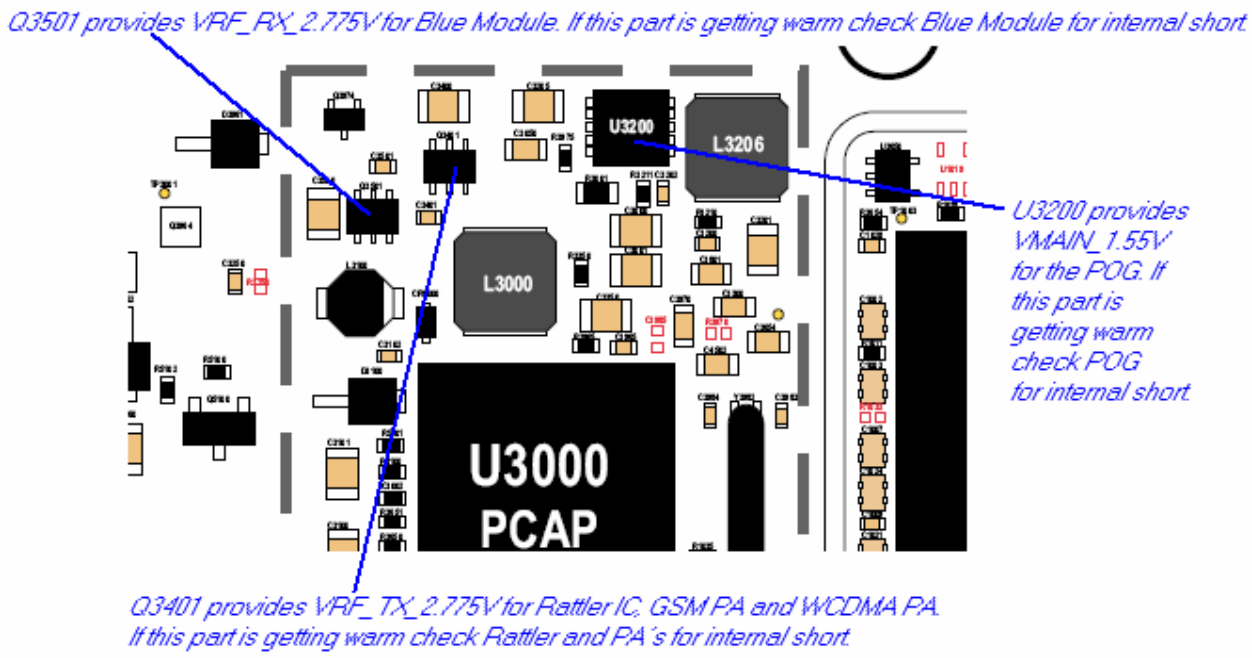
The power supply should be set to 3.6V with current limitation to 2A. We strictly recommend checking the current the PCB draws on the display of the power supply.

Shields covering suspected parts should be removed before freezing the PCB.

The PCB should be handled with care. After removing the shields the PCB should be given some time to cool down slowly before freezing it to far below zero to avoid physical stress to the multilayer PCB with lead free soldered parts.

In some cases the part, which is getting warm has itself an internal short. After removing this part the off current should be fixed. For verification check off current or measure resistance BATT+_RAW (M5400-4) to GND. A new part can be placed.

If the short / low resistance remains after removing the part which was getting warm, it should be checked which signals/ voltages this parts provide. In the most cases this part will provide a supply voltage to other parts from which one possibly could have an internal short and therefore is getting warm.

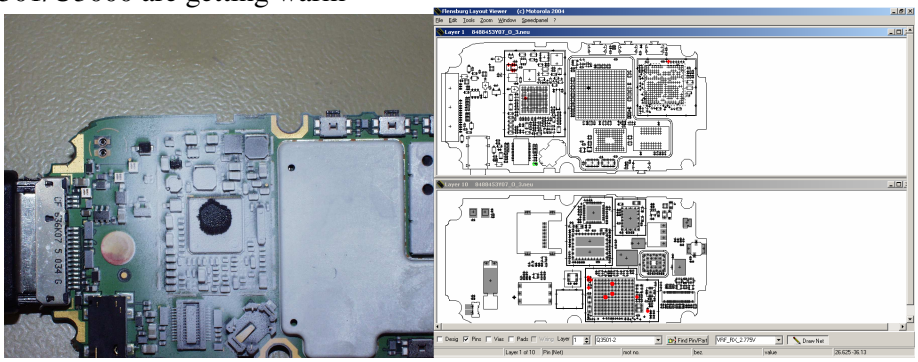


To find out the defective part an easy way is to use the Flensburg Layout Viewer to follow the signal (check for SHORT_RESistors after which the signals possibly could have a changed name), and to remove the parts one after another, until the short is gone.

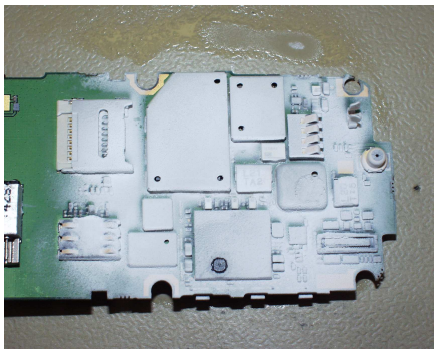
Most frequent parts with internal shorts causing these kinds of failures are the PA´s (U400/U800), the Blue (U900), the Rattler (U200), and the PCAP (U3000).

Example:

- BAT00 – radio draws about 400 mA in standby, no off current
- Q3501/U3000 are getting warm



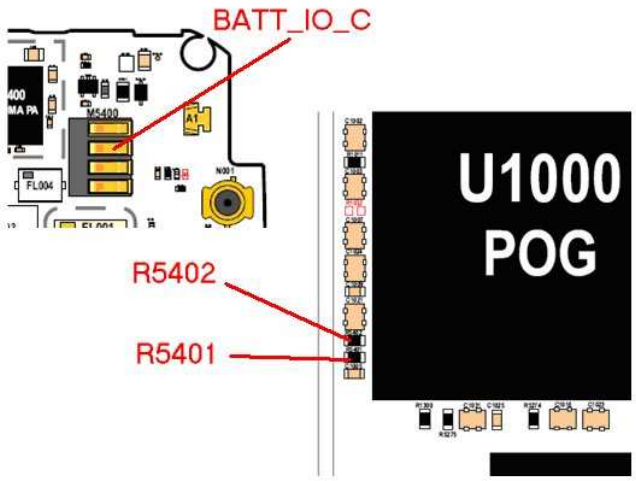
– Q3501 provides VRF_RX_2.775V for Blue Module U900 via Short Resistor R902 (using Flensburg Layout Viewer)



- Blue Module U900 is also getting warm
- Blue Module U900 itself has an internal short. defective U900

BAT04 – Invalid Battery

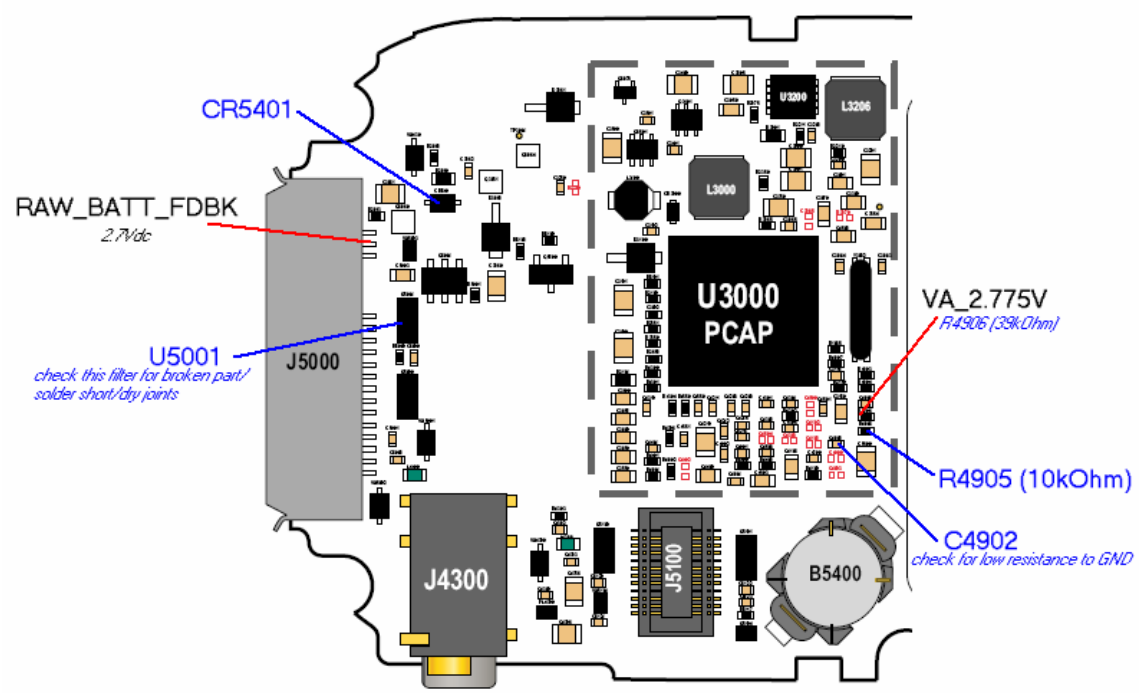
- verify BATT_IO_C (M5400-3) while PCB is connected to CE-USB cable. It should be 2.775V. If it is low
- check R5401 and R5402 (100 Ohm). If they are ok it should be a problem with the POG U1000



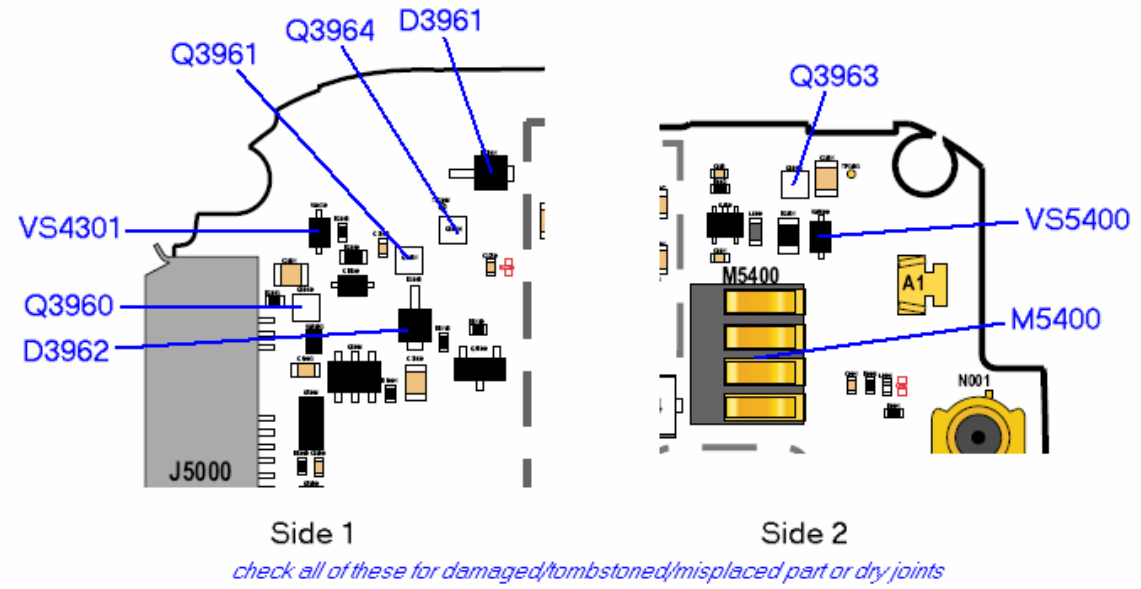
CHG01 – Does not charge

If display indicates “Charging not possible”, check RAW_BATT_FDBK at J5000 with attached CE-Connector. It should be around 2.7Vdc.

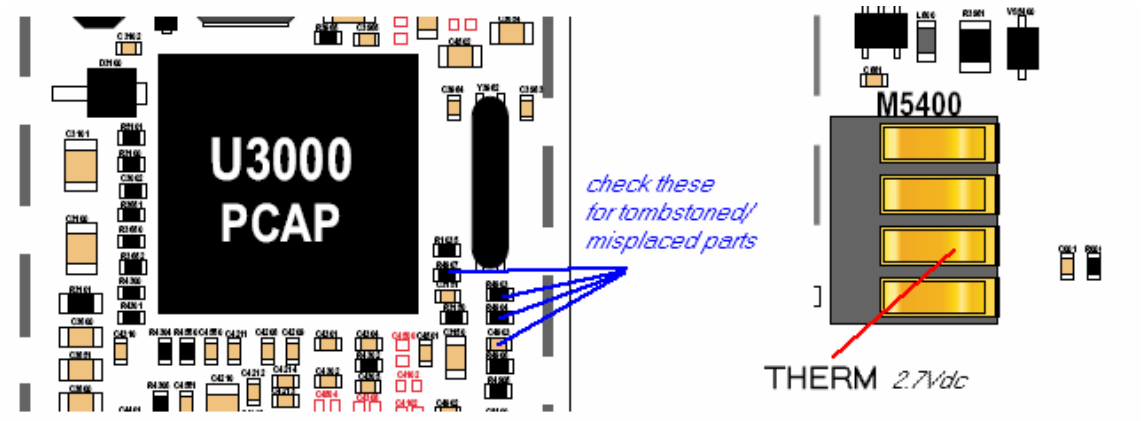
- If not check U5001/CR5401, R4905 (10KOhm), C4902 for low resistance to GND, R4906 (39 KOhm) – VA_2.775Vdc – if ok change PCAP (U3000)



- If ok check whether there is a high current consumption or an off current via battery. If so please follow troubleshooting as described in the BATxx section of this document.
- Check Q3960, Q3961, Q3963, Q3964, D3962, D3961, VS5400, VS4301
- If ok change PCAP (U3000)



CHG01 – Charging – Does not charge
Battery Thermistor problem
Check THERM at M5400-2, it should be 2.7Vdc. If it is not check R4907, R4903, R4904, C4903 for tombstoned/misplaced parts. If ok, change PCAP (U3000)

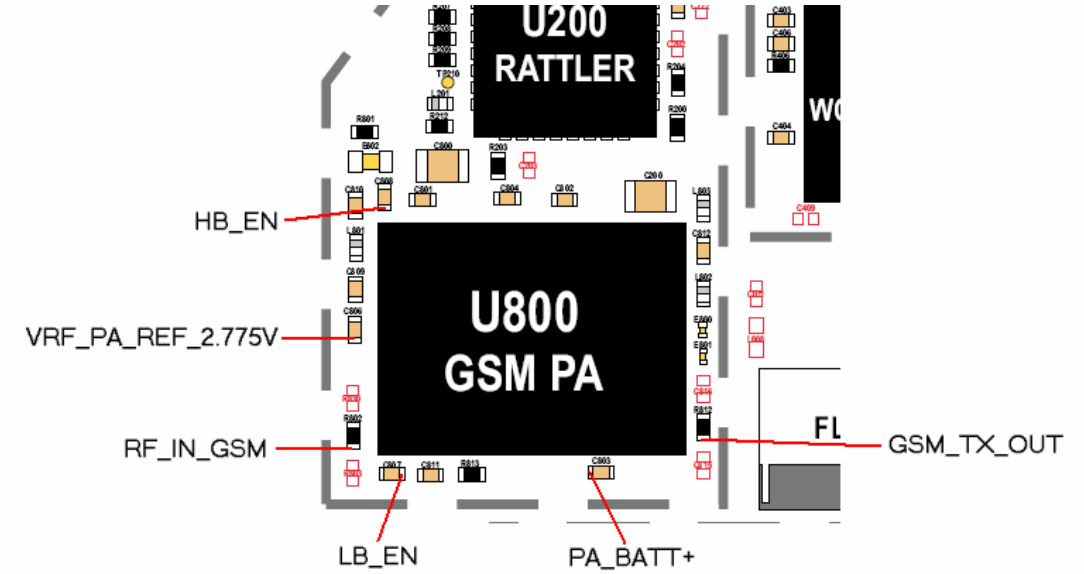


CPR01 – Voice call - Can't make
CPR02 – Voice call - Can't receive call
CPR03 – Voice call – no service

First step in every Call related problem should be to figure out whether there is a receiving problem or a transmitting problem and which bands are affected.

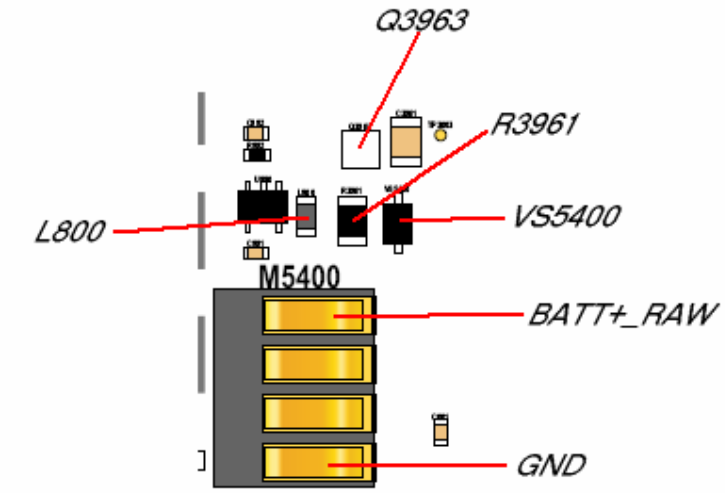
No TX GSM900
Let radio transmit on GSM900 using Repair Studio/Radiocomm. Make sure to provide a battery voltage via micro clamp-type test probes to battery contacts M5400.

- Check GSM_TX_OUT at R812 – if ok in size and form (if unsure compare to good radio) check FL001
- if not ok check RF_IN_GSM at R802
- if RF_IN_GSM is good following signals should be present:
- VRF_PA_REF_2.775V at C806
- PA_BATT+ at C803
- LB_EN at C807 (pulsed 3V at 217Hz) – signal from Harmony



- There are two more signals coming from Harmony directly to the PA, but without test points, which are TX_EN_2V7 and 9E_MODE

If VRF_PA_REF_2.775V is missing or low, it's probably not correctly generated by the PCAP **or** is being pulled down by a defective part which most probably will get warm – and can easily be found by a thermal troubleshooting as described in the BATxx section of this document. VRF_PA_REF_2.775V is the same as VRF_TX2.775V and supplies both PA´s U800 and U850, the Rattler IC U200 and the Harmony U100.
If PA_BATT+ is missing check L800, R3961 and VS5400.

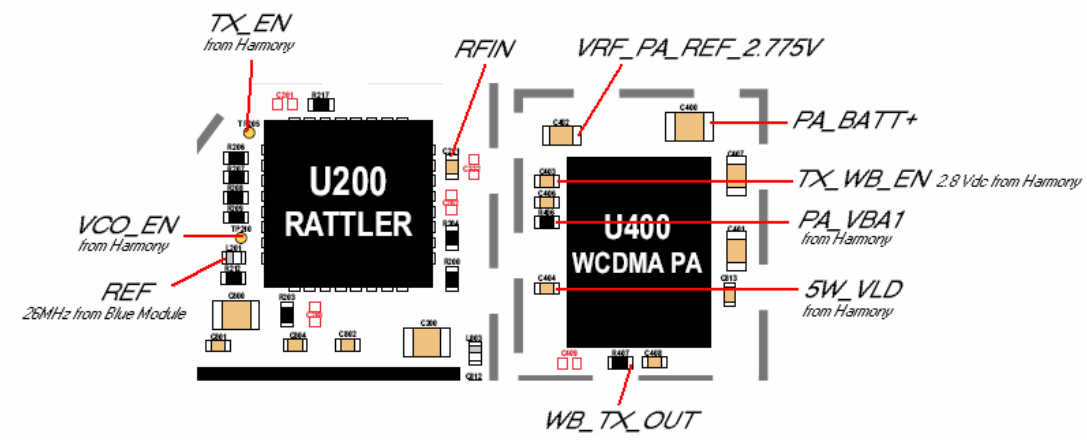


If LB_EN is missing it's probably a defective Harmony

- if RF_IN_GSM is bad it's probably a problem with the Blue Module U900 or with the POG

No TX WCDMA
Let radio transmit on WCDMA using Repair Studio/Radiocomm. Make sure to provide a battery voltage via micro clamp-type test probes to battery contacts M5400.

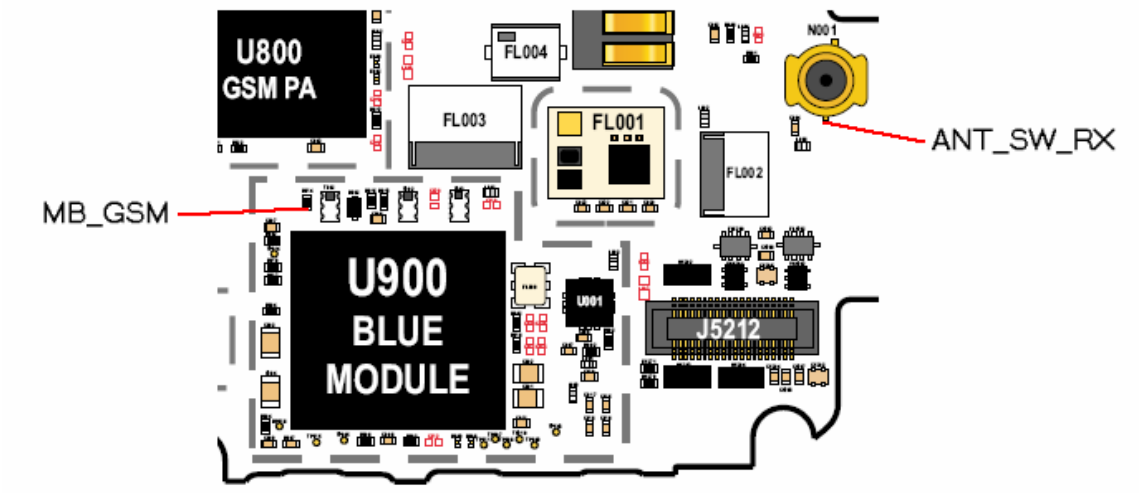
- check WB_TX_OUT at R407 – if ok in size and form (if unsure compare to good radio) check FL003,FL001
- if not ok check RFIN at C221
- if RFIN is good check supply voltages VRF_PA_REF_2.775V at C402 and PA_BATT+ at C400, TX_WB_EN at C403 about 2.8Vdc (WCDMA TX Enable signal from Harmony). If all of these are present it should be most likely a defective WCDMA PA U400.
- If RFIN is bad check TX_EN (2.7Vdc from Harmony), VCO_EN (2.7Vdc from Harmony), REF (26 MHz clock from Blue Module). If all of these are present it is most likely a defective or bad soldered Rattler IC (U200) or a problem with the Harmony (U100)



No RX GSM900

Inject a RF from Test Set. Check ANT_SW_RX at antenna switch N001-1. Check for presence of MB_GSM at R914.

- If not ok change FEM FL001
- If ok there is most likely a problem with the Blue Module U900 or the Harmony U100



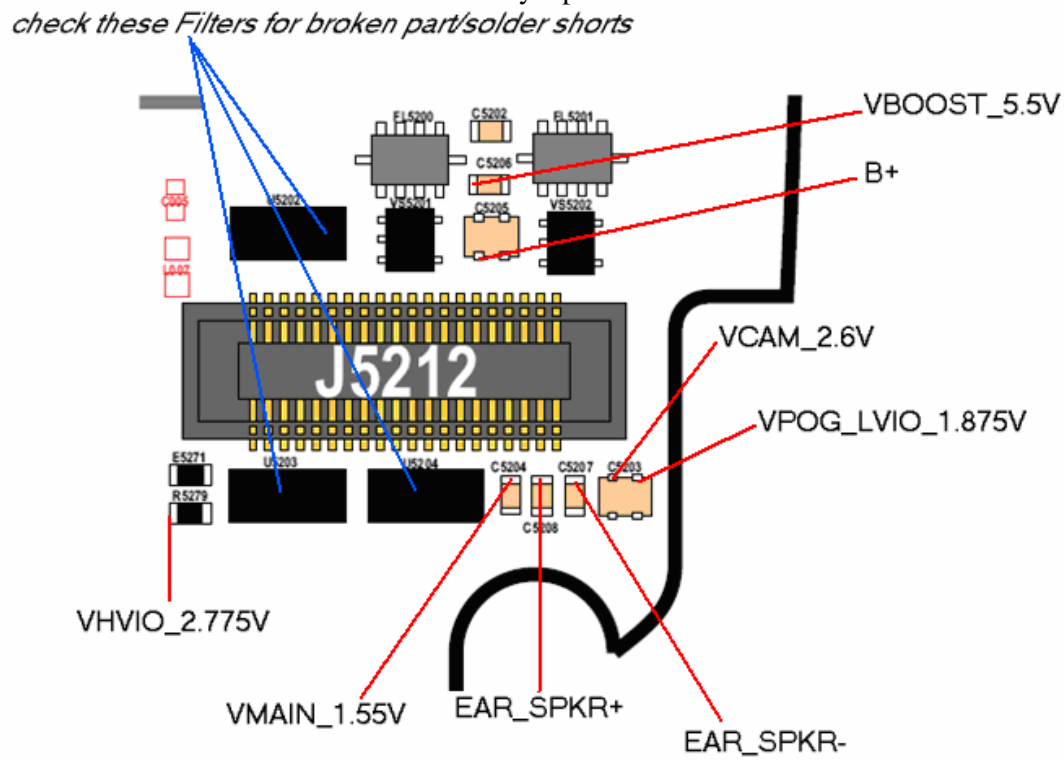
DIM01 – Display Main – no display
DIS01 – Display Secondary – no display
DAP10 – Data Application – poor picture quality
Make sure the problem is not located in the Flip Assembly, by testing PCB with a good one.
Following supply voltages for the Flip Assembly should be present:

- VCAM_2.6V at C5203
- VPOG_LVIO_1.875V at C5203
- VMAIN_1.55V at C5204
- VHVIO_2.775V at R5279
- B+ at C5205
- VBOOST_5.5V at C5206

If ok check:

- Filters U5202/U5203/U5204 (look especially for broken part!)
- Diodes VS5200/VS5202
- Filters FL5200/FL5201
- U5200/U5201 (sometimes they are bad soldered)

If all of these are ok it should be most likely a problem with the POG.



DIM08 - Display Main – No backlight
DIM09 – Display Main – Low/Dim backlight
DIS07 – Display Secondary – No backlight
DIS08 – Display Secondary – Low/Dim backlight
The display backlights are driven by BL_DISP_SINK from the PCAP. So if Flip and Flip connector J5212 are ok it is most likely a problem with the PCAP (U3000).

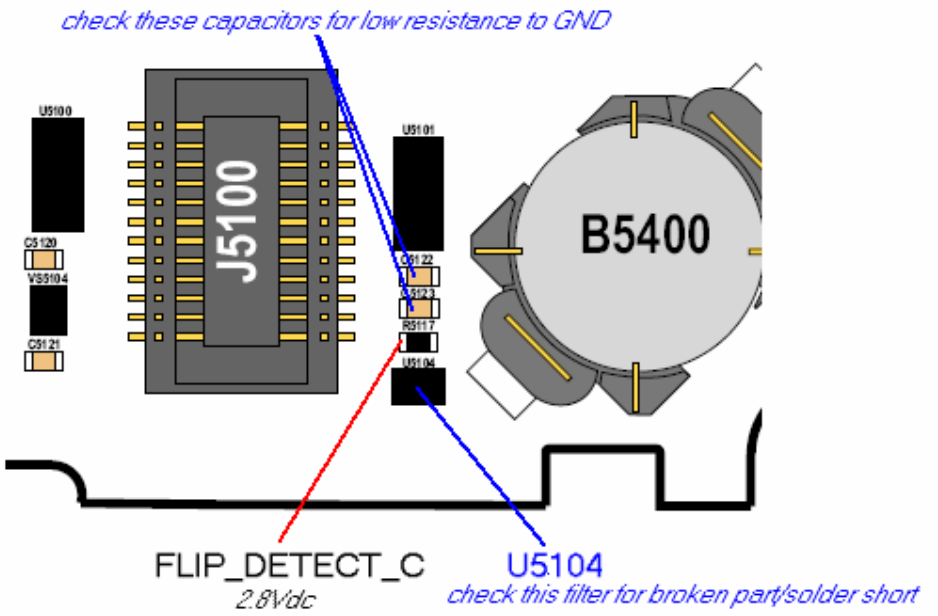
DIM01 – Display Main – No display
MKP01 – Main Keypad – No Function/hangs
TON01 – Turn on/off – No turn on
Flip detect problem

Units with a flip detect problem will show following symptoms:

- no power on via battery
- no main display via CE connector supply
- CLI display is not switching on open/close flip
- no keypad function

Check FLIP_DETECT_C at R5117 – should be 2.8Vdc (High), if it is low check

- C5122/C5123 for low resistance to GND
- Check Filter U5104 for broken part/solder short
- Remove Filter U5104
- Check FLIP_DETECT_C at R5117 again
- If FLIP_DETECT_C is 2.8Vdc (High) now, the Filter U5104 was defective
- If not, change the POG

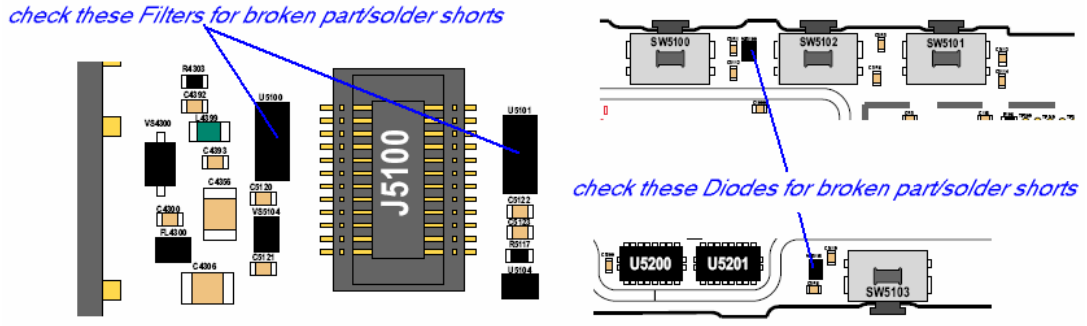


MKP01 – Main Keypad – No function/hangs
SIK01 – Side Keys – No function

Due to the keypad matrix architecture with 8 rows in 4 columns it is quite useful to verify which keys (if not all) are affected. By knowing which keys are not working it is possible to find out which row or column is affected. By using the FLViewer it can be tracked which filters/capacitors the signal passes until it reaches the POG.
In practice the defective part very often can be found just by visual inspection. Check:

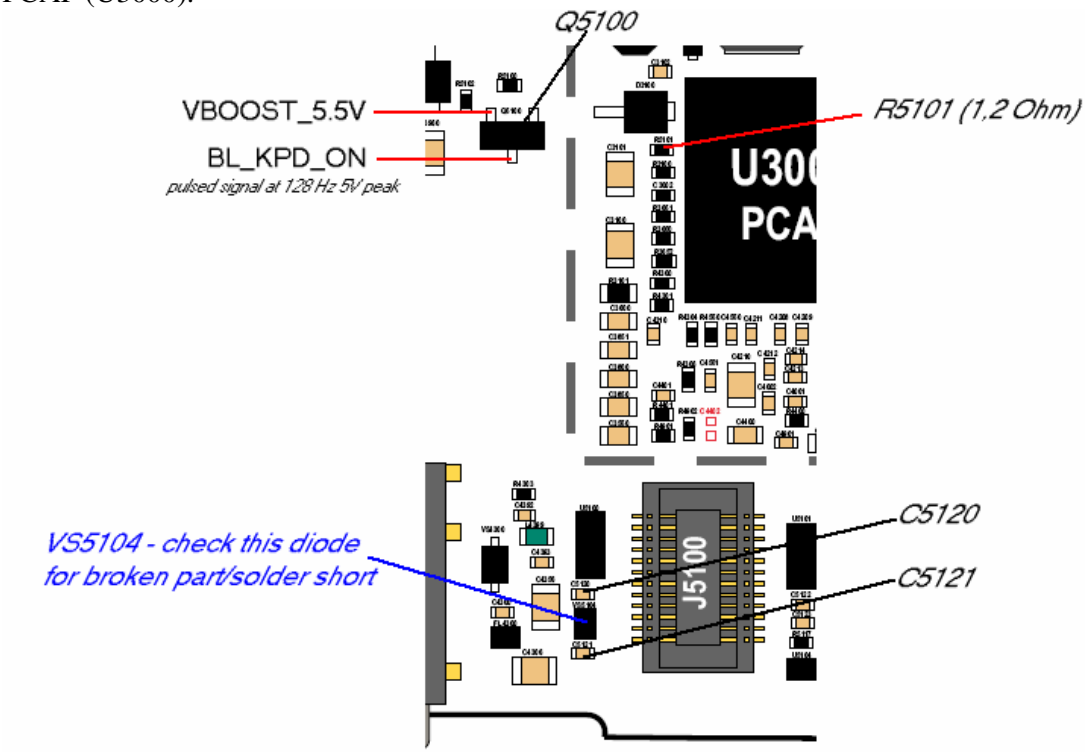
- VS5100
- VS5103
- U5100
- U5101 for solder shorts/broken part

If switches/keypad connector/Diodes/Filters are ok it's probably a problem with the POG.



MKP05 – Main Keypad – No/Dim backlight

Turn on keypad backlight using Repair Studio/Radiocomm. Check VBOOST_5.5V at Q5100-2, check BL_KPD_ON at Q5100-3 – it should be a pulsed signal at 128 Hz 5V peak. If not check VS5104, C5120/C5121 on low resistance, Q5100, R5101 (1.2 Ohm!) – if ok change PCAP (U3000).

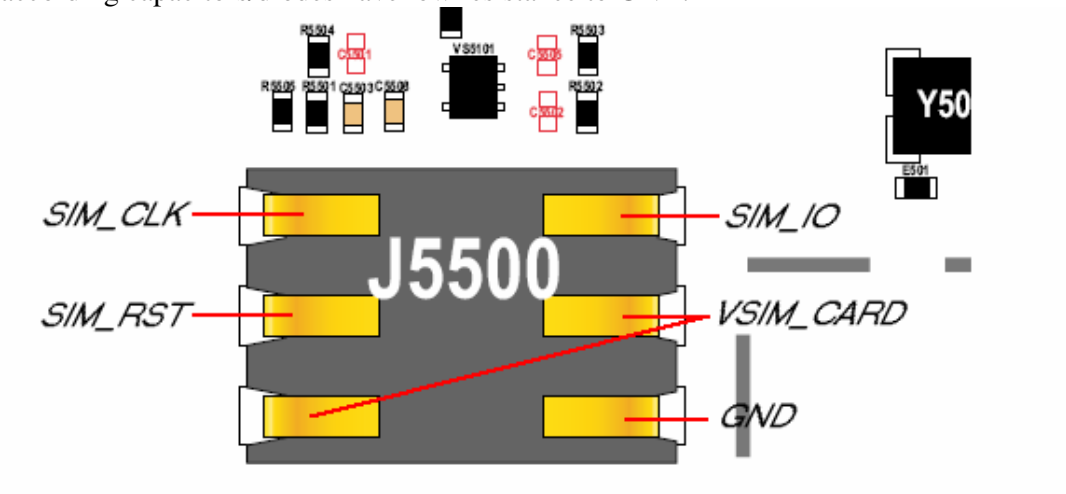


SIM01 – SIM card – check card/insert SIM

Measurement on the SIM interface is a little bit difficult, as no signals will be present until a SIM card and a battery are inserted. As far as I know there is still no SIM feature implementation in Repair Studio or Radiocomm. But in the most cases it should be possible to figure out which part is defective by simply measure with an ohm meter following signals to GND:

- VSIM_CARD at J5500-2,J5500-6 - if far less than 30 kOhm to GND it is probably because of a defective PCAP (U3000)
- SIM_IO at J5500-1
- SIM_CLK at J5500-4
- SIM_RST at J5500-5 - if any of these has far less than 30 kOhm to GND it is most likely because of a defective POG (U1000)

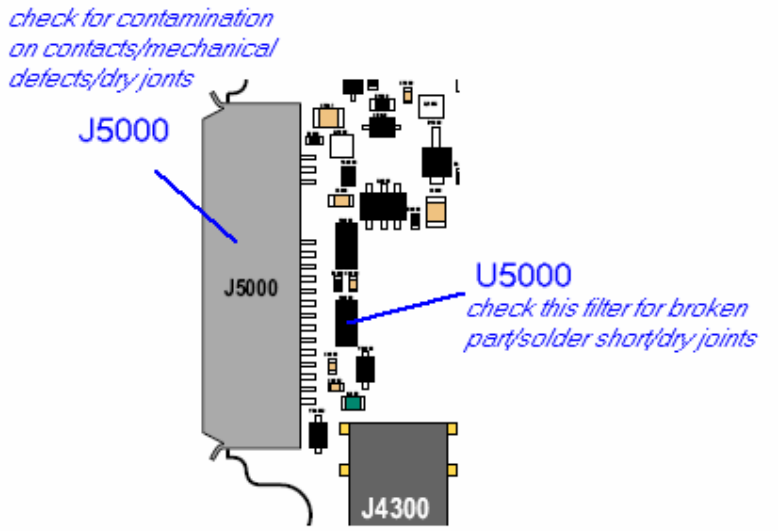
Before changing the PCAP (U3000) or the POG (U1000) make sure that none of the according capacitors/diodes have low resistance to GND.



TON01 – No Turn On

Verify if radio doesn't turn on (assembled with display). If it does, but doesn't enumerate via CE-Connector at RSD/Repair studio it should be a problem with the USB connection. In some cases a 1FF SW reflash in FORCED FLASH MODE (by connecting CE-Connector to radio while "*" and "#" are pressed) can fix this issue. If not

- Visually check CE Connector for mechanical defects or contamination on contacts, bad soldered pins or solder shorts
- Visually check ESD filter U5000 for solder shorts/broken part



The USB interface is located in the POG. If unsure change in order

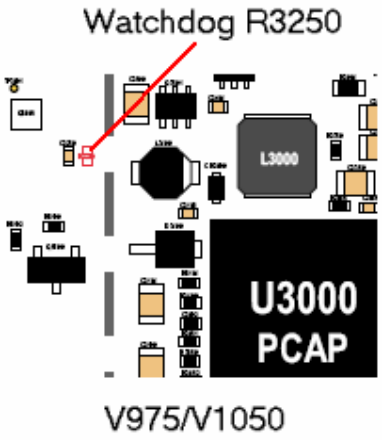
- ESD Filter U5000
- POG U1000 (only in combination with Flash Memory)

If radio doesn't turn on, but draws high current (>500 mA)

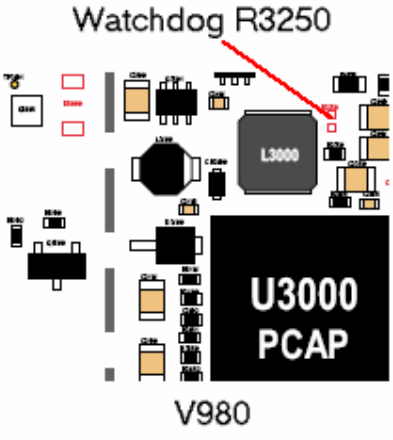
- Please follow troubleshooting instructions as described in the BATxx section of this document.

Note: Watchdog

In case the phone draws current but switches off after a few seconds, you can force the phone not to switch off, by setting the ***Watchdog R3250DNP.*** *By placing a short resistor as R3250, or by just solder across the pads of R3250 the WATCHDOG signal will be pulled to HIGH level (VLVIO_1.875V) and the PCAP will not switch off its power regulators. Thereby you will be able to measure or to do a thermal troubleshooting using a coolant spray.*



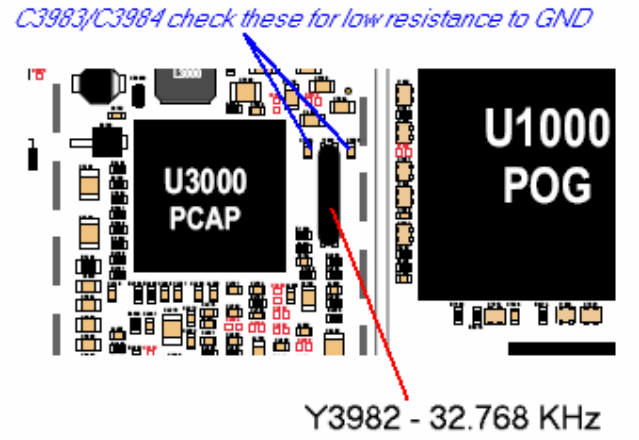
V975/V1050



V980

If radio draws no current it's most likely a problem with the 32.768 KHz clock generated by Y3982

- change Crystal Y3982
- if unsuccessful change PCAP (U3000)

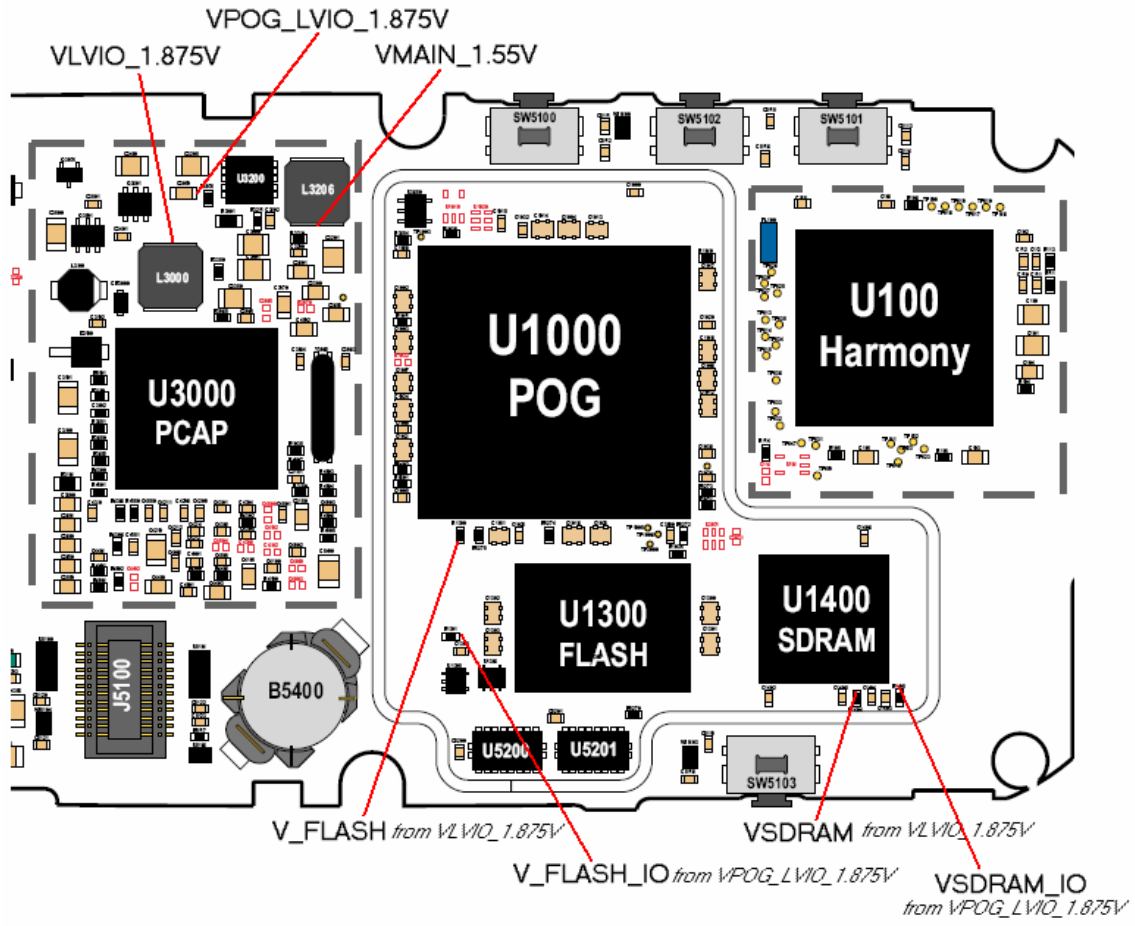


If the current consumption is in normal range (40mA to 300mA)

- try doing a 1FF SW reflash in FORCED FLASH MODE. *If radio enters the forced flash mode or starts in flash mode by itself the main supply voltages for the logic section should be ok – Most likely the trouble can be found in the logic section (POG/Flash Memory/SDRAM Memory)*
- if unsuccessful, a flash log file generated by Repair Studio/RSD can be viewed. There you will find the reason why the flash operation failed. However, this information can be ignored, as in almost every case the next steps will be
- change Flash Memory U1300 (V975), U1300/U1310 (V980) – *if unsuccessful additionally*
- change POG U1000 - *if unsuccessful additionally*
- change SDRAM Memory U1400

If radio doesn't enter flash mode following signals should be checked:

- VLVIO_1.875V which become V_FLASH after passing Short R1300 /VSDRAM after passing Short R1404
- VPOG_LVIO_1.875V which become V_FLASH_IO after passing Short R1301/ VSDRAM_IO after passing Short R1405
- VMAIN_1.55V
- 32.768KHz clock at Y3982

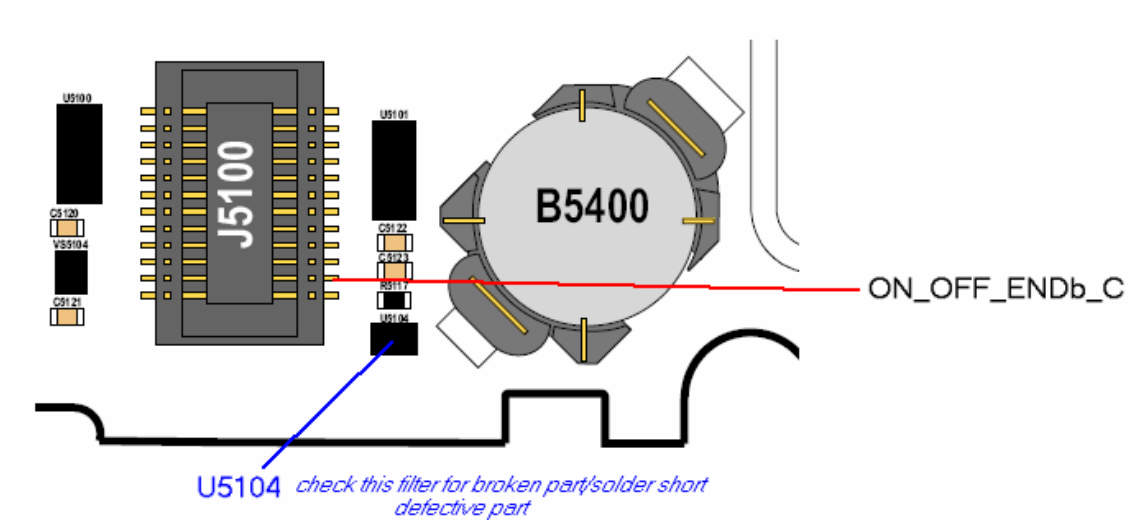


If one of them is missing or low, check current consumption. If it is high there might be something getting warm – follow thermal troubleshooting as described in the BATxx section of this document.
Otherwise change PCAP (U3000).

If radio starts in flash mode, and is reentering flash mode after 1FF reflash check OPT1 / OPT2 for short… (J5000/U5000)

TON01 – Turn on/off – No turn on
TON06 – Turn on/off – No turn off
MKP01 – Main Keypad – No function/hangs (On/Off switch)
On/Off switch not working
Check U5104 for broken part/solder short. If it seems visually ok, it might be a defective part.

- change U5104
- if unsuccessful change PCAP (U3000)



TON03 – Turn on/off – auto power down in standby
If radio stores panic: DSM_MEASUREMENT_ERROR there is most likely a problem with the 32.768 KHz clock, on which the radio is running when entering the deep sleep mode.

- change Y3982 and test radio with a network SIM card and let radio entering deep sleep mode
- if radio still powers down, change PCAP (U3000)

Follow up failures caused by repair action
Quite a lot of repairs which were sent to Level 4 service have a second fault, which is caused by an unsuccessful repair trial.
We strictly recommend to visually check the PCB for skewed or tombstoned parts, solder shorts or heat bubbles in PCB after every soldering action. Especially small parts which are located close to shields can easily be misplaced during removal or setting of the shields.
We experienced that some parts seems to be more heat sensitive than others. We had some issues with defective RattlerICs (U200) after changing the GSM PA (U800). In these cases there could be an off current or high standby current consumption and trouble with TX power in WCDMA.
On *No display issues* after changing the flash memory U5200 and U5201 should be checked. The main problem on the V975/V980 is surely the *underfilled* Harmony.

Flash procedures

Note: It is very important to do a restart after every flash process! Otherwise the phone will start in flash mode again.

Software update
Following steps are necessary to update the Software to latest approved Software:

- unlock phone (if subsidy locked)
- flash customer specific 1FF superfile (example: **DC One File Flash:** R245_U_82.31.58I_LP002C_DRM0101_JPDE_R245H3GV975_02_SE6040CXXW801E_1FF.SHX)
- after restart:
- take out of "In Factory" – if necessary
- do Master Reset/Master Clear

Recovering Flash Memory in Forced Flash Mode
If the phone doesn't start because of corrupted software it might be possible to recover it:

- connect phone to CE-connector while pressing "*" and "#"
- ***or*** use Flash Cable with OPT1 and OPT2 shorted.

The phone should start in flash mode now: *S Flash Rainbow POG.*

- flash 1FF superfile (example: **DC One File Flash:** R245_U_82.31.58I_LP002C_DRM0101_JPDE_R245H3GV975_02_SE6040CXXW801E_1FF.SHZ)
- after restart:
- do Master Reset/Master Clear

If the phone doesn't start in flash mode or as: *S Blank Rainbow POG,* there is a problem. Please follow troubleshooting instructions as described in the TON01 section of this document.

Image flash
Following steps are necessary to flash a phone with blank (new) flash memory:

- connect phone to CE-connector
- phone will start in flash mode as *S Blank Rainbow POG*
- flash image file (example: **monster file:** R24_U_80.3B.20I_monster_rom_UIV980FACT01R2401D_p6c_hardware.shz)
- after restart:
- write and save Primary Subsidy, Secondary Subsidy and Service Password
- write and save IMEI
- write and save Serial Number
- do a complete phasing/call processing
- upgrade: flash latest approved customer software as 1FF file
- after restart:
- take out of "In Factory"
- do Master Reset/Master Clear

Note: it is important to save the subsidies before saving the IMEI