Debug Guide PEBL U6

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

Table of Contents

1. Requirements

1.1. System Requirements

- Power supplies, Oscilloscope, Spectrum Analyzer, Test Set
- Preheater for lead free soldering/ soldering machine for BGA´s
- Microscope
- RepairStudio, including MotoPCB/Radiocomm
- FASTT
- Block diagrams/Schematics
- PinNetFinder FLVIEW

1.2. Basic information on troubleshooting Motorola Phones

- Make sure all contacts are clean
- Use newest approved software
- MASTER -RESET /-CLEAR can fix some issues
- Do a visual inspection for customer abuse/liquid contamination

1.2.1. Some hints to handle lead free soldering

- remove battery and microphone
- **always cover the Bluetooth chip U301 with a metal block or teflon shield**
- the mylar tape is not too sensitive. It can stand some soldering processes, but if it is warmed up handle it carefully. It can't stand to be scratched in that condition
- use flux for lead free soldering
- use the preheater (HAKKO 853) ,available at AMS

1.2.2. Some useful information about EMU (Enhanced Mini USB)

- USB 2.0 FS (full speed, 12Mbits) and optional support for USB OTG
    (on the go , communication without extra host between two devices)
- analog audio (stereo is supported)
- power out to an accessory (max. 200mA e.g. for FM-Stereo headsets or
    EMU headsets)
- charging (only chargers have D+ and D- shortened inside, so they are
    detected as charger / Vbus is connected to the charge power / ID and
    Ground are connected to an ID resistor inside the charger to define
    what kind of charger it is 200k/440k)
- serial communication with intelligent accessories

The EMU power is 5.1V. The phone will switch on with lower power, but that
would mean an unstable condition for example for the flash process.

pin configuration
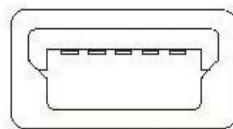
5 4 3 2 1
front view
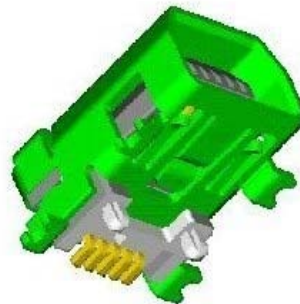
- Pin 1 **VBus** – USB Power / Switched B+ (In/Out)
- Pin 2 **D-** – (USB) / TXD (Serial) / Audio Out Left / Sendend
- Pin 3 **D+** – (USB) / RXD (Serial) / Audio In /Audio Out Right
- Pin 4 **ID** – ID (Detects accessory type) / Audio Interrupt
- Pin 5 **GND** – Power Ground
- Shield **Shield** – Ground Reference

1.2.3. Some useful hints

- Always ask for important field service bulletins (FSB)

- Make sure contacts are clean and not bent

- Use latest approved software

- Master Clear / Master Reset solve some problems.

- Inspect PCB for customer- or liquid damage

2. Top Ten defect parts

Following is an analysis summary of the U6 repaired during NPI process by the Repair Entitlement Group CSS Flensburg
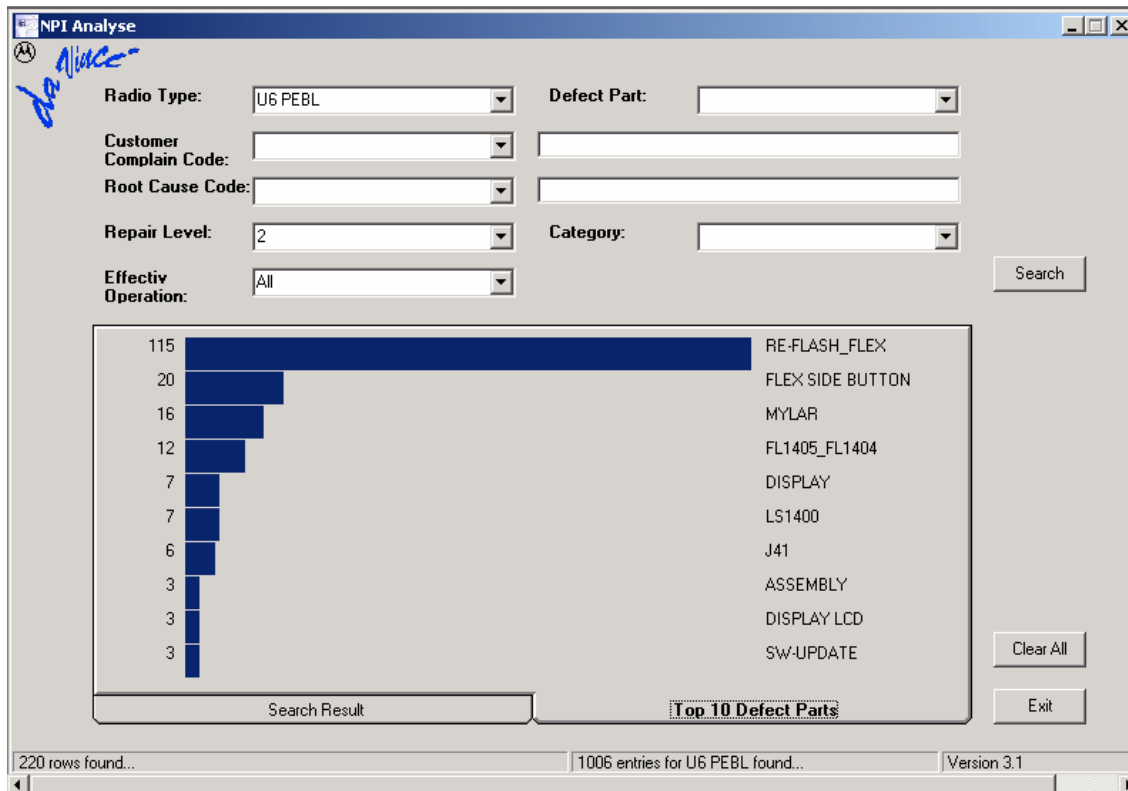
Figure 1 – Level 2 parts
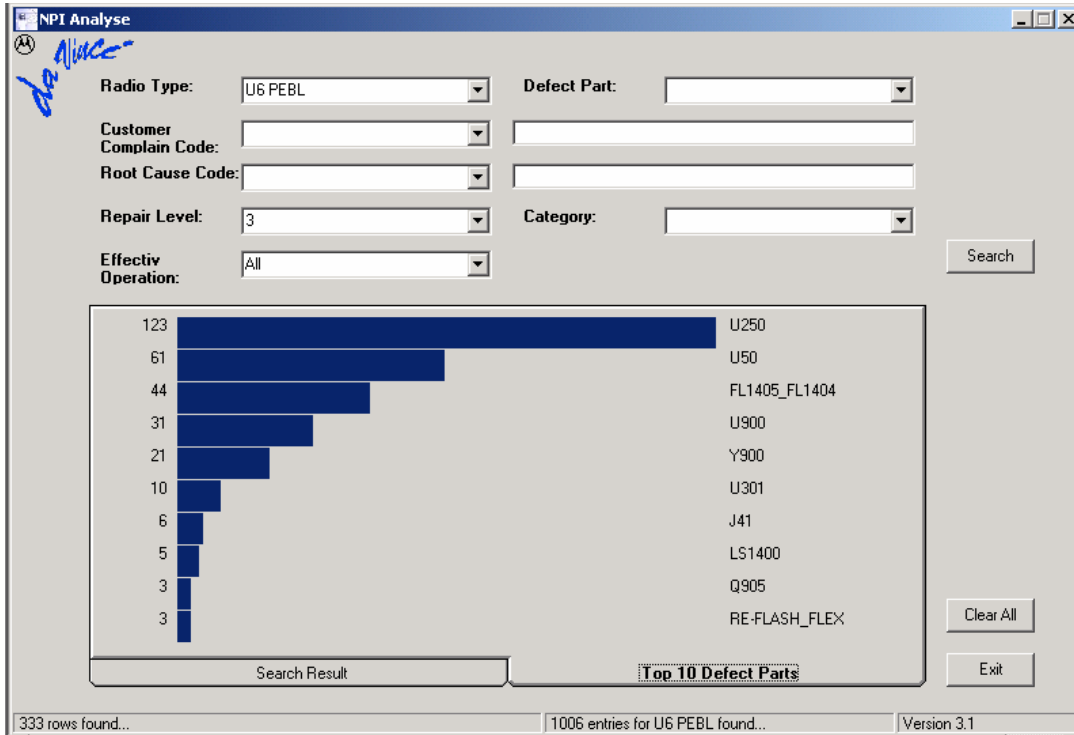
Figure 2 – Level 3 parts

3. Troubleshooting Level 2

3.1. First Step

Make sure on *any* problem, that it is no software related one by simply doing a 1FF reflash with a MasterReset / MasterClear afterwards. In many cases a simple Master Reset can already fix the problem.

3.2. No Speaker Audio

- assembly defective

Verification: Temporarily replace the flip assembly with a known good flip assembly. If the fault has not been cleared, it is because of a defective transceiver board assembly. Forward to an authorized level 3 service center or proceed to Level_3 Trouble-Shooting.

- Speaker bad soldered/defective

Remove Flip Cover and visually inspect soldered contacts at speaker. If not ok, resolder Speaker. Otherwise replace Speaker with a new one. It is one picepart with the camera module.
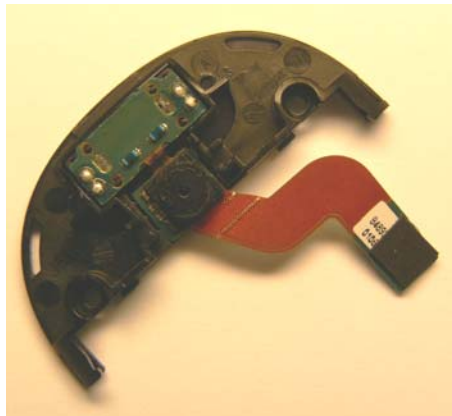
- Flex Assy defective

Remove Flip Cover. Remove the display module assembly flex connector from its socket and temporarily connect the display module with the transceiver board with a known good flex assy .The flex assy is already assembled to the hinge for economic reasons. If the fault has been cleared, reassemble flip assy with new hinge including the flex assy.

3.3. No Microphone Audio

Forward to an authorized level 3 service center or proceed with
Level_3 Trouble-Shooting because the microphone is soldered on the PCB
and is located near the power amplifier!

mic J41

3.4. No Ring tone/Alert function

The alert is located in the Rearhousing
- Check LS 1400 ringer contact on pcb for bent pins or bad soldering.
- check the ringer in the rearhousing for faulty connection.Test with a
    known good testhousing
- Forward to an authorized level 3 service center or proceed with
    Level_3 Trouble-Shooting

3.5. No Vibrator function

- Vibrator defective
    temporarily replace Vibrator (located in Rearhousing) with a known
    good one and check if the fault has been cleared or supply 1.3Vdc
    directly to the vibrator. If it is then working there must be a problem on
    the PCB.

- Check contacts at vibrator and on PCB (VIB P-1) for dirt and/or bent pin

- Forward to an authorized level 3 service center or proceed with
    Level_3 Trouble-Shooting

3.6. No display/-backlight/poor picture quality

- To find out if the PCB or the flip is defective, replace the flip assembly with
    a known good one. If the fault has not been cleared, it is because of a
    defective pcb. Forward to an authorized level 3 service center or
    proceed with Level_3 Trouble-Shooting

- No display/display-backlight/poor picture quality, flip related problem:

    - Check display flex assy (inside slide hinge assy) for assembly damage

     - if ok replace only the main display assy with a known good one

    - If the flex is good, check if the flex connector is fully inserted.

- No main display or CLI display, flip related problem:

Check function of both displays. If just one of them has no function, most likely that display itself is faulty.
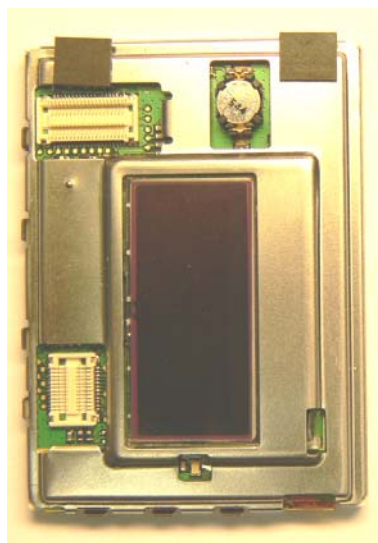
3.7. No turn on

- Check battery if either discharged or defective
- Check battery connectors / USB connector for dirt or misalignment
- Exclude keyboard failure ,check mylar tape on the pcb for bad contact or damage
- If there is no Level2 reason forward to an authorized level 3 service center or proceed to

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3.8. Can't make Voice call/No service

- Check antenna contact (M3) on PCB for damage

- Forward to an authorized level 3 service center or proceed to
  Level_3 Trouble-Shooting

3.9. No Keypad Backlight

- Check Mylar for misplacement or damage
- Don't use the same mylar again
- Use the mylar placement tool
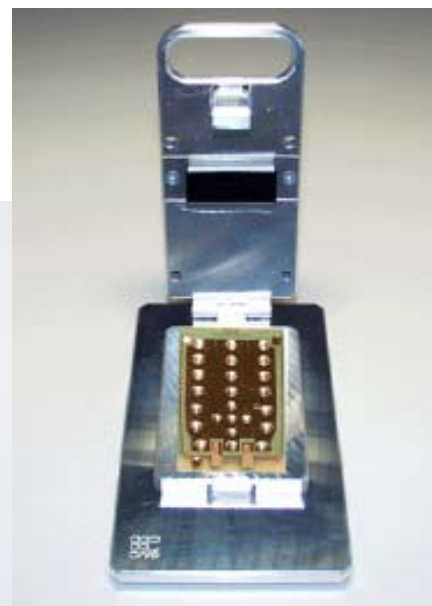
- Forward to an authorized level 3 service center or proceed to
Level_3 Trouble-Shooting

3.10. No Sidekeys

- Check sidekeys for mechanical damage, correct assembly and
clean contacts

- Don't use the same sidekeys again

- Make sure, that the gasket flex assy is assembled to the hinge. If it is missing,
there is no pressure on the contacts

- Forward to an authorized level 3 service center or proceed to
Level_3 Trouble-Shooting

4. Troubleshooting Level 3

4.1. First Step

- 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.

4.2. Audio problems

- First step on every audio related problem is to identify which audio
  path is 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 Neptune U800.
  Send to Level 4 Service Center.

4.3. No Speaker Audio

- Use "Moto PCB" of RepairStudio or the original FLView to follow the
  signals.

- Check HAND_SPKSP at C1211 and HAND_SPKRM at C1210,
  both should have around 1.5Vdc offset voltage, if audio loop is
  switched on, and additional up to 3Vpp at 1kHz, if test tone is switched
  on with Repairstudio/CIT/Audio Loop.

- If ok,check the connector J1300.If not ok change ATLAS IC U900

4.4. No Microphone Audio

- Set radio in internal audio loop using RepairStudio Tab CIT / press Audio
  loop at Loopback box . Use "Moto PCB" of RepairStudio or the
  original FLView to follow the signals.Use the block diagram in addition
  to follow the line thru the PCB.

- Remove SH1400 and check Mic BIAS1 at C1203 – should be around 2.1Vdc
  If there is no correct voltage, replace ATLAS IC U900

- If ok, check voltage MICINM at C1201

(changes its pinname to /INT_MICP on the other side of the capacitor) while speaking or blowing into the microphone to see an audio signal .If there is no audio signal, replace microphone

4.5. No Ring tone/Alert function

Activate the ringer with RepairStudio Tab CIT / press "Start Ringer" at tone generator. A 2.2V signal will be generated. Use "Moto PCB" of RepairStudio or the original FLView to follow the signals.Use the blockdiagram in addition to follow the line thru the PCB.

- Check components C1064 / C1065 / FL 1400 / L1422 / L1423 / ringer contact LS1400 for bad soldered or broken parts. If the failure is intermittent, change LS1400, even if you could not confirm the complaint. There were a few bad manufactured (see bulletins).

- Pin U8 and V10 from Atlas U900 are connected to the audio amplifier and he SAP (serial audio port) of the processor U800.If you have no signal at ALERT
plus or minus change U900.

- The alert signal is amplified by the ATLAS IC and generated by the Neptune LTE, so if the ATLAS alert audio path is ok, there could be a problem with the processor U800 not generating the alert signals. Send to Level 4 Service Center.
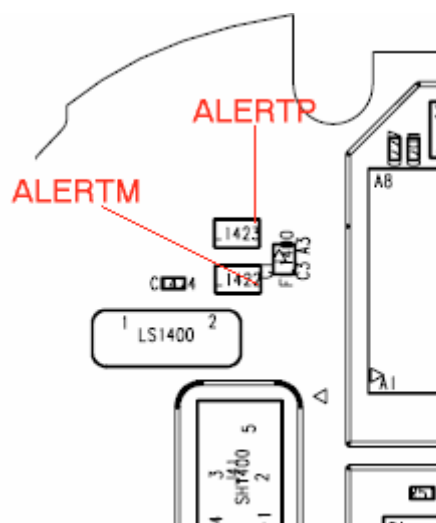
4.6. No Vibrator function

Turn on vibrator using RepairStudio Tab CIT / press "vibrator" in the tone generator box. Use the "MotoPCB" of RepairStudio or the FLView to follow the signals .Use the block diagram in addition to follow the line thru the PCB.

- Measure VVIB at vibrator contact VIB P1, should be 1.3Vdc.If missing, check VR1220

- If VR1220 is ok but still no voltage, change ATLAS IC U900 (regulator VVIB not supplied)

4.7. No display/-backlight/poor picture quality

Exclude that the problem is located in the flip (see Level 2 description)
Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.
The following supply voltages should be present:

VBUCK 1,875V
VBOOST 5,5V
IO_REG 2,775V
GRAPH_REG 1,275V

If all needed voltages are present the Neptune should be the defective part.
Send to Level 4 Service Center.

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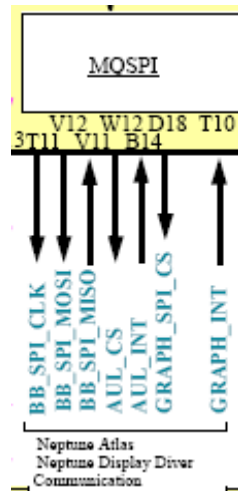
The Neptune U800 controls also the ATI (graphic processor) Reset .

The voltages can be ok without a flip connected, but can break down, if a flip is plugged in, although the flip is ok! Additionally check the clock signal

CLK_32KHZ_2.7V

Check at Atlas IC U900 and additionally at J1300 (display connector)
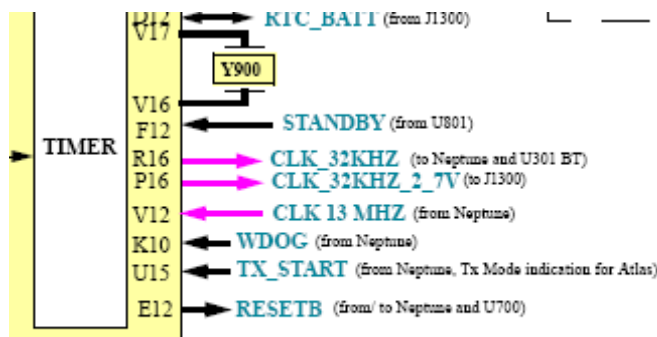
4.8. Flip detect problem

- Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- Check the regulator voltage PERIPH_IO_REG 2,775V from Atlas U900.
      If present, replace U1601/U1600.

- If also ok it should be a Neptune U800 part failure. Send to Level 4 Service Center.

4.9. Flip Indicator LEDs – No function

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- Charging Status, Bluetooth Signal Light – if any of these are not working:

- make sure the fault is not in the flip by testing pcb with a known good flip unit

- check J1300 for solder shorts,dry solder joints or other damage

- check CHRGLED and BTLED from Atlas IC U900 at J1300:

If not present change ATLAS IC U900

4.10. Keypad / Side Keys – No function/hangs

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals from the key through filters to the Neptune U800.

Due to the keypad matrix architecture rows and 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 filter may be defect. Use an Ohm Meter to check the resistance to GND. The defective part is often visually damaged.

Check:
- FL1404
- FL1405
- C1602 / 1603 / C1605 / C1606

If the filters and descrete components are ok, it should be a part failure of Neptune U800. Send to Level 4 Service Center.

4.11. On/Off switch not working

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.
If the on/off button is not working your unit will not start with a battery, but with the repaircable supplying voltage to the EMU connector. Or compare with a known good Keypad.
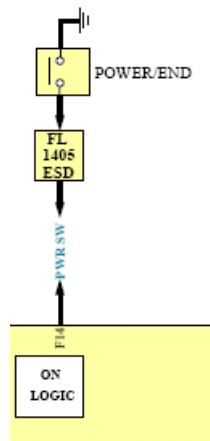
Check PWR_SW at C937. Voltage should measure 2.775Vdc when the on/off normally open switch is not pressed. Voltage should measure 0 Volts when the swith is pressed/closed.

If signal is missing, check FL1405.

If still no change, the ATLAS IC U900 is defect.

4.12. No Keypad backlight (EL Backlight)

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.
(EL = elumination). The EL driver U1501 is on the pcb.

- Turn on Keypad backlight via RepairStudio/CIT/ Backlight

- Measure on the keyboard-side of the pcb at EL-LAMP V+. If the hook in
RepairStudio is set at Backlight/Keypad it should be 90 Vp-p.

- If not,remove the shield SH1500 and measure EL_SUPPLY from ATLAS
U900 at L1501 (2,775V).If L1501 is ok,measure at U1501 pin 5.

- If not present check PERIPH_IO REG (2,775V)at U1501 pin 1.

- If also ok, change ATLAS U900.

- If ok, check also EL_EN from Neptune U800 at R1502.
If missing U800 has to be changed. Send to Level 4 Service Center.

4.13. No Sidekeys

- Follow Level 2 description first and use the "MotoPCB" of RepairStudio or
the original FLView to follow the signals.

- Check FL1404 / FL1405.

- If they are ok, but still no function of sidekeys, it should be a Neptune U800
part failure. Send to Level 4 Service Center.

4.14. SIM Card – check card/insert SIM

Measurement on the SIM interface is a little bit difficult, as not all signals will be present until a SIM card and a battery are inserted.But if you already have your probe in place, switch on the unit and the signals

VSIM (1,8V / 3V)
SIM_CLK (2,775V)
SIM_DIO (2,775V)
SIM_RST (2,775V)

will be present for a little moment after your phone has been detected (started up completely) .

- If V_SIM is missing check R1210 and L1202.

- If ok change ATLAS U900.

- If CLK / RST missing check R1201 /1203, if also ok it should be a U800
        part failure. Send to Level 4 Service Center.

4.15. No Turn On

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

-If your phone draws enough **current, but doesn't enumerate via EMU-connector**, there should be a problem with the USB connection. In some cases a 1FF SW reflash in forced flash mode (plug in the EMU-repaircable, while "*" and "#" are pressed) can fix this issue.

- If not, visually check EMU Connector J_USB for mechanical defects or contamination on contacts, bad soldered pins or solder shorts.

- Follow the ID line with help of "MotoPCB" or the original FL View

- Check VR1204 to ground.

- If VR1204 is ok, it is a problem of ATLAS IC U900, where the EMU USB interface is located.

- If radio doesn't turn on, but **draws high current** (>500 mA),please
Follow the troubleshooting instructions, described in the 4.17. Battery
life short/Charging problems/No turn on due to excessive current drain
section of this document.

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 R830 DNP.** Place a short resistor as
R830, or just put solder across the pads of R830, the " /WDOG" signal will be pulled
to high level and the ATLAS IC U900 will not switch off its power regulators. Now,
you have time to measure or find thermal failures using a coolant spray as described in
the Battery life short/Charging problems/No turn on due to excessive current drain
section of this document.
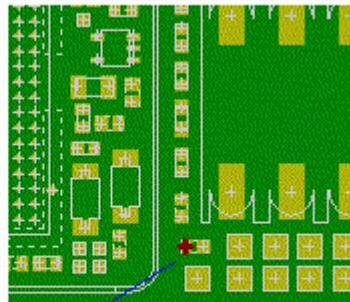
R380 watchdog

- If radio draws **no current** it's most likely a problem with the 32kHz clock
generated by Y900. You can measure the clock signal with an
oszilloscope.

- If not present, change crystal Y900.

- Íf unsuccessful change ATLAS IC U900.

- If the current consumption is in **normal range (30mA to 300mA)**

    - Try a 1FF SW reflash in forced flash mode (# and *). If radio enters
       the forced flash mode or starts in flash mode by itself the main
       supply voltages (VBUCK 1,8V) for the logic section should be ok.
       U700 (flash part) or U800 (processor) should be defect.
       Send to Level 4 Service Center.

    - A flash log file, generated by Repair Studio can be viewed.
       There you will find information in which state the flash
       operation failed.

4.16. Turn off – powers down in standby

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- If radio **stores panic: DSM_MEASUREMENT_ERROR** there is
    most likely a problem with the 32kHz clock (Y900), which keeps
    the radio in "deep sleep" mode.

    - change Y900 and test radio with a network SIM card and let the
        radio enter "deep sleep" mode

    - If radio still powers down, change ATLAS IC (U900).

- If radio **soft resets/ power cycles** and turns on again
    - (possibly with a blank/white screen) try a software reflash/upgrade
        with newest operator approved software.

    - If the trouble remains,
        it could be a problem with the ATLAS IC U900 or with the
        Neptune U800.If U900 is not the reason, send to Level 4
        Service Center.

4.17. Battery life short/Charging problems/No turn on due to excessive current drain

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- In most cases these problems are caused by an **off current**.
First 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 BATTP (M1400-4) 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 test probes, and see which parts are getting warm.

- The power supply (for BATTP) should be set to 3.8V with current limitation to 2A. We strictly recommend using the Power Supply Unit Current Drain Meter to check the current drain of the PCB.

- 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.

- The part, which is getting warm has mostly an internal short. After removing this part, the off current should be fixed. For verification check off current or measure resistance BATTP (M1400-4) to GND.
A new part should be placed after verification.

- If the short or low resistance remains after replacing the part which was getting warm, it should be checked which signals/ voltages this part provides.
In the most cases this part will provide a supply voltage to other parts, which also can get warm due to an internal short.

Most frequent parts with internal shorts causing these kinds of failures are the PA U50, the ATLAS IC U900 and sometimes the Bluetooth chip if overheated by the soldering process.
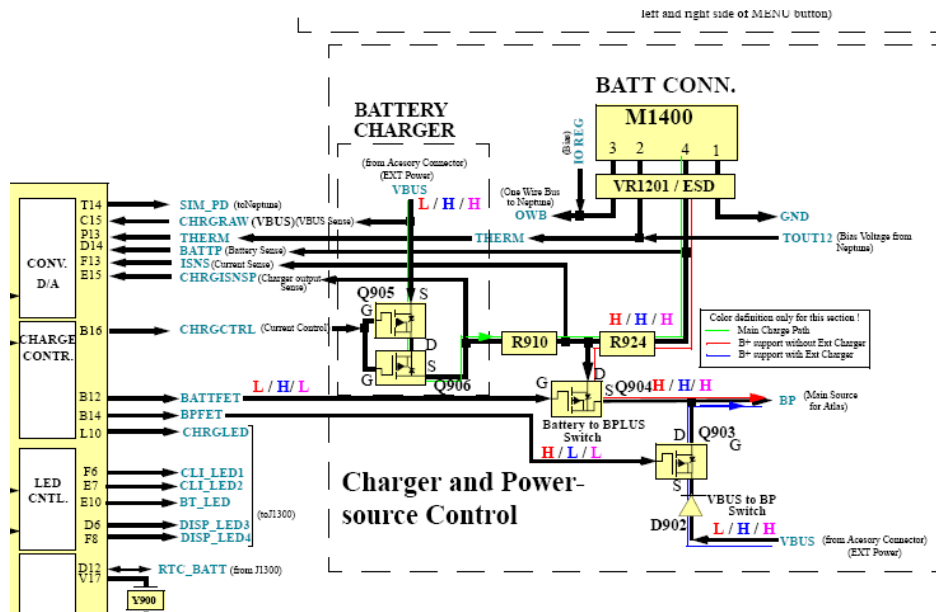
4.18. Does not charge

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- If the phone seems to charge, but battery meter stays at low level,
  check whether there is a high current consumption or an
  off current via battery. If so please follow troubleshooting
  as described in the Battery life short/Charging problems/No
  turn on due to excessive current drain section of this document.
- If there is no off current, check the path for the charging current.
  Make a battery/charger phasing to see, if only the charger
  current or also the battery-phasing is affected.

For a charger current problem:

- Check the whole charger path for misplaced parts,
  solder shorts or defective parts

- If all ok, replace ATLAS IC U900.

4.19. Invalid Battery

Use the "MotoPCB" of RepairStudio or the FLView to follow the signals.

- Verify, that the battery connector is in good position and is good soldered

- Measure OWB at battery connector (M1400 pin3) while pcb is connected to EMU-USB cable. It should be 2.775V.

- Check VR1201 and VR800.

- Check if PERIPH_IO REG is present at R1200.

- If ok, Neptune U800 should be the problem. Send to Level 4 Service Center.

4.20. Battery Thermistor problem

Use the "MotoPCB" of RepairStudio or the FLView to follow the signal.

- Check THERM at battery connector M1400 pin 2, with a repair cable connected, it should be 2.775V

- If it is not check VR1201 visually.

- Remove the shield SH800 above ATLAS IC U900.

- Check resistors in THERM line.

- If they are ok it should be a problem with the ATLAS IC U900.

4.21. Accessory detection problem

The phone starts up with main display start up screen in normal charging condition, instead of starting the charge process. Same repair flow, if headset is not detected.

- Check the ID line of the EMU/USB connector J_USB to ground (bad , if less than 1MOhm).

- If less than 1MOhm, take out VR1204.

- If still less than 1MOhm, change U900 and replace the VR1204

4.22. Can't make 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.

Make sure, that the RF connector (M1201) is cleaned (with cleaner or alcohol) before making a phasing/call-processing test or only in case of test failed.

4.23. No / bad TX signal

Use the "MotoPCB" of RepairStudio or the FLView to follow the signal.

Set radio on transmit GSM-band 900 using RepairStudio/RX,TX tab/TX tab/set test mode to activate the buttons/select power and channel. Make sure to provide a battery voltage (3,6V) via micro clamp-type test probes to battery contacts at M1400, if the phone switches off at high power level.

- Measure the TX output signal at U50 pin 21 with the Spectrum analyser.

- If ok in size and form (if unsure, compare with a good unit) check M1201

- If too small, bad or missing signal, check if B+ is present and measure the low band line at U50 pin 2.If you activate band 1800 / 1900 measure at high band line at U50 pin 9.

- If the spectrum is ok ,compared to a good unit, change U50.

- If the spectrum is bad, check U51/U52.

- If they are ok, the GSM/EDGE transceiver U250 pinG1 and F1 is
the first location to measure the TX spectrum.It has always the
same size. Bevore changing this component in case of a missing
or bad signal, check also some voltages and the clock signals as
there are:

RF_REG
VCO_REG
PERIPH_IO_REG all from ATLAS IC U900

TX_START from Neptune (starts TX activity in the U250)

TX_EN from U250 (enables the transmitting process in the PA) is a
217kHz pulsed signal.

RAMP (pulsed at 217 Hz from U250) is proportional to the expected
amplification of the PA. Change the power level with help of
RepairStudio power selection. Normal values are about 750mV
at low power and 2,1V at max. power. With a defect PA it can
increase to 2,7V at low power.

Clock signals : the main clock is Y201 directly connected to the
GSM/EDGE transceiver IC U250.It provides the 26MHz to
oscillator and clock generator inside U250 and U250 generates
the OSCO clock for the Neptune U800.

4.24. No / bad RX signal

Inject an RF-signal generated from the Test Set. You can use the function of
RepairStudio/RX, TX tab/RX tab and select a channel. You can either check
RSSI signal or camp state.

- Measure the RX input signal at U50 pin 21 with the Spectrum
analyser. To enlarge the signal for a better view, change the
RX level at the testset.

- If the signal is bad check M1201.

- If the signal is good :all four lines RX 850/900/1800/1900 are
direct lines to U250.No chance to measure.

The SAW filter is included in U250.
Also the digital RX signals, data lines and RF clock between
U250 and Neptune U800 are direct lines.
There is only the chance to change one part after the other.
But if it is not U250 : Send to Level 4 Service Center.

5. Flash procedures

Note: It is very important to restart after every flash process!
This restart can be done automatically with RepairStudio, Menu / MISC /
Setup / Flash / set a hook at" restart"

5.1. Software update

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

- Unlock phone (if subsidy locked)

- Flash the customer specific 1FF superfile
    (example:R478_G_08.84.2FR_PDS00B_LP0939_DRM0101_
    VSTGERMAN206_JPJAVA_G_08_R478_06_06_02I_
    SE8695AXXF317B_1FF.shx)

- Do a MasterReset / MasterClear after restart

5.2. 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 EMU-cable while pressing "*" and "#".
    The phone should start in flash mode now with the product
    description in RepairStudio as " S Flash Neptune LTE".

- Flash the customer specific 1FF superfile
    (example:R478_G_08.84.2FR_PDS00B_LP0939_DRM0101_
    VSTGERMAN206_JPJAVA_G_08_R478_06_06_02I_
    SE8695AXXF317B_1FF.shx)

- do a MasterReset / MasterClear after restart

- If the phone doesn't start in flash mode, there is another problem.

Please follow troubleshooting instructions as described in
.

5.3. Image flash

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

- Connect the phone to the EMU/USB repair-cable

- The phone starts in flash mode as "SE Blank Neptune LTE"

- Flash the image file
    (example:R478_G_08.83.6DI_F6_RFDI_GMPPEBB001AA0C2_
    image_SA)

- After successful flashing the phone should start now.

- Write and save Primary Subsidy, Secondary Subsidy and
    Service Password

- Write and save IMEI

- Write and save Serial Number and the bluetooth-address

- Do a complete phasing/call processing

- Flash wanted or latest approved customer software as 1FF file

- Do MasterReset / MasterClear after restart