6 Troubleshooting Instructions

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Introduction to NEM-4 Troubleshooting

This document is intend to be a guide for localizing and repairing electrical faults in the NEM-4 device. First there is a brief guide for fault localizing. Then fault repairing is divided into Troubleshooting paths.

Before any service operation you must be familiar with the NEM-4 product and module level architecture. You have to also be familiar with the NEM-4 specified service tools such as the Phoenix service software, flashing tools and software.

General guidelines for NEM-4 trouble shooting

Tools needed for Troubleshooting

- Service tools (as listed at service tools chapter in service manual)
- Laboratory power supply with current indicator
- Oscilloscope
- Digital multimeter ...

General guidelines

If the device cannot be turned on by any means, see “dead device” trouble shooting

Current consumption (missing consumption) gives an idea whether the device is able to start up.

Dropping supply voltage or very large current consumption indicates a short circuit

Check whether the connection with Phoenix works and what can be discovered with Phoenix (ADC-readings, baseband selftest, bb-calibrations etc.)

Check baseband selftests with Phoenix if “CONTACT SERVICE” is shown on the display.

Check visually display and rocker faults

Force phone to LOCAL mode and make keyboard test by phoenix

Check that board-to-board connector is OK, and connectors make good contacts.

If liquid damage, stop repairing!

Flash phone before disassembling it if fault is not obvious and Phoenix connection is OK.

Disassemble phone:

Check failed module visually:

Mechanical damages?

Solder joints OK?

Continue with specific trouble shooting procedure for the module:

If there is an obvious fault, repair it before reflashing the device

Flash first if a fault is not obvious

If flashing is not working go to flashing trouble shooting

Due to CSP packages short circuits or broken solder joints are not easily seen. If the examined signal seems to be continuously in low or high level, then measure for possible short circuit to ground (signal low) or to supply voltage (signal high) Note that if a problem is not found from any visible contact/component it can be under CSPs where the signal is connected.

Care must be taken when assembling and disassembling the transceiver. Failure to do this may result in unnecessary damage to device.

Nominal current consumption

NOTE: Service tools need some amount of current to work.

The following current consumption values are measured from a complete NEM-4.

Vbatt = 3.6V

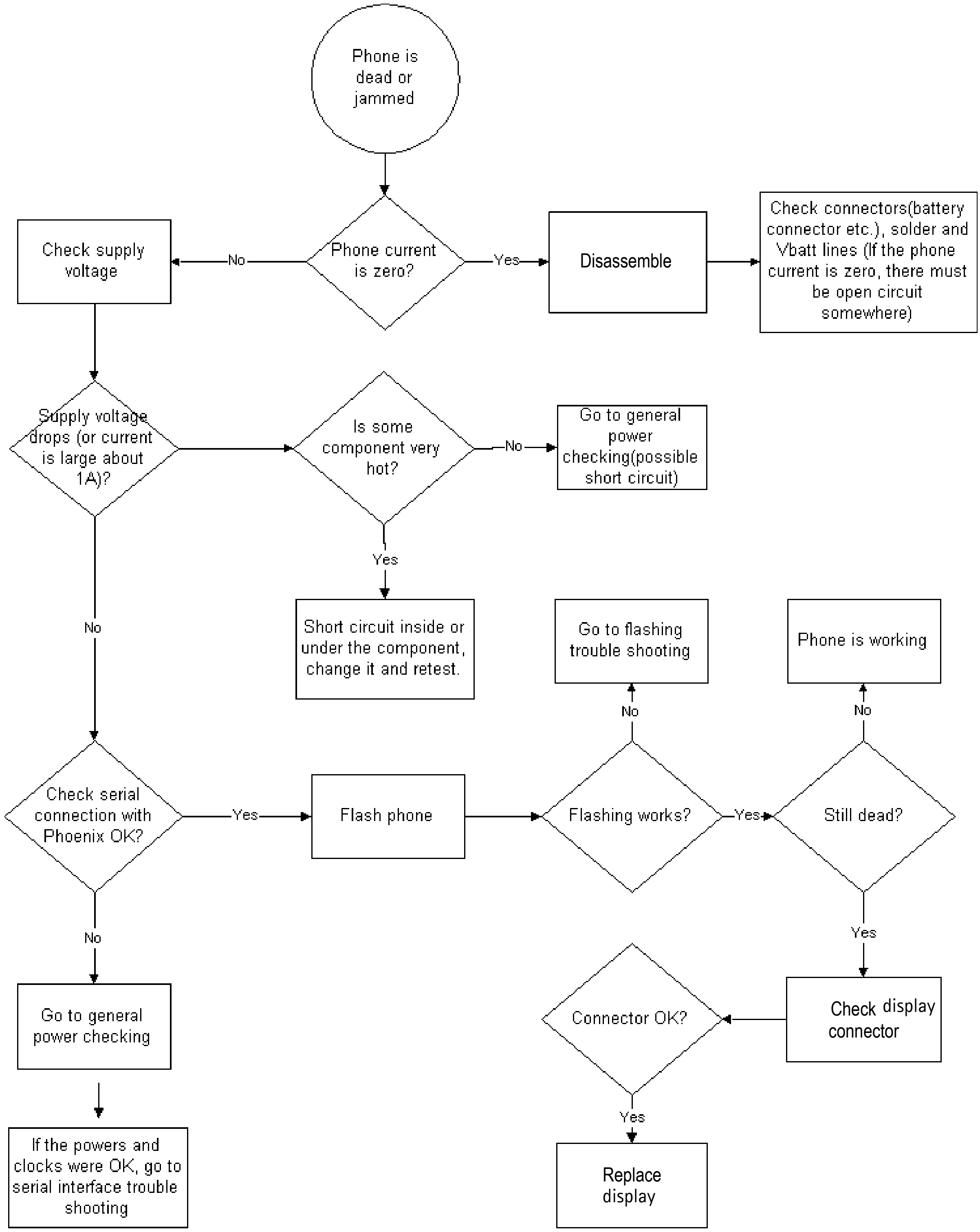
Measured nominal currents are drawn from the main battery.

Measurements have been made with a current probe connected to an oscilloscope.

Operating Mode	Current Consumption
Idle	5mA
2W audio call	350mA (LOCAL MODE)
MP3 playback	nominal 80mA
FM-radio playback	nominal 25mA

Troubleshooting paths

Dead or jammed device



Partially damaged device

If the device is working, but some functionality is missing try to localize where the problems is and see relevant part of this manual. E.g audio is not working see "Audio Troubleshooting" , if charging is not working see chapter Charging Troubleshooting etc.

Most common symptoms reported by customer

In this chapter is described most common symptoms reported by customers when the device is brought in for service. Some tips where the trouble can be found are given also. When Troubleshooting use these tips and follow the given Troubleshooting path.

Most common symptoms for audio problems

"Earpiece sound is missing"

"Headset is not recognized"

"Microphone is not working"

"Volume cannot be adjusted"

"Ringing tones does not work"

"Audio volume too low"

"Radio does not work"

"IHF sound is missing"

"Headset sound is missing"

"MP3/AAC play does not work"

If the symptom is something like above, see audio Troubleshooting.

Most common symptoms for USB and BT problems

"Bluetooth does not work or a connection can not be established"

"USB connection does not work or PC cannot find device"

If symptoms are something like above, follow USB or Bluetooth Troubleshooting guidelines.

Symptoms related to energy management

"Phone does not stay on"
"Charging is not working"
"Time is lost during battery change"
"Charging takes too long"
"Operating time is very short"

These symptoms lead to relevant part of energy management Troubleshooting

Problems related to UI:

"Keypad is not working"
"Backlight is dim"
"Backlight not even"
"Backlight is blinking"
"Keypad or display backlight is not working"
"Display related problems"

"Rocker is not working"

Most common RF related symptoms:

"Call cannot be made"
"Phone does not find signal"
"Call is often dropped"
See RF Troubleshooting.

ASIC is changed

ASIC's can be changed only at a defined service level.

UEM changed

If UEM is changed baseband calibrations should be made. New IMEI must be programmed also. ZOCUS calibration is not necessary.

UPP_WD2 changed

IMEI must be reprogrammed.

ZOCUS changed

Zocus must be re-calibrated

Test points

Table 1: Test points in Baseband area (F6)

Test Point	Signal description
J128	GPIO1 (WD2->ADSP)
J129	GPIO0 (ADSP->WD2)
J904	VCOREA enable (N261 EN, UEMRST)
J900	VHPA enable (N266 EN, GENIO14)
J901	VAUD (N265 EN, GENIO25)
J903	VAUX2 enable (N264 EN, GENIO16)
J218	GENTest0
J004	N330 (Boomer) _SHUTDOWN (from WD2 GENIO8)

J906	ADSP S11 (WD2->ADSP through UEM level shifter IRLEDC)
J907	ADSP S13 (ADSP->WD2 through UEM level shifter IRRXN)
J558	ADSP CLKR0 (BCLK_OUT) to AIC
J559	ADSP DR0 (DIGITAL_AUDIO_IN) from AIC
J560	ADSPDX0 (DIGITAL_AUDIO_OUT) to AIC
J561	ADSP FSX0 (LRC_OUT) to AIC
J562	ADSP C1 (ADSP Flash OE#)
J563	ADSP C2 (ADSP Flash WE#)
J567	ADSP C3 (ADSP Flash CE1#)
J564	ADSP GPIO2
J565	ADSP GPIO3
J312	FLASH _CE (D310)
J315	FLASH CLK (D310, D311, D313)
J311	FLASH _CE (D311)
J313	FLASH _CE (D313)
J314	SDRAM CLK (D312)
J197	GPIO13 (Keyboard matrix ROW0)
J196	GPIO12 (Keyboard matrix ROW1)
J179	GPIO16 (Keyboard matrix COL4)
J116	GPIO30 (Keyboard matrix COL5)
J119	GPIO15 (Keyboard matrix ROW3)
J118	GPIO14 (Keyboard matrix ROW2)
J176	GPIO18 (Keyboard matrix ROW5)
J175	GPIO17 (Keyboard matrix ROW4)
J177	GPIO10 (Keyboard matrix COL2)
J178	GPIO11 (Keyboard matrix COL3)
J117	GPIO8 (Keyboard matrix COL0)
J180	GPIO9 (Keyboard matrix COL1)
J181	GENIO1 (ROCKER1)
J145	GENIO2 (ROCKER2)
J182	GENIO10 (ROCKER3)
J194	GENIO28 (MUSIC PL KEY)

J184	GENIO11 (ROCKER5)
J183	GENIO13 (ROCKER4)
J912	LCD signal
J185	LCD signal
J186	LCD signal
J187	LCD signal
J188	LCD signal
J189	LCD signal
J190	LCD signal
J191	LCD signal
J113	LCD signal
J114	LCD signal
J905	UEM DLIGHT (Display LED driver control)
J404	SIM Data
J405	SIM Clock
J406	SIM Reset
J913	MMC CMD
J914	MMCDAT0
J577	N470 Dir3
J579	N470 Dir2
J576	N470 A1
J578	N470 A3
J593	N470 A2
J910	N470 EN2
J911	N470 EN1
J568	USB PU ?
J569	USB D+
J575	USB D-
J398	VBAT (After current sense monitor) R382
J902	N301Zint

"CONTACT SERVICE" on display

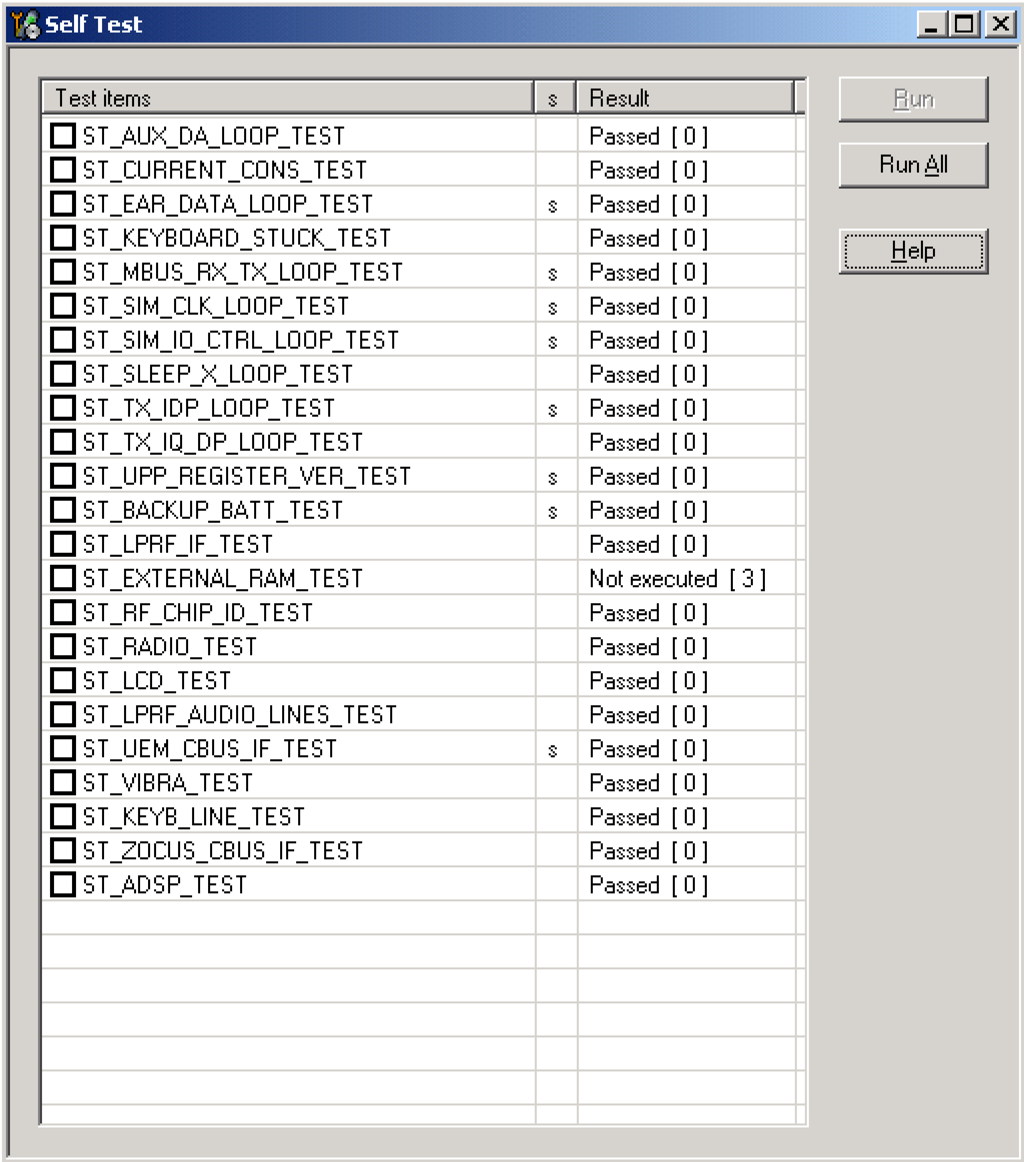
CONTACT SERVICE on display (Self-tests by Phoenix)

Display information: **"Contact Service"**

This fault means that software is able to run and thus the watchdog of UEM can be served.

Selftest functions are executed when the phone is powered on and if one or more selftest functions fail, the message "Contact Service" is shown on the display.

MCU selftest cases can be split into two categories: The ones that are executed during power up and the ones that are executed only with a PC connected. These test and the items included are as follows:


Self Test

Test items	s	Result
ST_AUX_DA_LOOP_TEST		Passed [0]
ST_CURRENT_CONS_TEST		Passed [0]
ST_EAR_DATA_LOOP_TEST	s	Passed [0]
ST_KEYBOARD_STUCK_TEST		Passed [0]
ST_MBUS_RX_TX_LOOP_TEST	s	Passed [0]
ST_SIM_CLK_LOOP_TEST	s	Passed [0]
ST_SIM_IO_CTRL_LOOP_TEST	s	Passed [0]
ST_SLEEP_X_LOOP_TEST		Passed [0]
ST_TX_IDP_LOOP_TEST	s	Passed [0]
ST_TX_IQ_DP_LOOP_TEST		Passed [0]
ST_UPP_REGISTER_VER_TEST	s	Passed [0]
ST_BACKUP_BATT_TEST	s	Passed [0]
ST_LPRF_IF_TEST		Passed [0]
ST_EXTERNAL_RAM_TEST		Not executed [3]
ST_RF_CHIP_ID_TEST		Passed [0]
ST_RADIO_TEST		Passed [0]
ST_LCD_TEST		Passed [0]
ST_LPRF_AUDIO_LINES_TEST		Passed [0]
ST_UEM_CBUS_IF_TEST	s	Passed [0]
ST_VIBRA_TEST		Passed [0]
ST_KEYB_LINE_TEST		Passed [0]
ST_ZOCUS_CBUS_IF_TEST		Passed [0]
ST_ADSP_TEST		Passed [0]

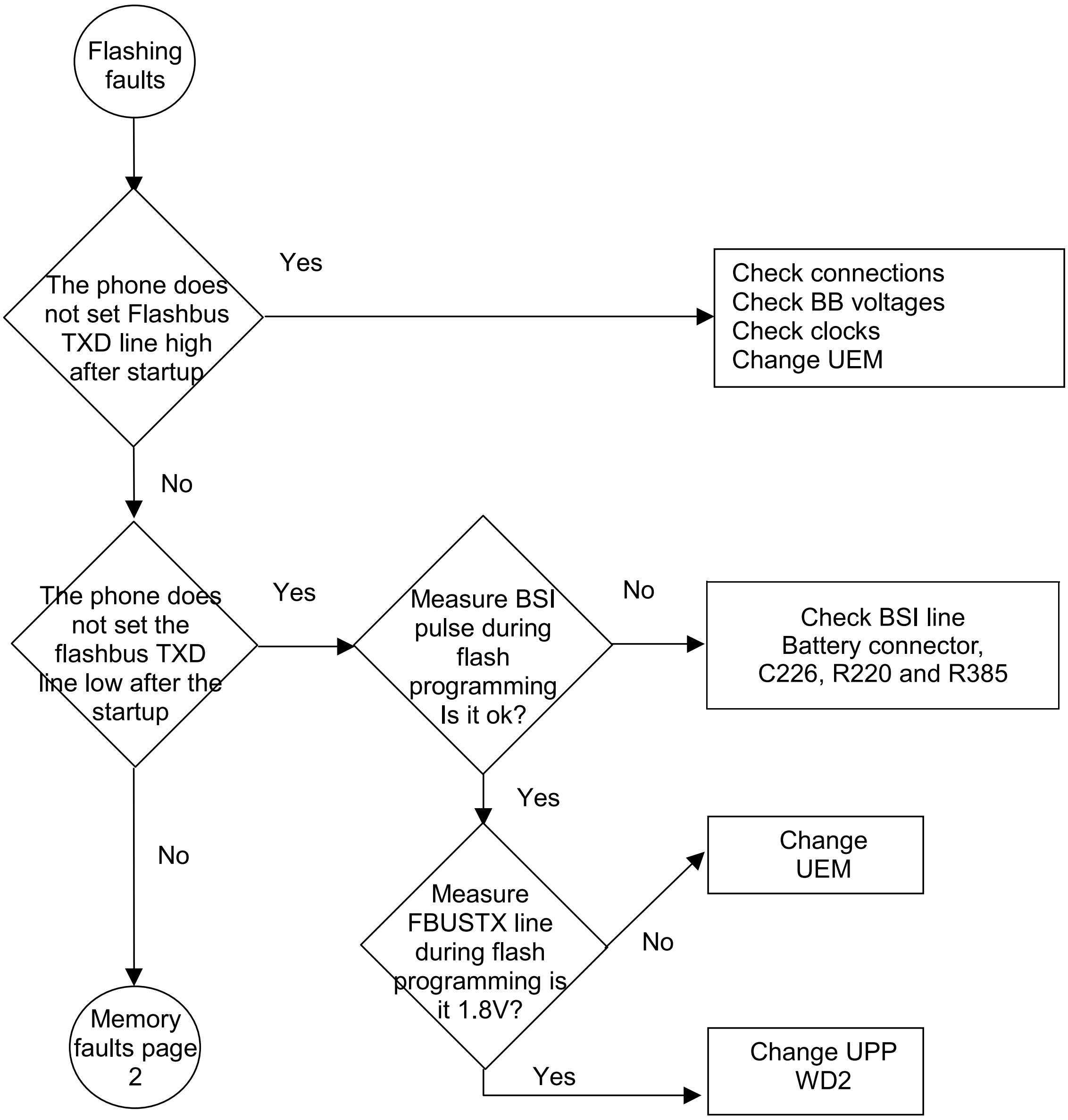
Run
Run All
Help

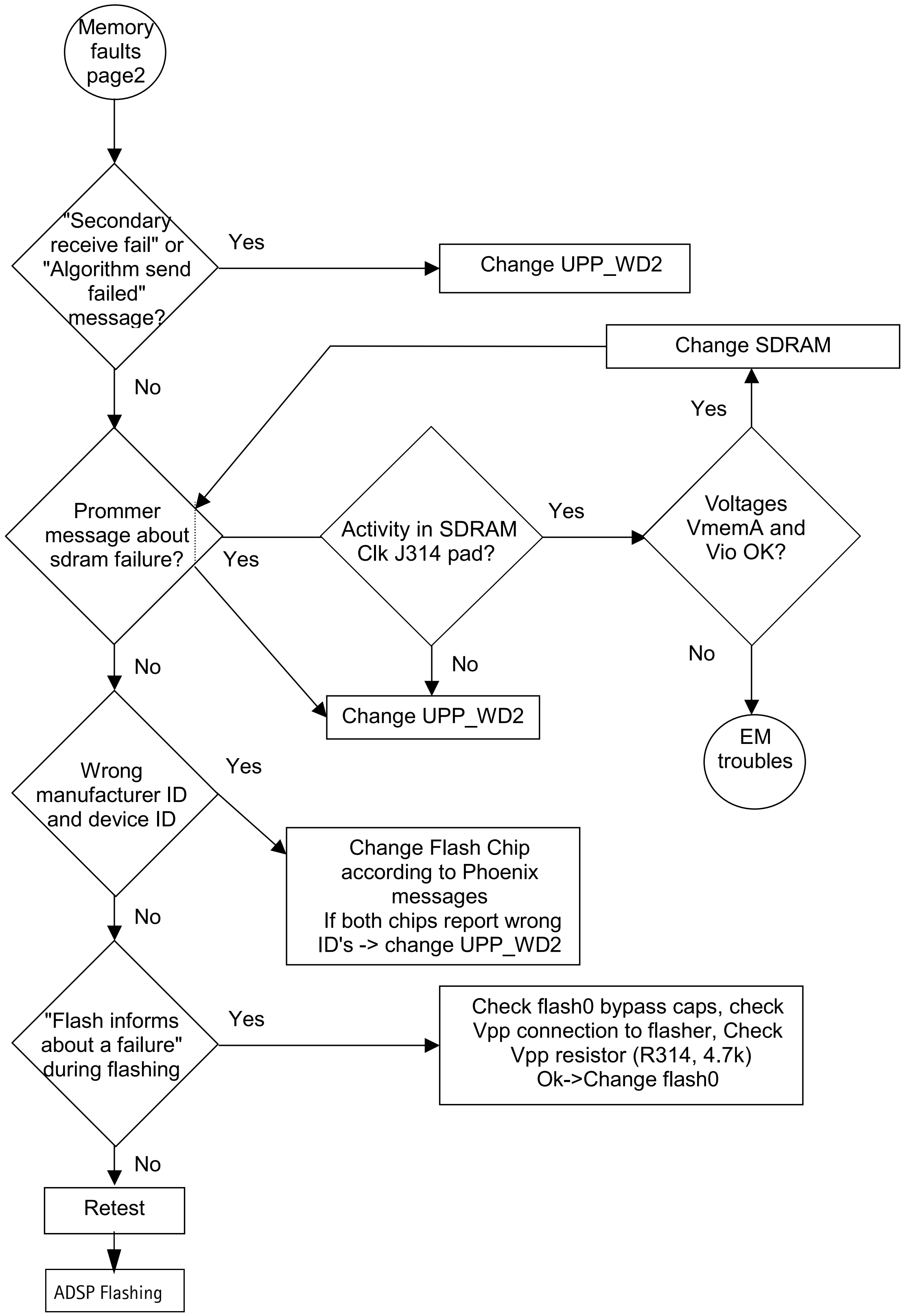
If some selftest is failed, see relevant chapter in this Troubleshooting document.

Baseband HW subarea Troubleshooting

Flashing Troubleshooting

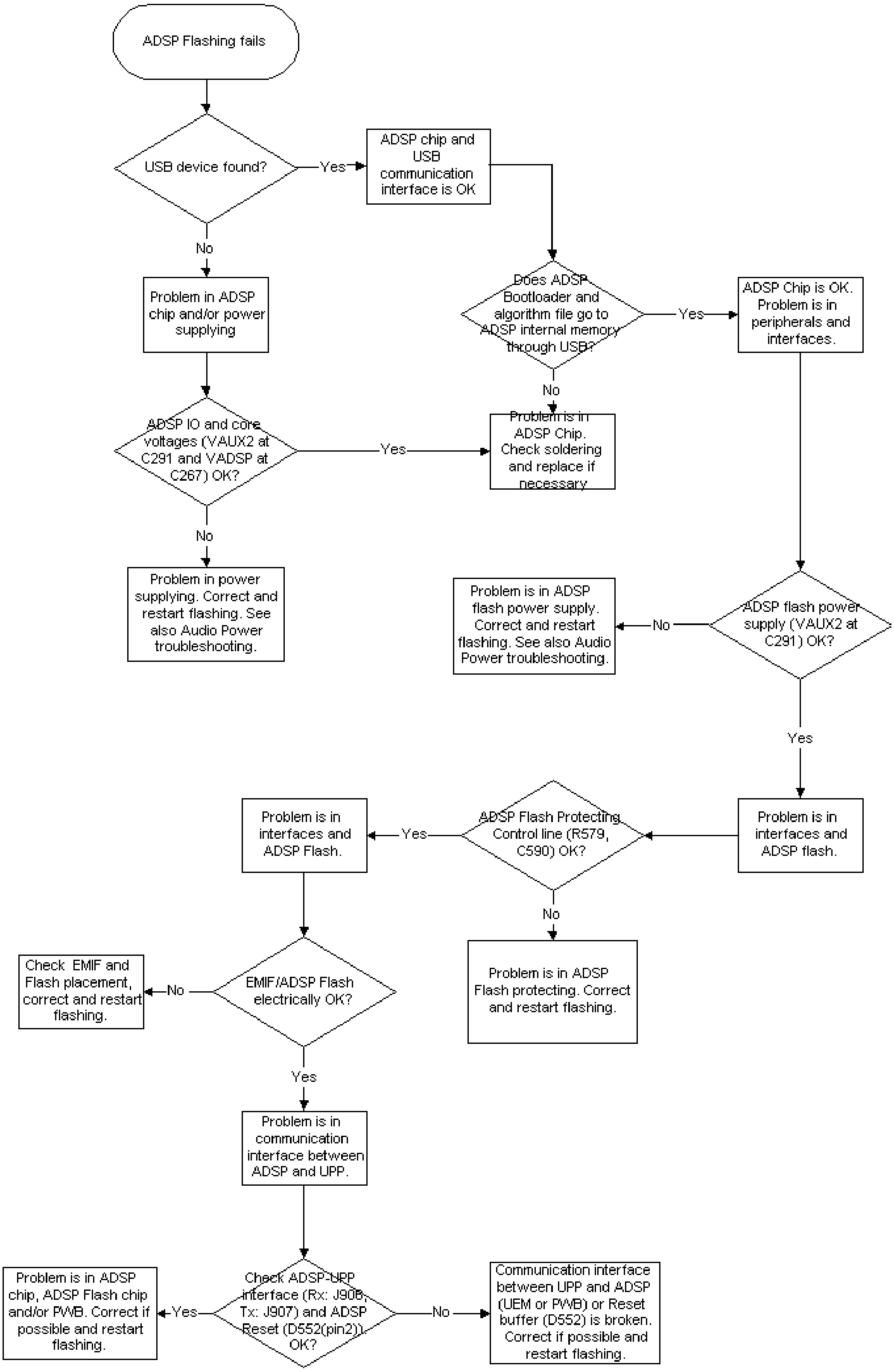
NEM-4 has three memory components installed on the main pwb. The best indication of which one is causing problems can be obtained by flashing the device. It has to be kept in mind that all three flashes are interfaced with UPP WD2 asic that might it self have some problems. The necessary steps are described below. Phoenix error messages during flashing greatly help on defining what is wrong. To be able to flash the device, most device BB area components must function properly.




Memory faults page2
"Secondary receive fail" or "Algorithm send failed" message?
Yes
Change UPP_WD2
Change SDRAM
No
Yes
Prommer message about sdram failure?
Activity in SDRAM Clk J314 pad?
Yes
Voltages VmemA and Vio OK?
Yes
No
No
No
Change UPP_WD2
EM troubles
Wrong manufacturer ID and device ID
Yes
Change Flash Chip according to Phoenix messages
If both chips report wrong ID's -> change UPP_WD2
No
"Flash informs about a failure" during flashing
Yes
Check flash0 bypass caps, check Vpp connection to flasher, Check Vpp resistor (R314, 4.7k)
Ok->Change flash0
No
Retest
ADSP Flashing

ADSP flashing Troubleshooting

ADSP flash environment consists of ADSP, ADSP flash, EMIF (external memory interface), communication interfaces (USB and UPP/UEM), ADSP flash protecting control and power supplies for ADSP and ADSP flash.



Energy management Troubleshooting

Device does not stay on

If the device is switched off without any visible reason, there may be problems in the following areas:

- UEM watchdog problem (WD is not updated by SW)
- BSI line problem (BSI line is floating => contact failure)
- Battery line problem
- Soldering problem

The most likely reason is UEM WD (watchdog), which turns the device off after about 32 seconds if SW is jammed.

This may caused by SW problem, UPP_WD2 problem (Not server by SW), UEM or memory malfunctions.

The following tests are recommended:

- General power checking
- Clocks
- Memory testing
- Serial Interface

If there is something wrong in BSI line, the device seems to be dead after the power key is pressed. However the regulators of the device are on a few seconds before the power-down.

This mode can easily be detected from the current consumption of the device. After a few seconds the current consumption drops almost to 0 mA.

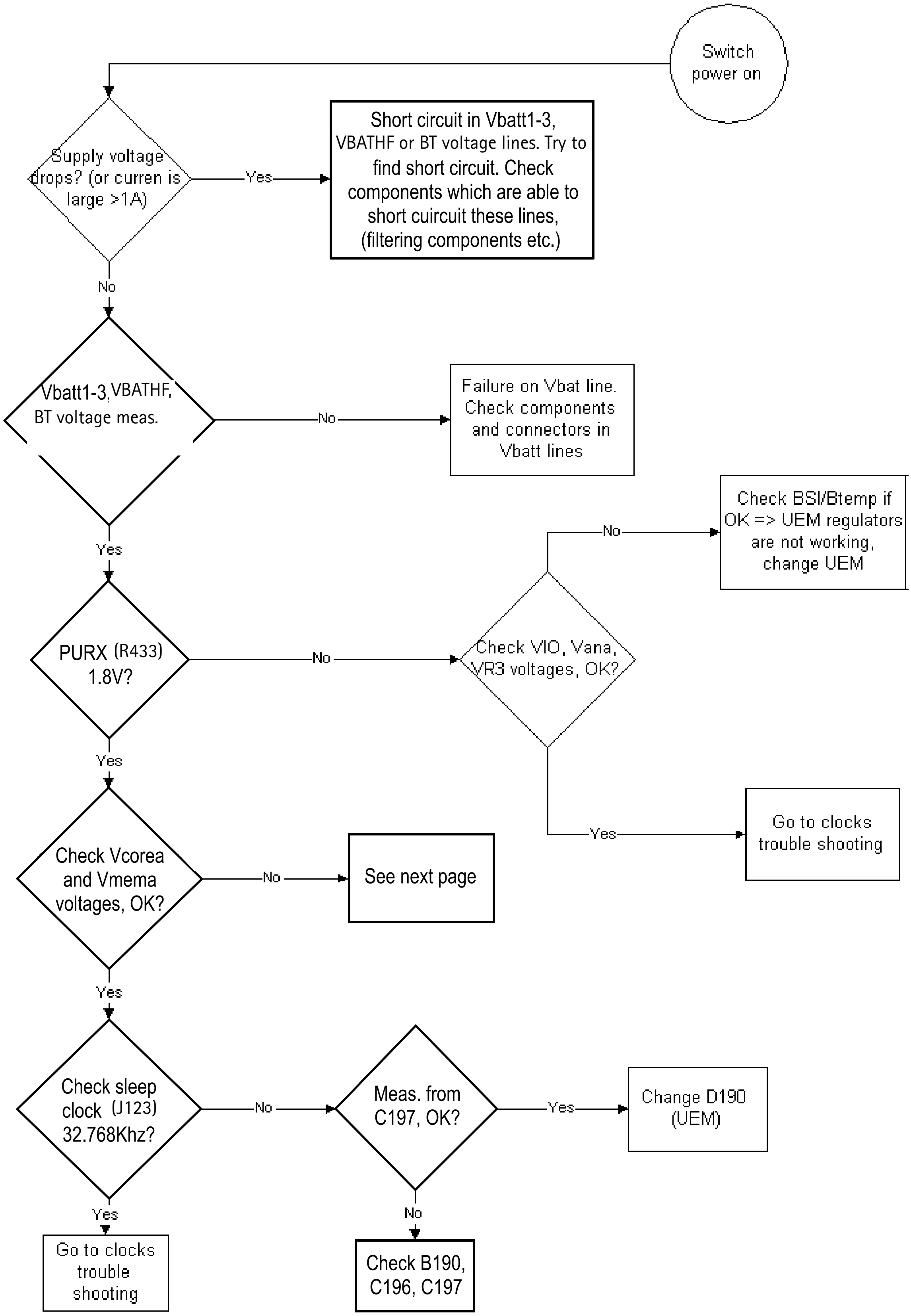
In this case check component or soldering

- Battery connector X381
  EMI-filter R385
  UEM D190 (pin number C2)

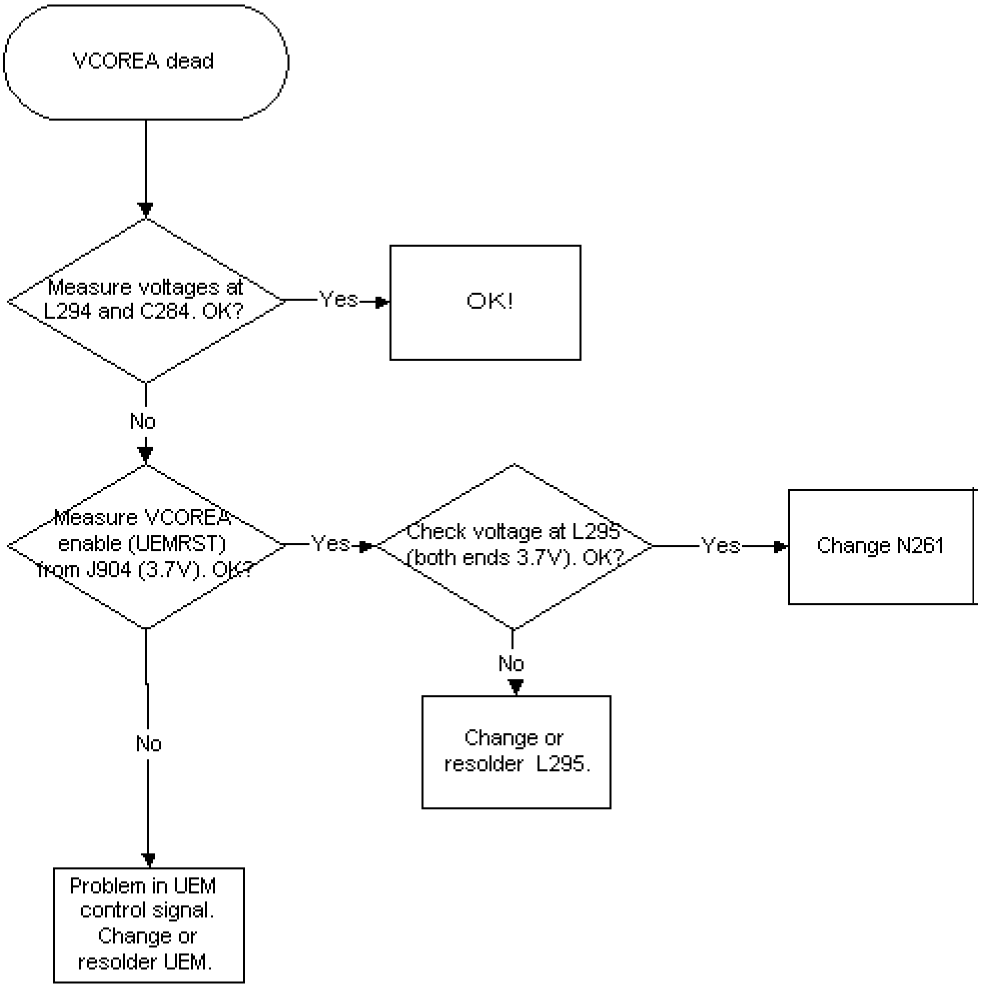
If phone boots to TEST or LOCAL mode with normal battery, BSI is short circuited to ground. Check EMI-filter and filtering capacitors, which are located to BSI.

General power checking

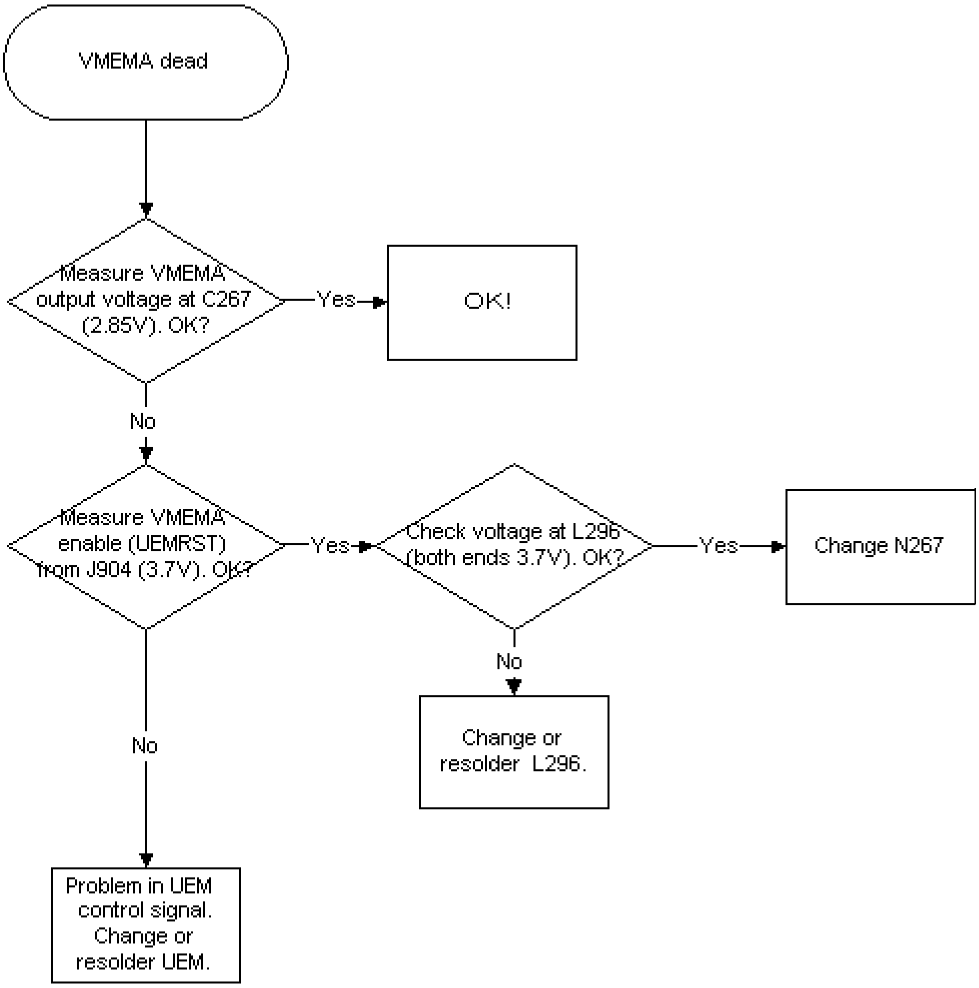
Use service tool FLA-41R. Battery voltage should be at least 3.6V. After phone disassembly, use module jig MJS-8Q.



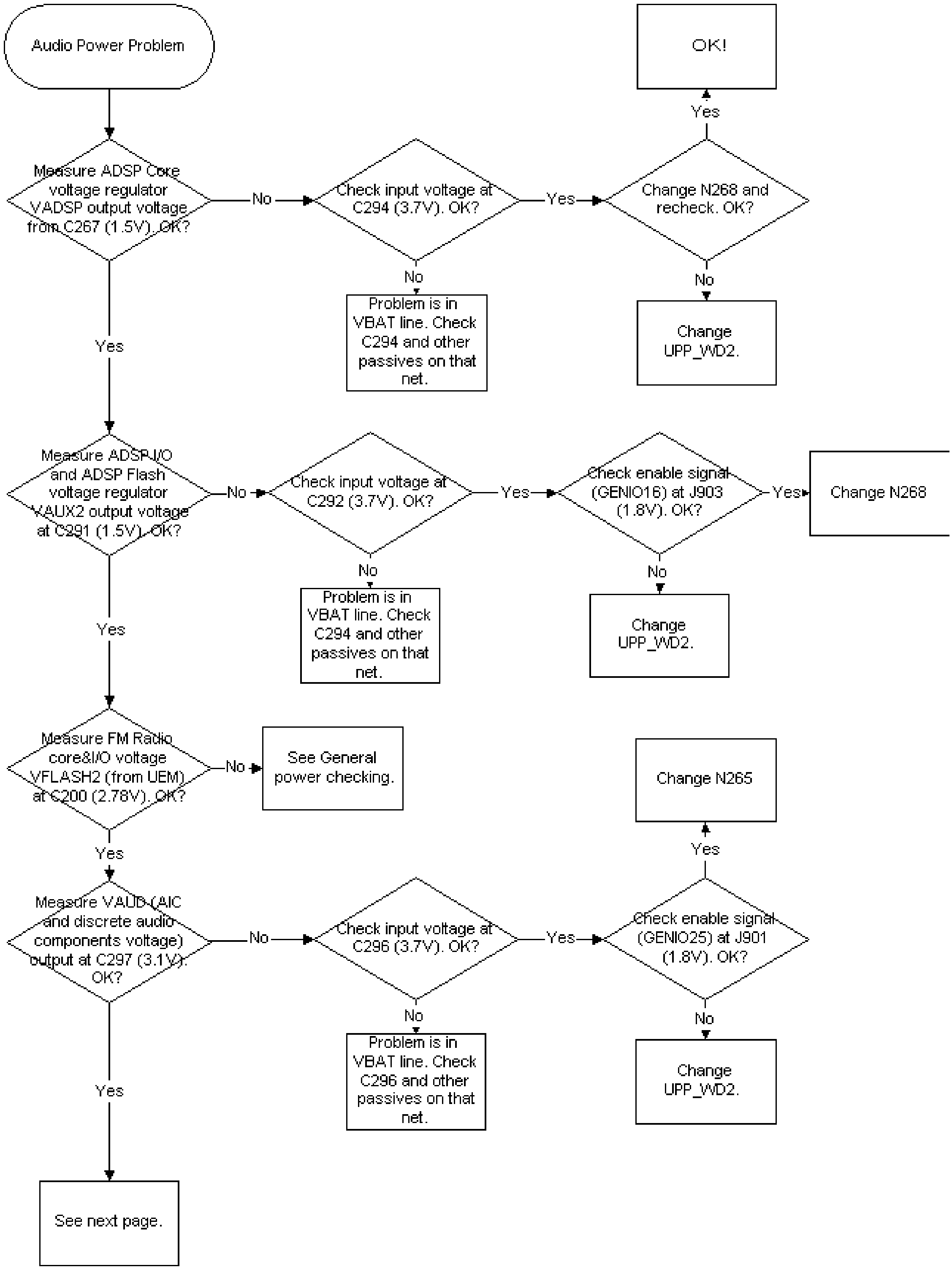
VCOREA Troubleshooting



VMEMA Troubleshooting



Audio Power Troubleshooting



Clocks Troubleshooting

Clocks include the following:

- RF-clock
- ADSP Clock
- DBUS, CBUS clocks
- Flash and SDRAM clocks
- Sleep clock
- Bluetooth clock
- SIM clock
- MMC clock

NEM-4 has three external oscillators for baseband clocking. The main clock is generated by 26MHz oscillator (B601) and routed through Mjoelner RF ASIC to UPP_WD2 engine ASIC. Sleep Clock is generated by 32kHz oscillator to UEM, which then supplies it to UPP_WD2, Bluetooth module and FM radio chip. The third oscillator generates 12MHz clock for ADSP and AIC. UPP_WD2 uses the system clock to generate various clocks for different purposes.

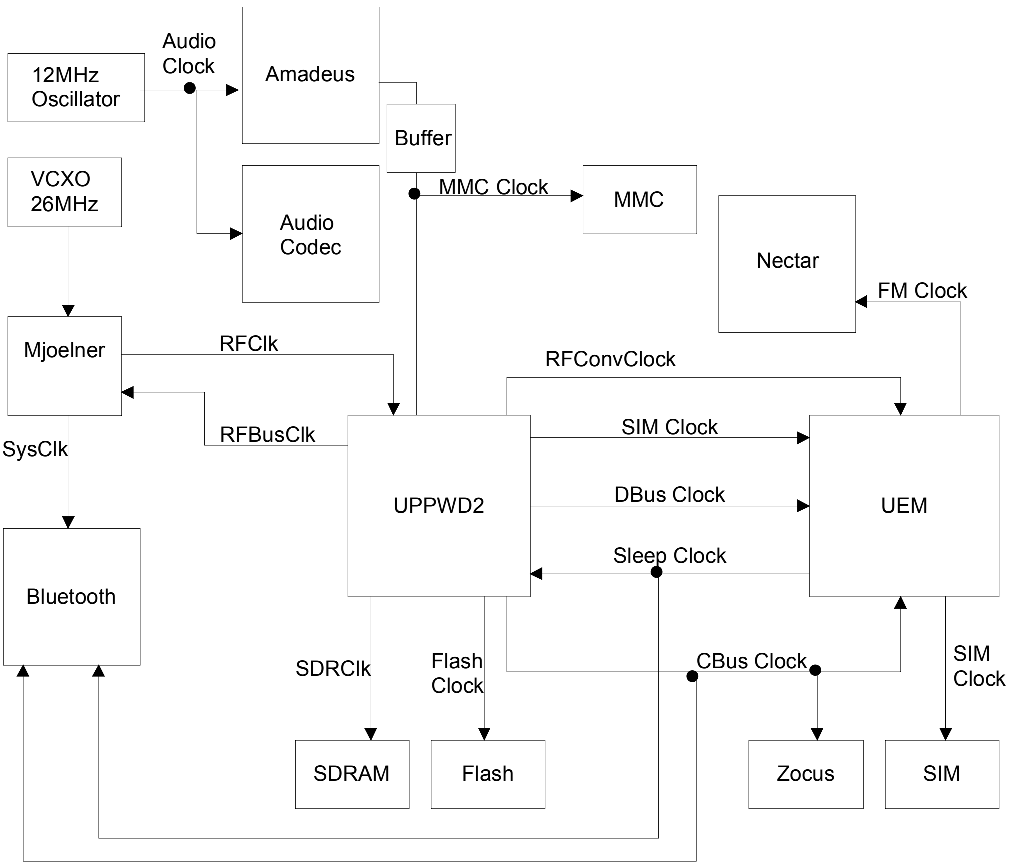


Figure 1: Clock diagram

System clock can be measured from the lower pad of capacitor C171. This clock should be running when phone is on.

In SLEEP mode the VCXO is off. UEM generates low frequency clock signal (32.768 kHz) that is fed to UPP_WD2, Bluetooth and ZOCUS.

When the flashing of the device does not succeed, but powering is OK, follow these instructions.

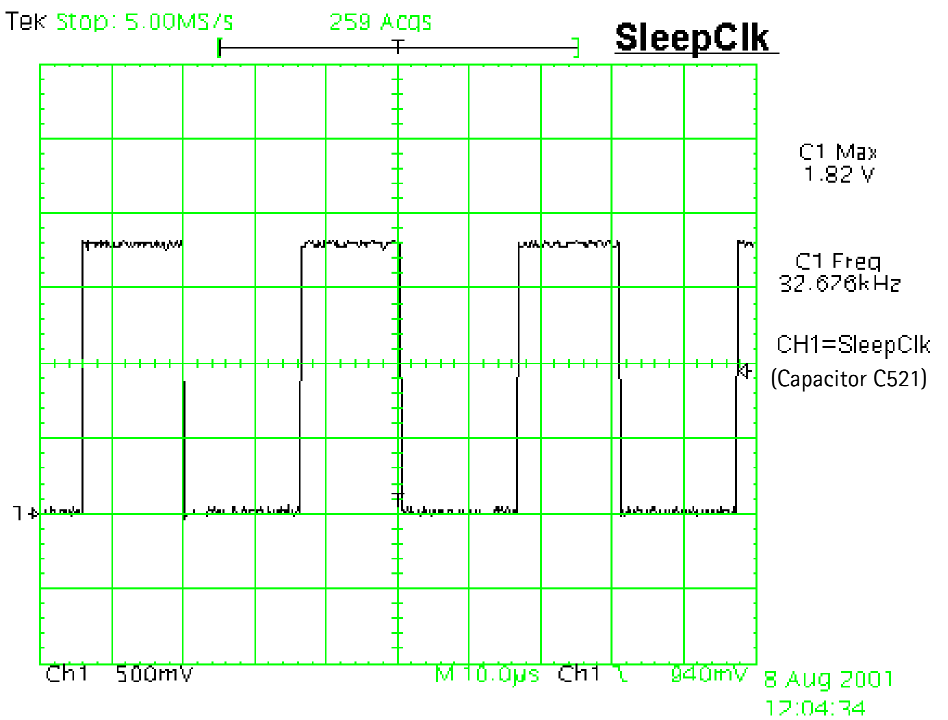
Note: The absence of clocks may indicate that the device (put phone to LOCAL mode when the sleep is not allowed or press buttons so that phone is not in sleep mode) is in sleep mode. Make sure that the device is not in sleep during clocks measuring.

IMPORTANT: Clock signals have to be measured with 1MΩ (or greater) probes!

Measure signal from J170. This should be 26Mhz clock signal. See RF Troubleshooting for further information.

Check the crystal oscillator (B190) is oscillating at 32.768kHz frequency. If not change B190. If ok, measure SleepClk from test point from capacitor C521. Frequency should be the same 32.678kHz (see Figure 2, "Sleep clock," on page 20 below.) If not change UEM.

Figure 2: Sleep clock



ADSP Clock (12MHz sine wave) can be measured from oscillator B550.

Charging checking

Use the BL5-C battery and JBV-1/MJF-26 calibration set to test charging. (NOTE: power supply cannot be charged if it not has a current sinking capability.) When you are charging totally empty battery, remember that start-up charging might take a little bit longer time than normal. During this time display is blank.

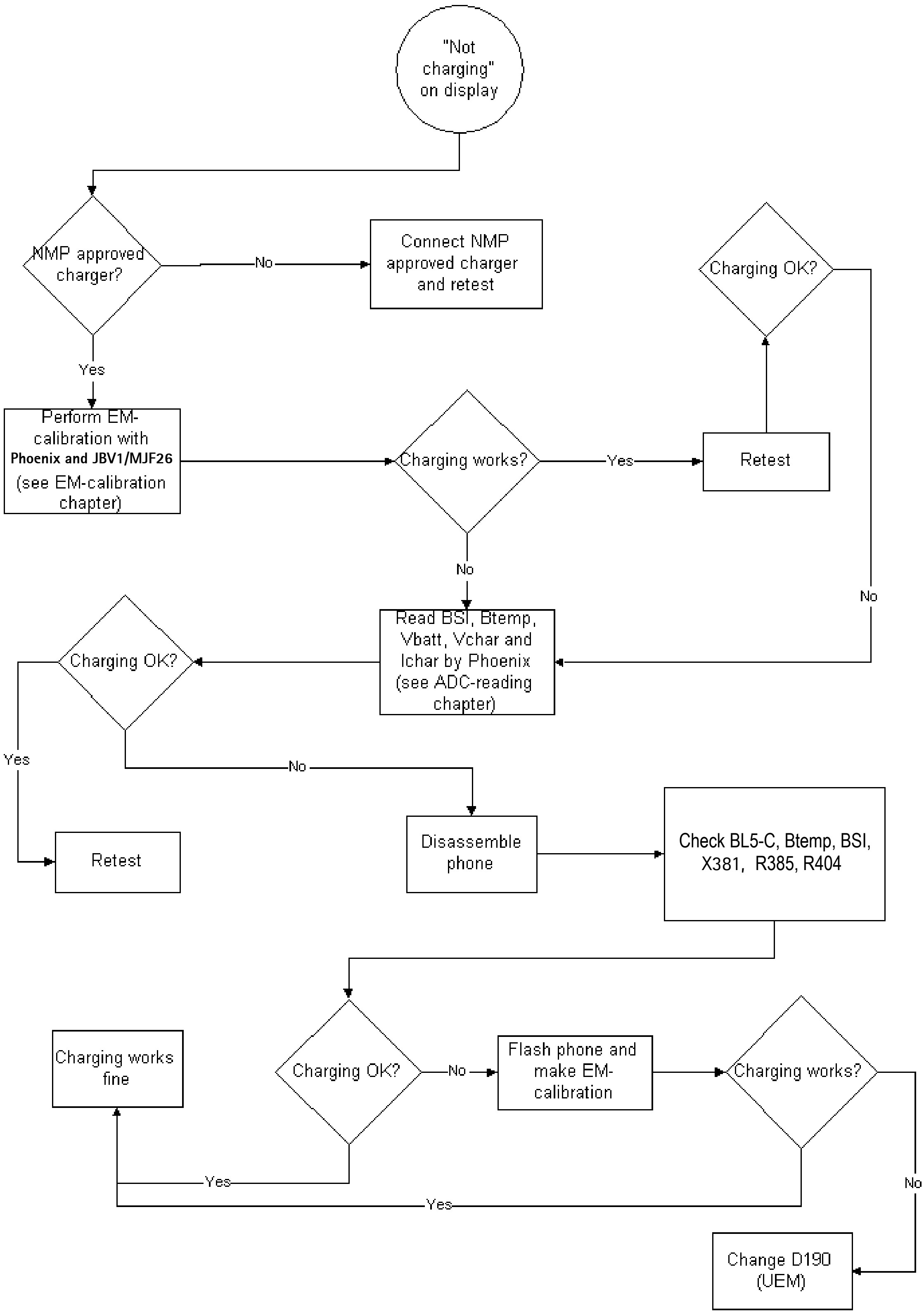
If charger is not NMP approved type and its current and voltage is not within NMP charger window then software does not start charging and there is "NOT CHARGING" on the display. Voltage should be between 5.3V - 9.5V and current between 200mA –

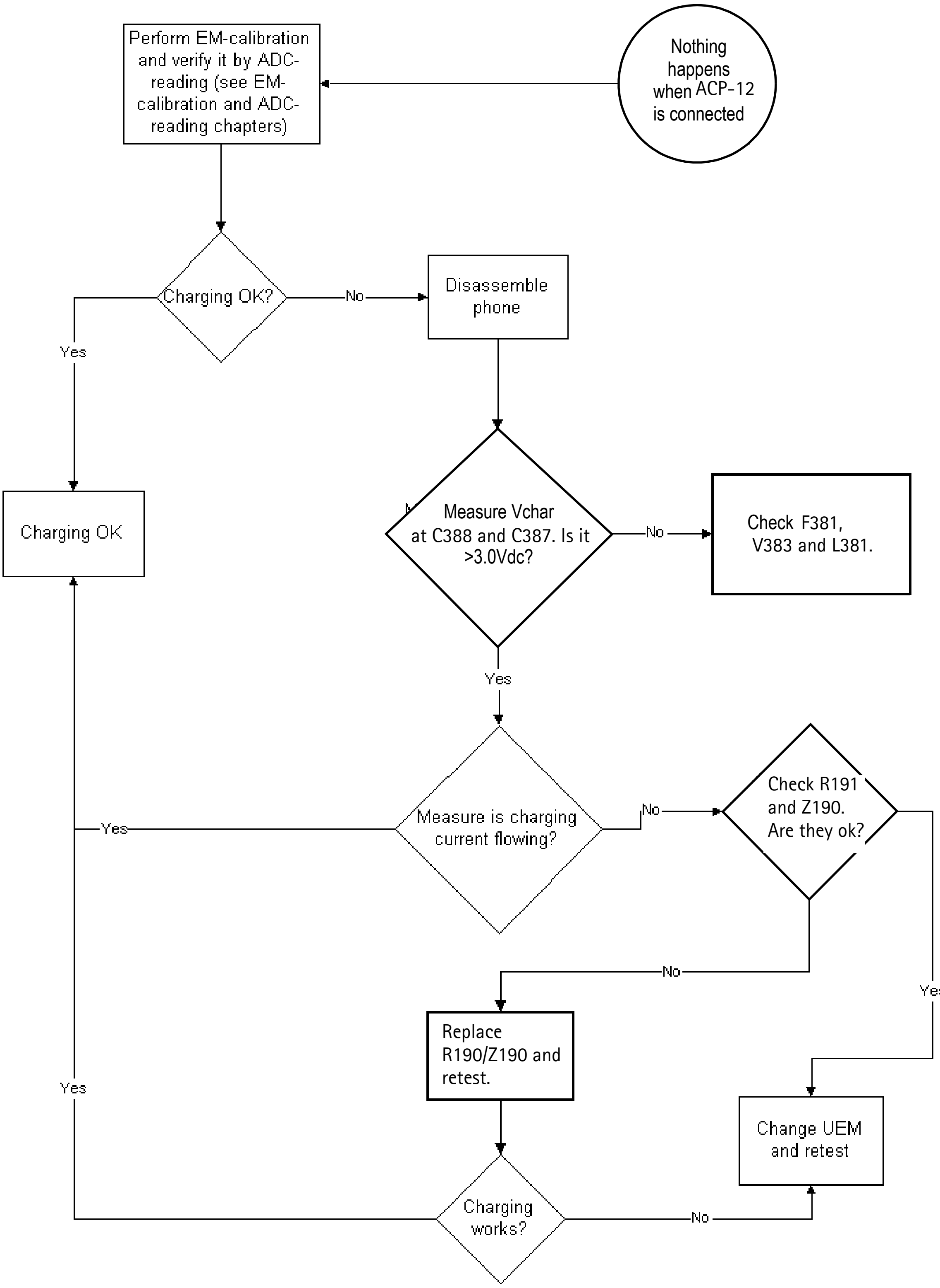
900mA

Remove and reconnect battery and charger few times before you start to measure device. This check ensures that the fault really exists.

(Refer to “Charging Troubleshooting”)

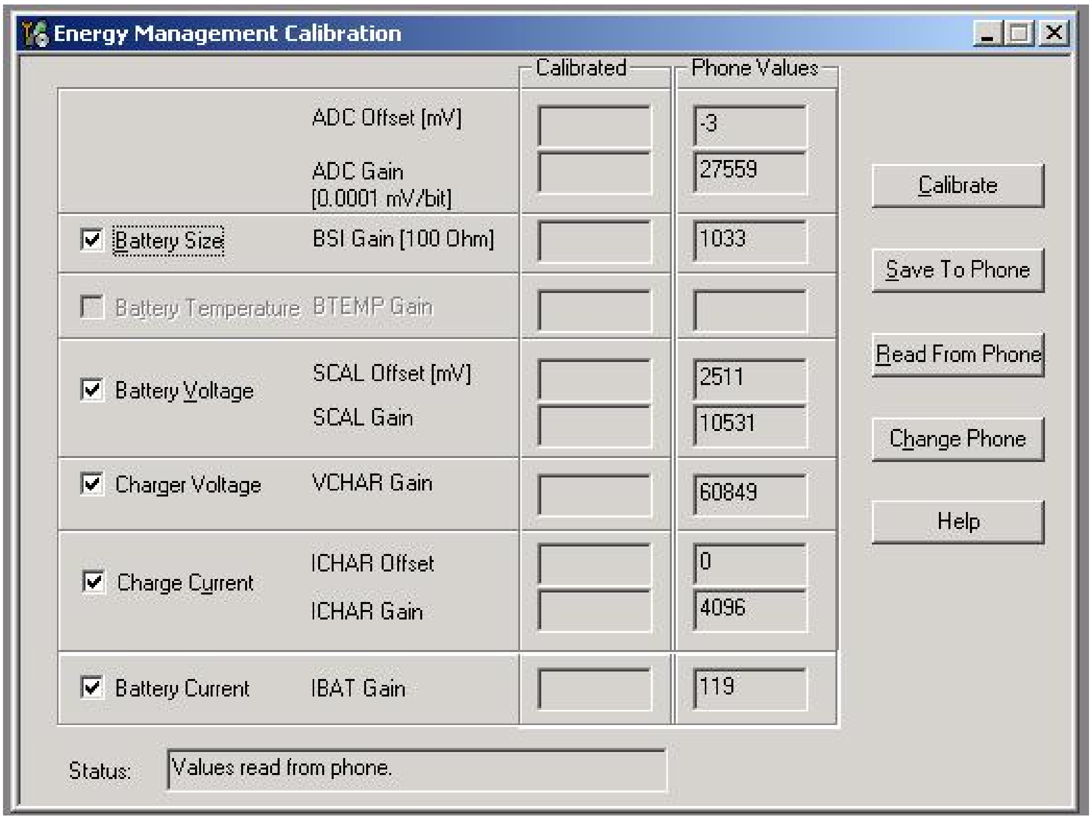
Figure 3: Charging Troubleshooting




Nothing happens when ACP-12 is connected
Perform EM-calibration and verify it by ADC-reading (see EM-calibration and ADC-reading chapters)
Charging OK?
No
Yes
Disassemble phone
Charging OK
Measure Vchar at C388 and C387. Is it >3.0Vdc?
No
Check F381, V383 and L381.
Yes
Measure is charging current flowing?
Yes
No
Check R191 and Z190. Are they ok?
No
Yes
Replace R190/Z190 and retest.
Yes
Change UEM and retest
Charging works?
No

Energy management calibration

During energy management calibration A/D-converter, BSI, Btemp, Battery voltage, Charger voltage and Charger current are calibrated.



Limits for calculated calibration values are as follows:

Channel	Low	High
ADC Offset	-50	50
ADC Gain	26000	29500
BSI Gain	860	1180
Vbatt Offset	2400	2600
Vbatt Gain	10000	11000
Vchar	57000	63000
Ichar	3600	5000

ADC-offset over limits:
Inspect BSI line and components in it (R385, Pull-up resistor R220). If these are OK, change UEM.

BSI Gain over limits:
Inspect BSI line and components in it (R385, Pull-up resistor R220). If these are OK, change UEM.

Vbatt offset and Gain:
Inspect Vbatt lines and component in it.

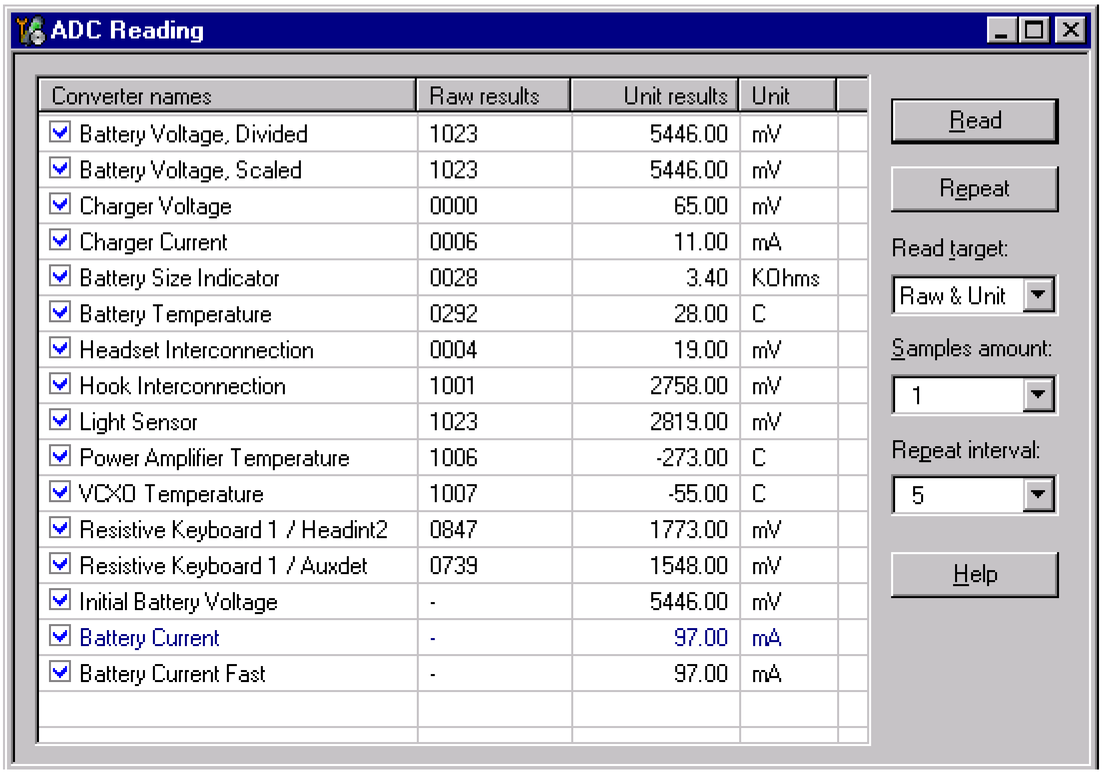
Vchar over limits:
Inspect components which are connected Vchar line: V383, F381 and L381

Ichar over limits:
Inspect components which are connected at Vchar line. If those are OK, First change current sense resistor (R191), if calibration is not still successful change UEM.

Calibration can be checked using ADC-readings. Known voltages, currents and resistances are fed and read by ADC-readings, read values and known values can be compared.

ADC-reading

Divided and scaled battery voltage, Charger voltage, Charger current, BSI and Btemp values can be read by this tool. Read values few times before you can be sure that results are accurate.



Converter names	Raw results	Unit results	Unit
Battery Voltage, Divided	1023	5446.00	mV
Battery Voltage, Scaled	1023	5446.00	mV
Charger Voltage	0000	65.00	mV
Charger Current	0006	11.00	mA
Battery Size Indicator	0028	3.40	KOhms
Battery Temperature	0292	28.00	C
Headset Interconnection	0004	19.00	mV
Hook Interconnection	1001	2758.00	mV
Light Sensor	1023	2819.00	mV
Power Amplifier Temperature	1006	-273.00	C
VCXO Temperature	1007	-55.00	C
Resistive Keyboard 1 / Headint2	0847	1773.00	mV
Resistive Keyboard 1 / Auxdet	0739	1548.00	mV
Initial Battery Voltage	-	5446.00	mV
Battery Current	-	97.00	mA
Battery Current Fast	-	97.00	mA

NOTE: IF Vbatt Scaled and Divided unit results are different default calibration values are used. In this case perform EM-calibration to get full performance of phone.

Maximum tolerances are:

Reading	Check point	Tolerance
Reading	Check point	Tolerance
Vbatt SCAL_	4.2V	± 25mV
Vchar	8.4V	± 40mV
Ichar	500mA	± 20mA
BSI	75k	± 1.3kohm
Btemp	273K(47k)	± 5K

Backup battery

Symptom of backup battery fault is

Real Time Clock loses the correct time during short main battery removal.

The same symptom can also be seen when the backup battery is empty. About 30 minutes is needed to fully charge the backup battery in the device. NOTE: Backup battery is charged when the phone is powered or when the device is LOCAL or TEST mode.

Always check the backup battery visually for any leakage or any other visual defect.

Check that the backup battery is correctly mounted in the device before closing the cover.

Check with Phoenix that backup battery is OK

Measure the voltage of backup battery

- Normal operation when the voltage is > 2.0V
- Fully charged when the voltage is about 3.2V (because of large internal impedance voltage won't stay above 3.0V a long time after charging is disabled)

Enable backup battery charging (start to charge main battery or boot device to LOCAL or TEST mode)

Measure voltage of backup battery during charging, It should arise if it is not 3.2V, yet.

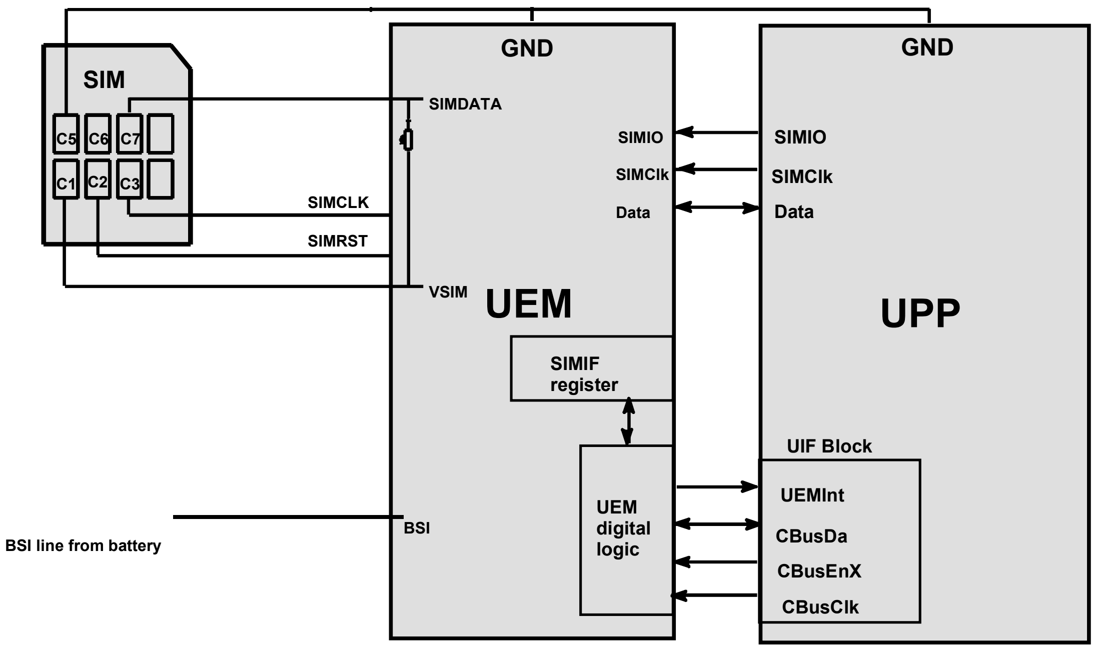
When the voltage is over 2.0V for sure, check backup battery with Phoenix.
-> In not OK then D190 is faulty.

Ensure that the RTC is running.

SIM card

The whole SIM interface locates in two chips UPP_WD2 and UEM. UEM contains the SIM interface logic level shifting. UPP provides SIMClk through UEM to the SIM. SIM interface supports both 3 V and 1.8 V SIMs.

UPP & UEM SIM connections



The SIM power up/down sequence is generated in the UEM. This means that the UEM generates the RST signal to the SIM. Also the SIMCardDet signal is connected to UEM. The card detection is taken from the BSI signal, which detects the removal of the battery. Monitoring of the BSI signal is done by a comparator inside UEM. The threshold voltage is calculated from the battery size specifications.

The SIM interface is powered up when the SIMCardDet signal indicates "card in". This signal is derived from the BSI signal. SW tries first to power up the SIM with 1.8 V. If this doesn't succeed power up is repeated with VSIM switched to 3 V.

The data communication between the card and the phone is asynchronous half duplex. The clock supplied to the card is in GSM system 1.083 MHz or 3.25 MHz. The data baudrate is SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

Figure 4: SIM Power Up.

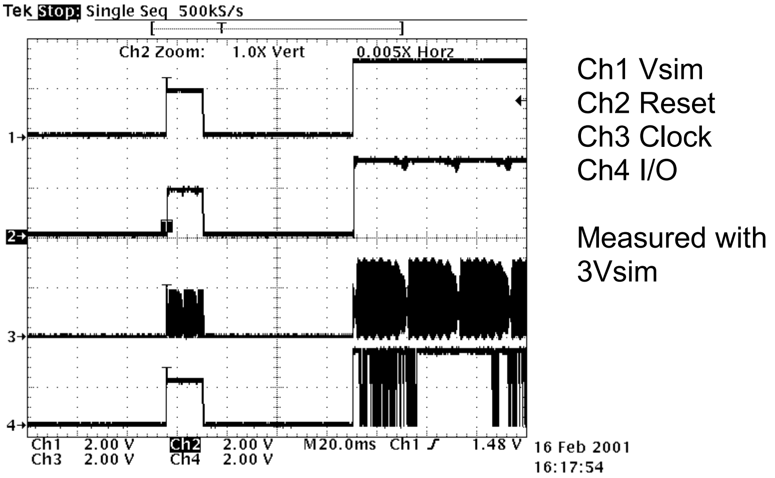


Figure 5: SIM answer to reset.

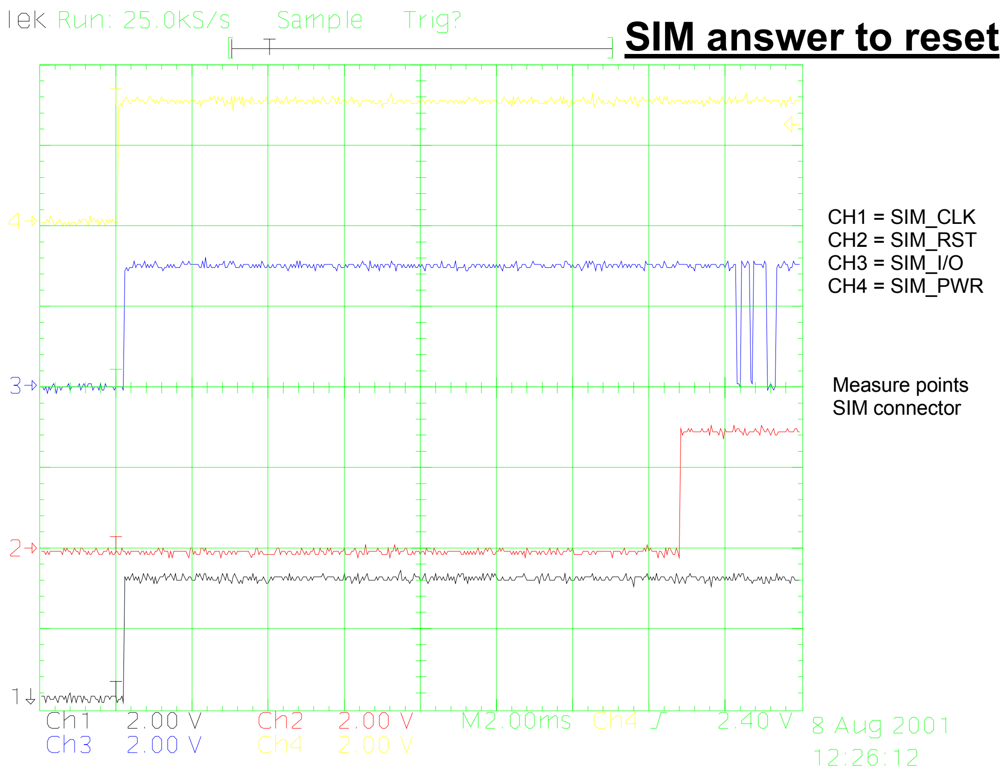
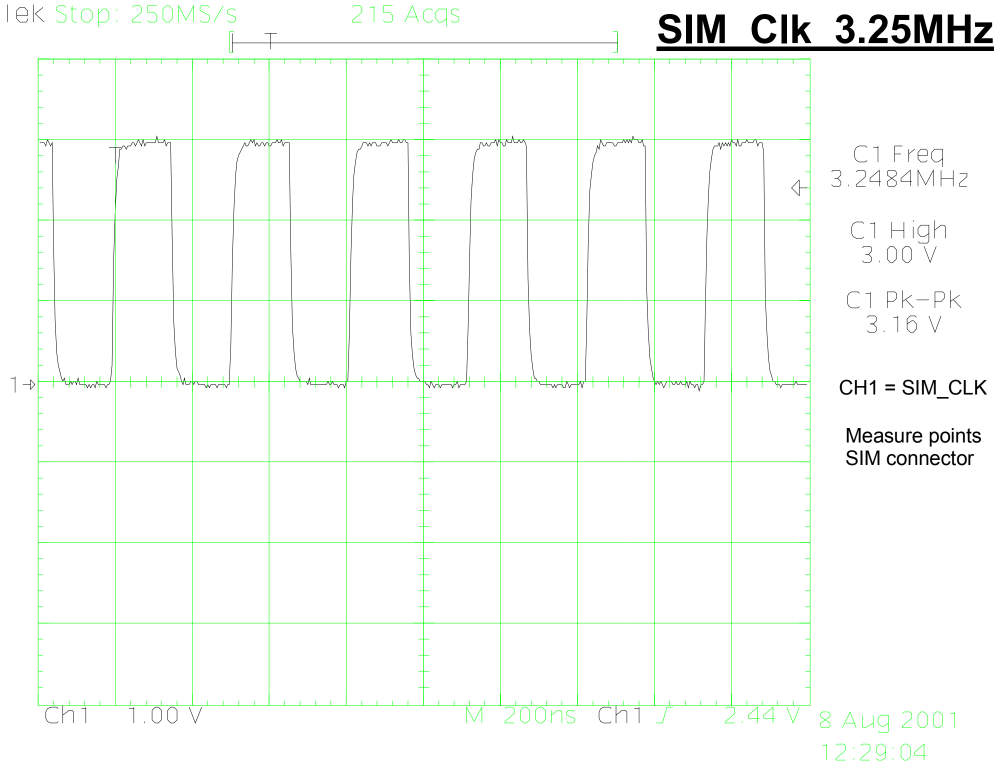
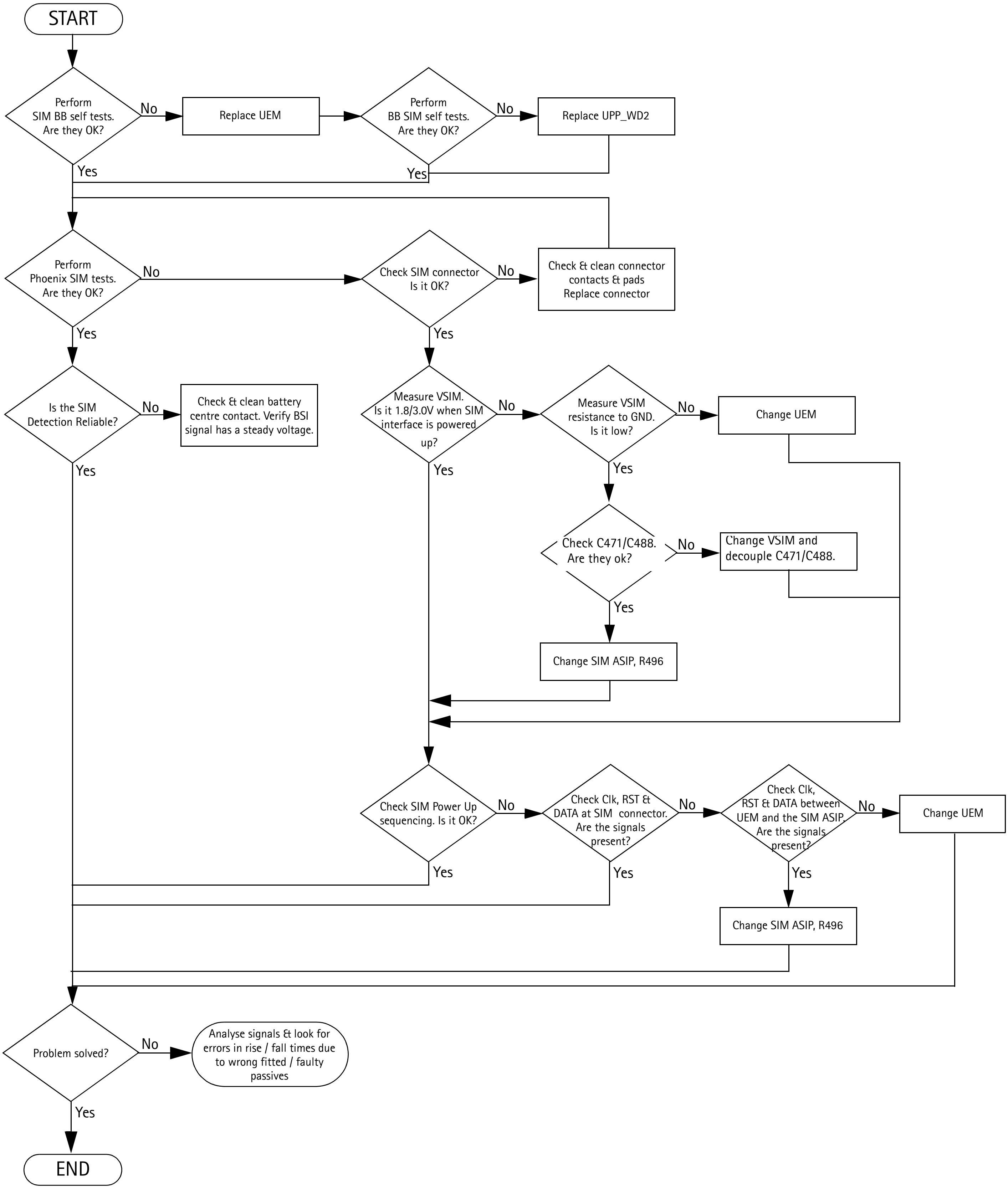


Figure 6: SIM Clk 3.25MHz.



Remember to check the two PHOENIX test cases before changing UPP!!!!

"Insert SIM Card" in device display although card is inserted



Audio Troubleshooting

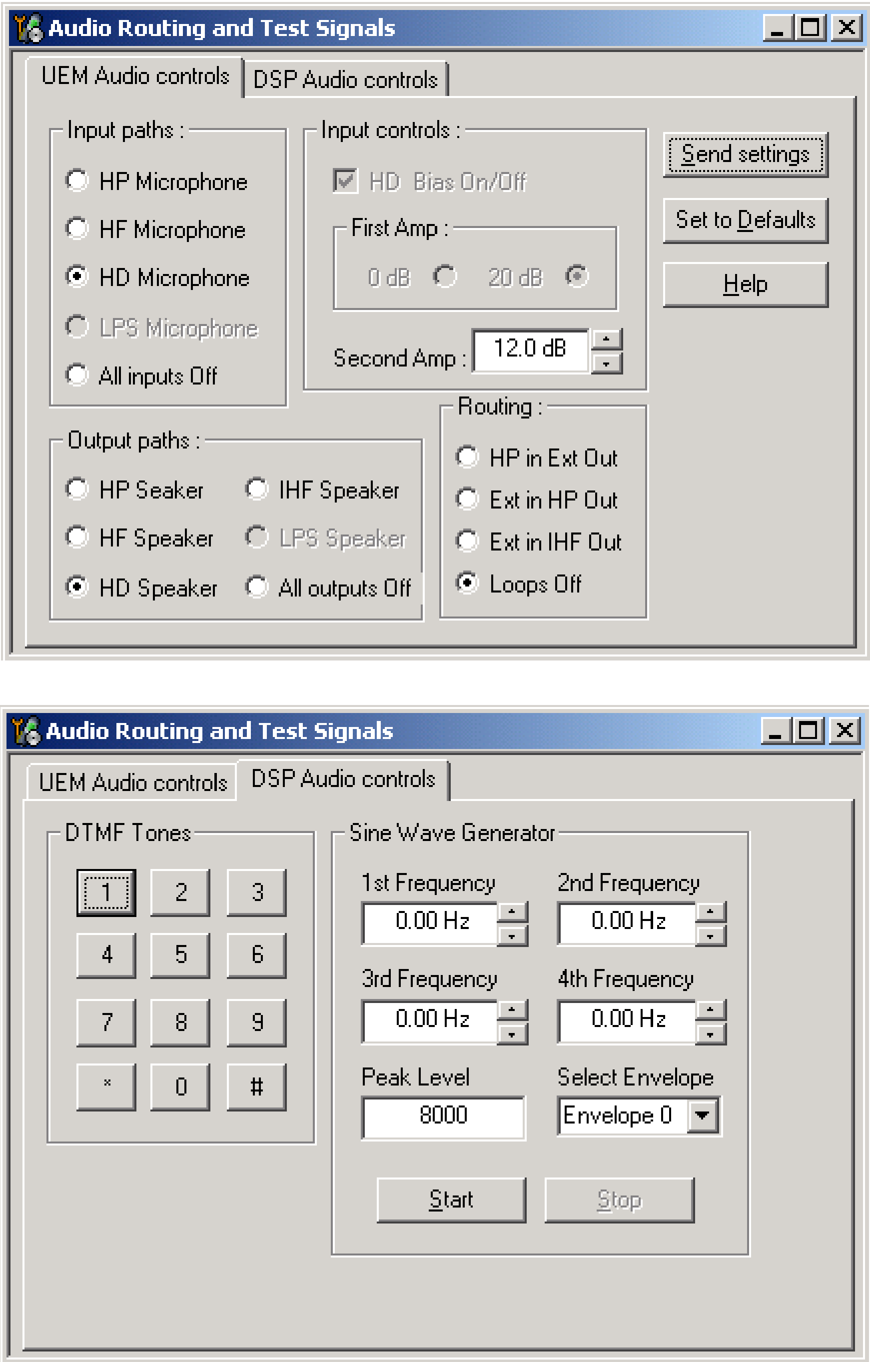
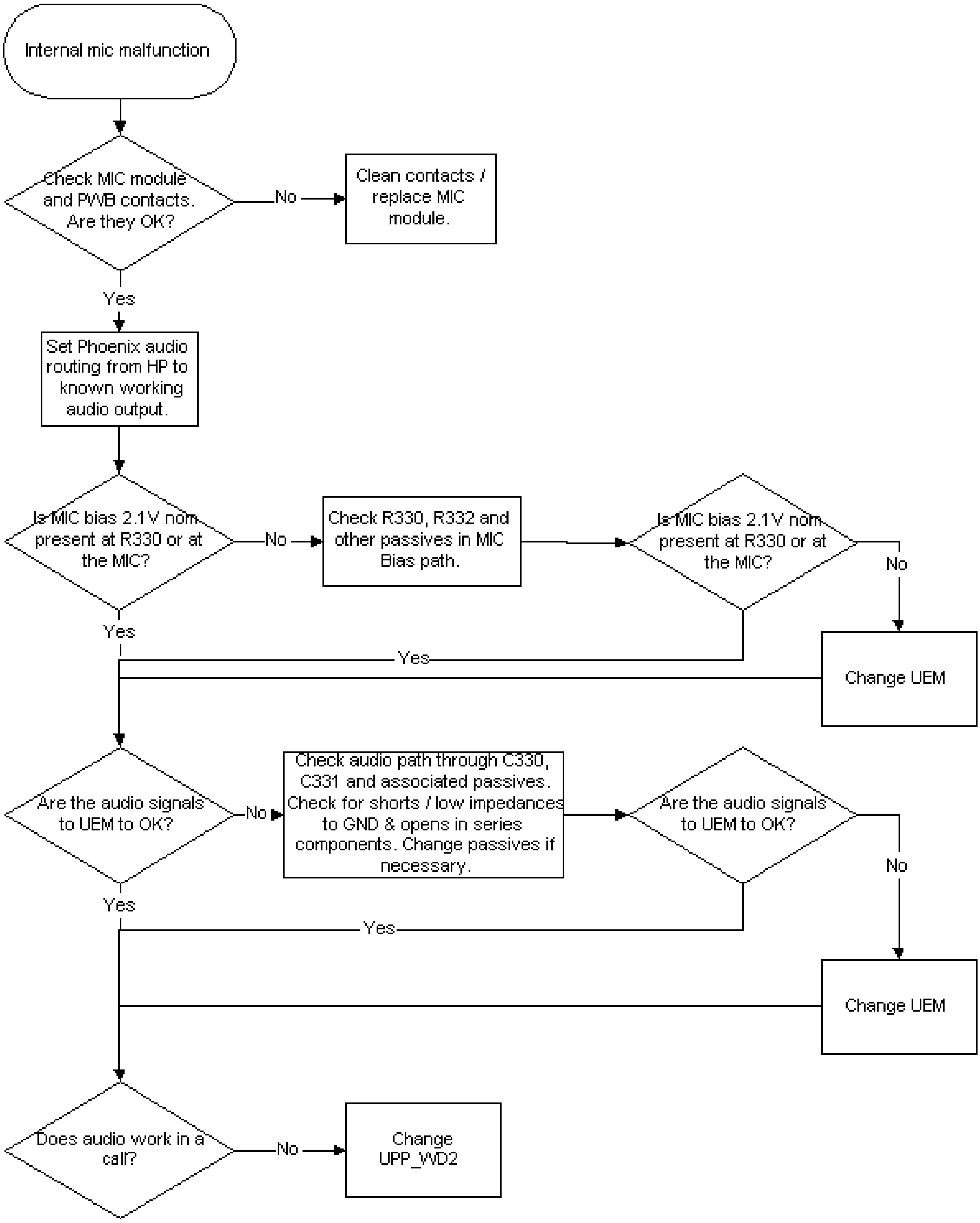


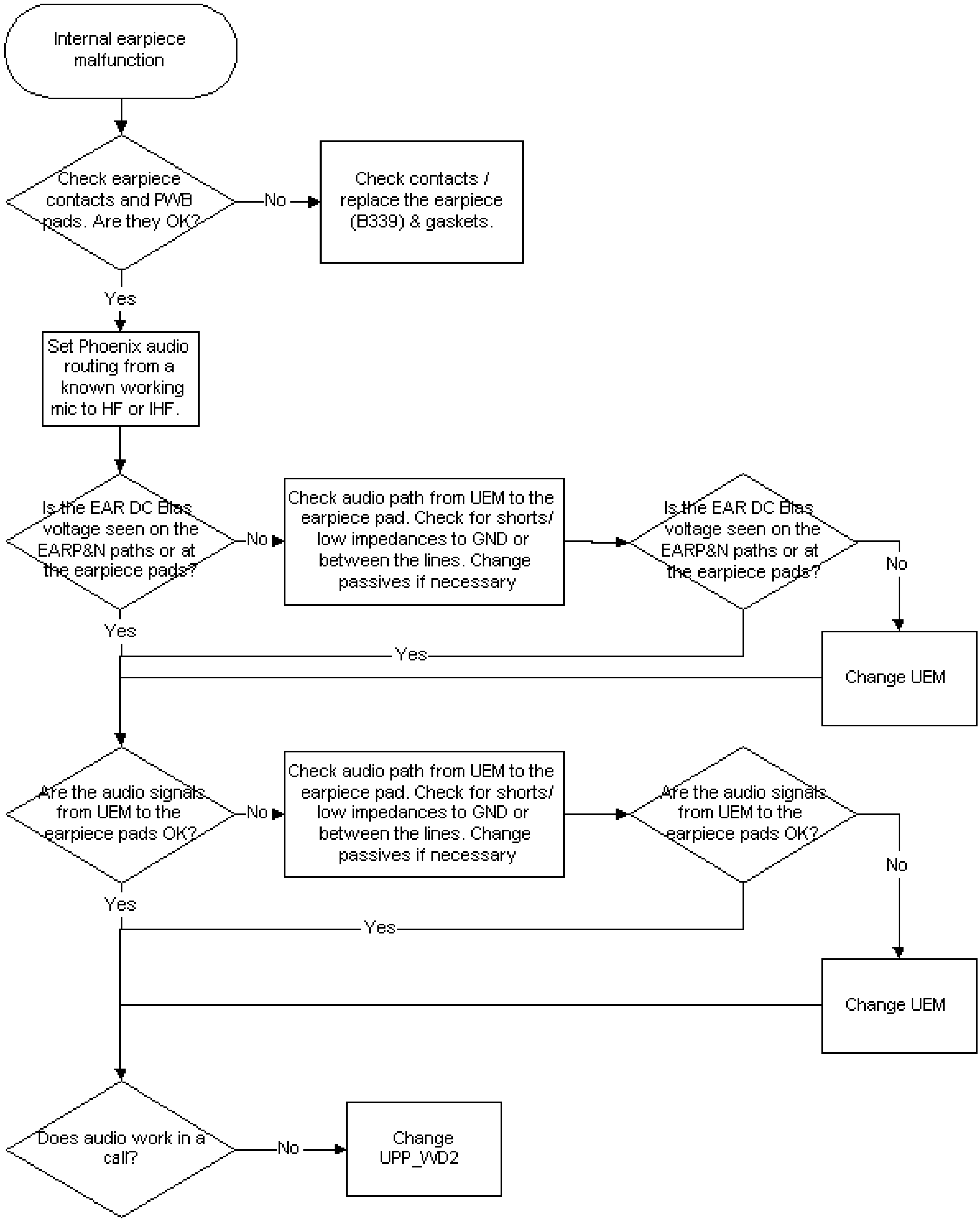
Figure 7: Audio routing window in Phoenix

Microphone

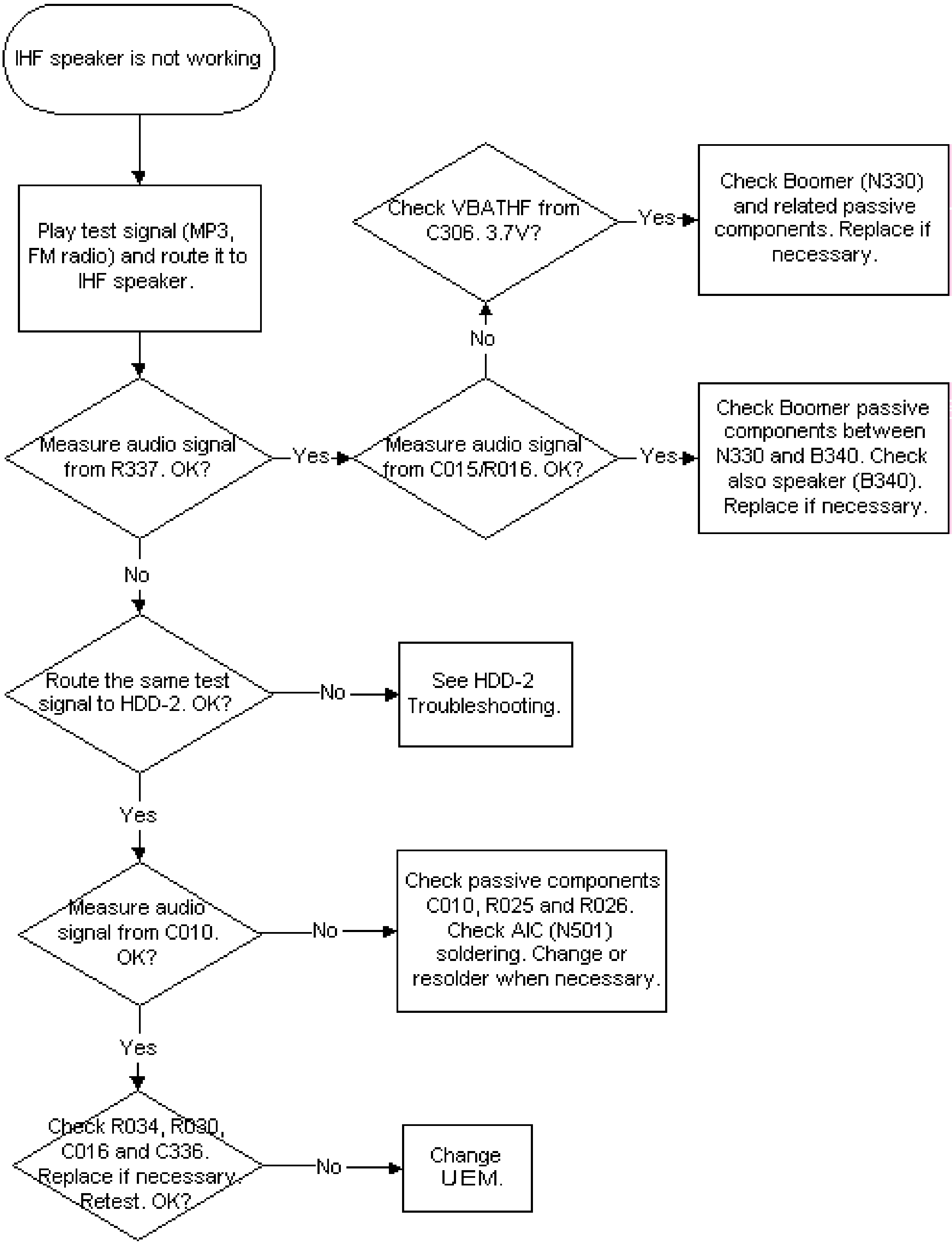

Internal mic malfunction
Check MIC module and PWB contacts. Are they OK?
No
Clean contacts / replace MIC module.
Yes
Set Phoenix audio routing from HP to known working audio output.
Is MIC bias 2.1V nom present at R330 or at the MIC?
No
Check R330, R332 and other passives in MIC Bias path.
Is MIC bias 2.1V nom present at R330 or at the MIC?
No
Yes
Yes
Change UEM
Are the audio signals to UEM to OK?
No
Check audio path through C330, C331 and associated passives. Check for shorts / low impedances to GND & opens in series components. Change passives if necessary.
Are the audio signals to UEM to OK?
No
Yes
Yes
Change UEM
Does audio work in a call?
No
Change UPP_WD2

Earpiece

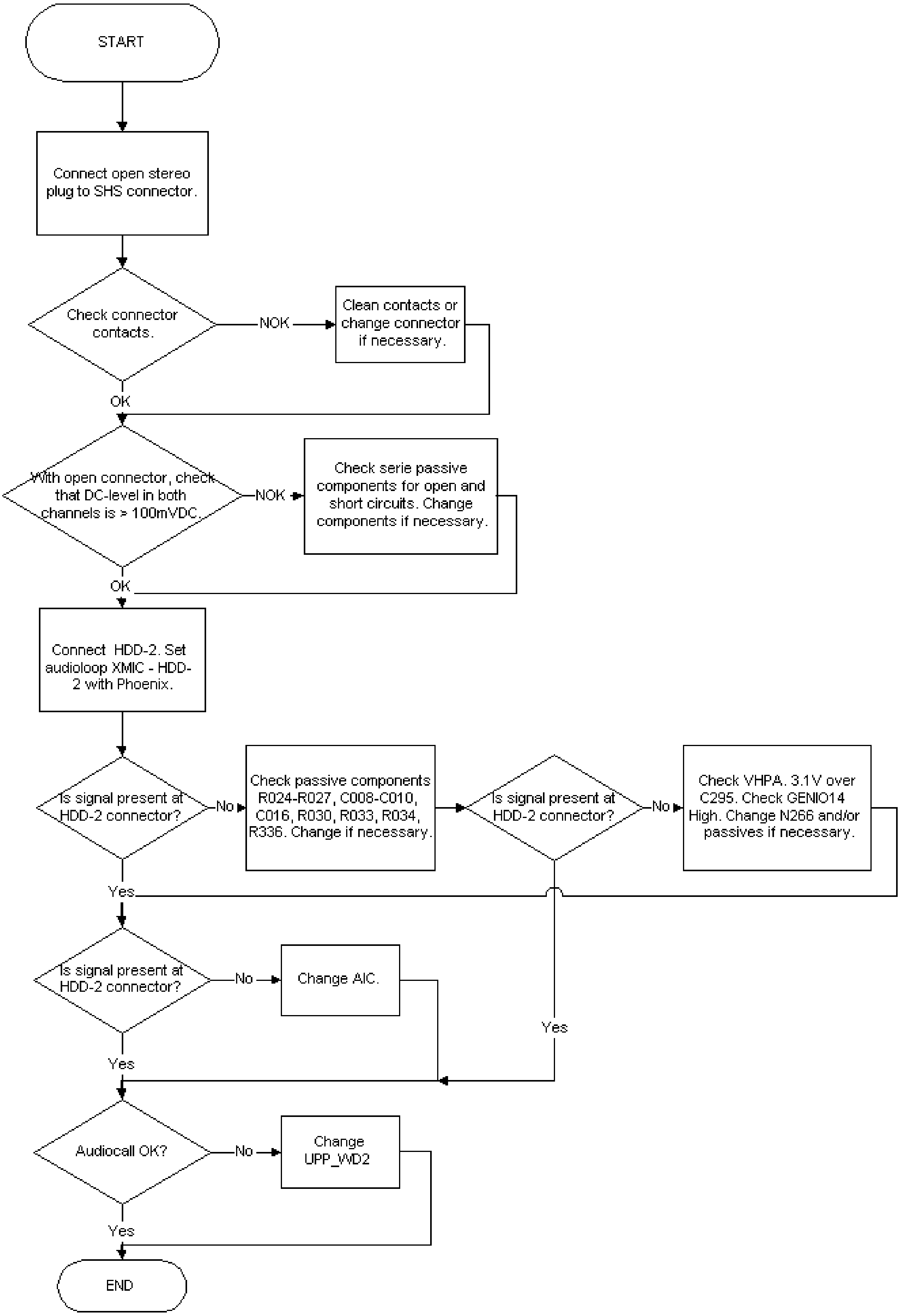
Check that holes are not coated.

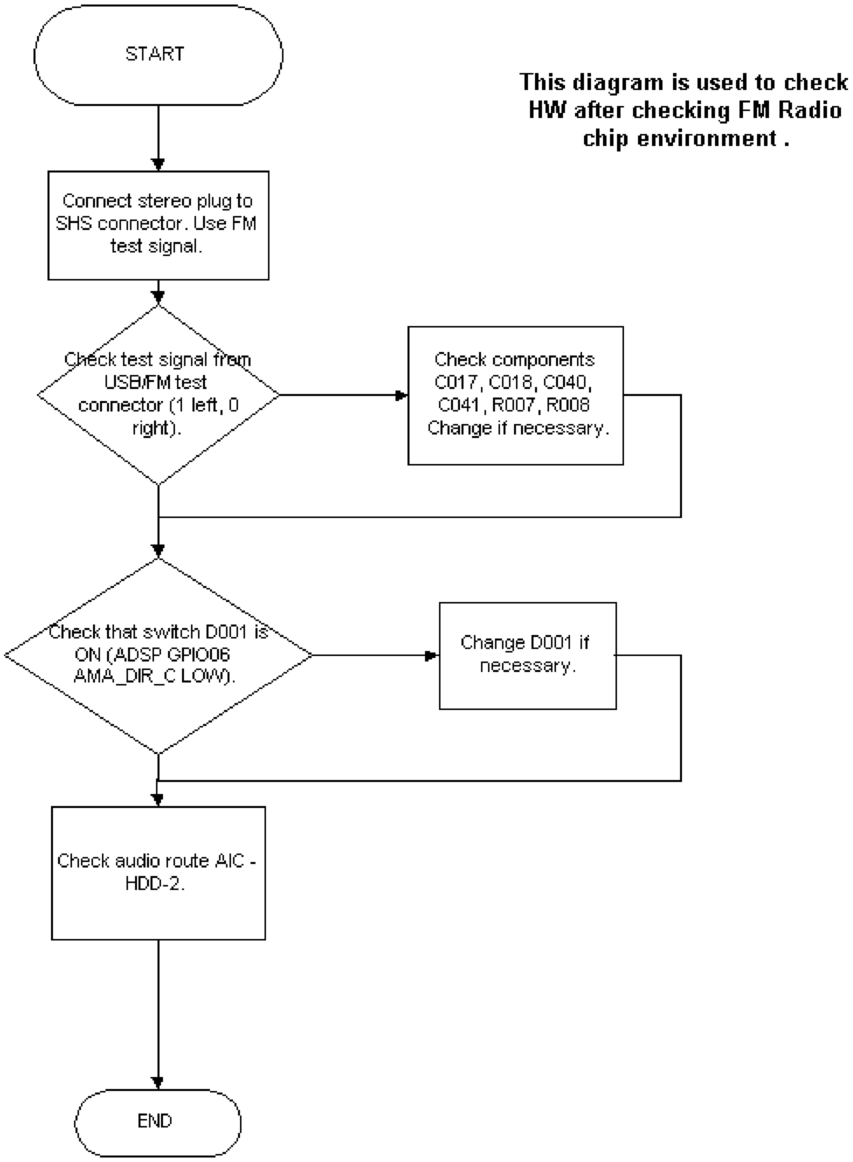


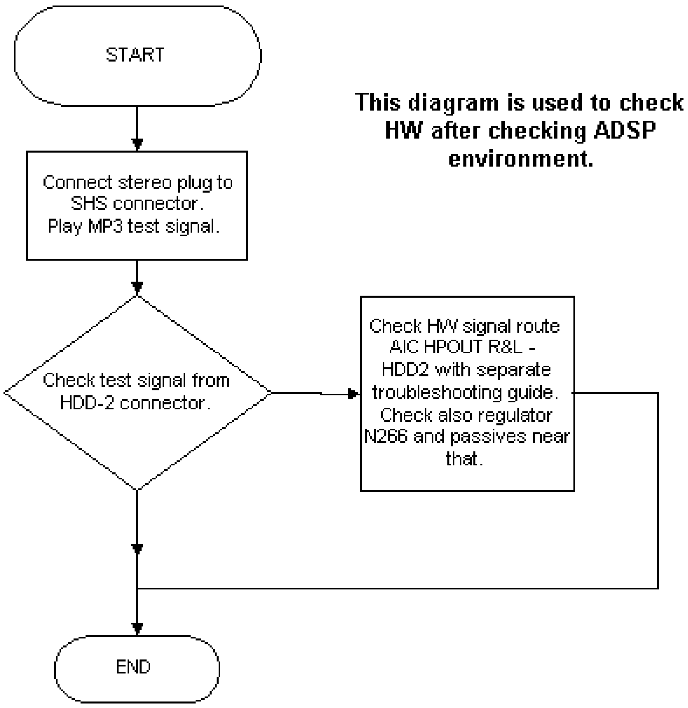
IHF


IHF speaker is not working
Play test signal (MP3, FM radio) and route it to IHF speaker.
Measure audio signal from R337. OK?
Yes
Measure audio signal from C015/R016. OK?
Yes
Check Boomer passive components between N330 and B340. Check also speaker (B340). Replace if necessary.
No
Check VBATHF from C306. 3.7V?
Yes
Check Boomer (N330) and related passive components. Replace if necessary.
No
Route the same test signal to HDD-2. OK?
No
See HDD-2 Troubleshooting.
Yes
Measure audio signal from C010. OK?
No
Check passive components C010, R025 and R026. Check AIC (N501) soldering. Change or resolder when necessary.
Yes
Check R034, R030, C016 and C336. Replace if necessary. Retest. OK?
No
Change UEM.

Headset Troubleshooting




START
This diagram is used to check HW after checking FM Radio chip environment .
Connect stereo plug to SHS connector. Use FM test signal.
Check test signal from USB/FM test connector (1 left, 0 right).
Check components C017, C018, C040, C041, R007, R008 Change if necessary.
Check that switch D001 is ON (ADSP GPIO06 AMA_DIR_C LOW).
Change D001 if necessary.
Check audio route AIC - HDD-2.
END



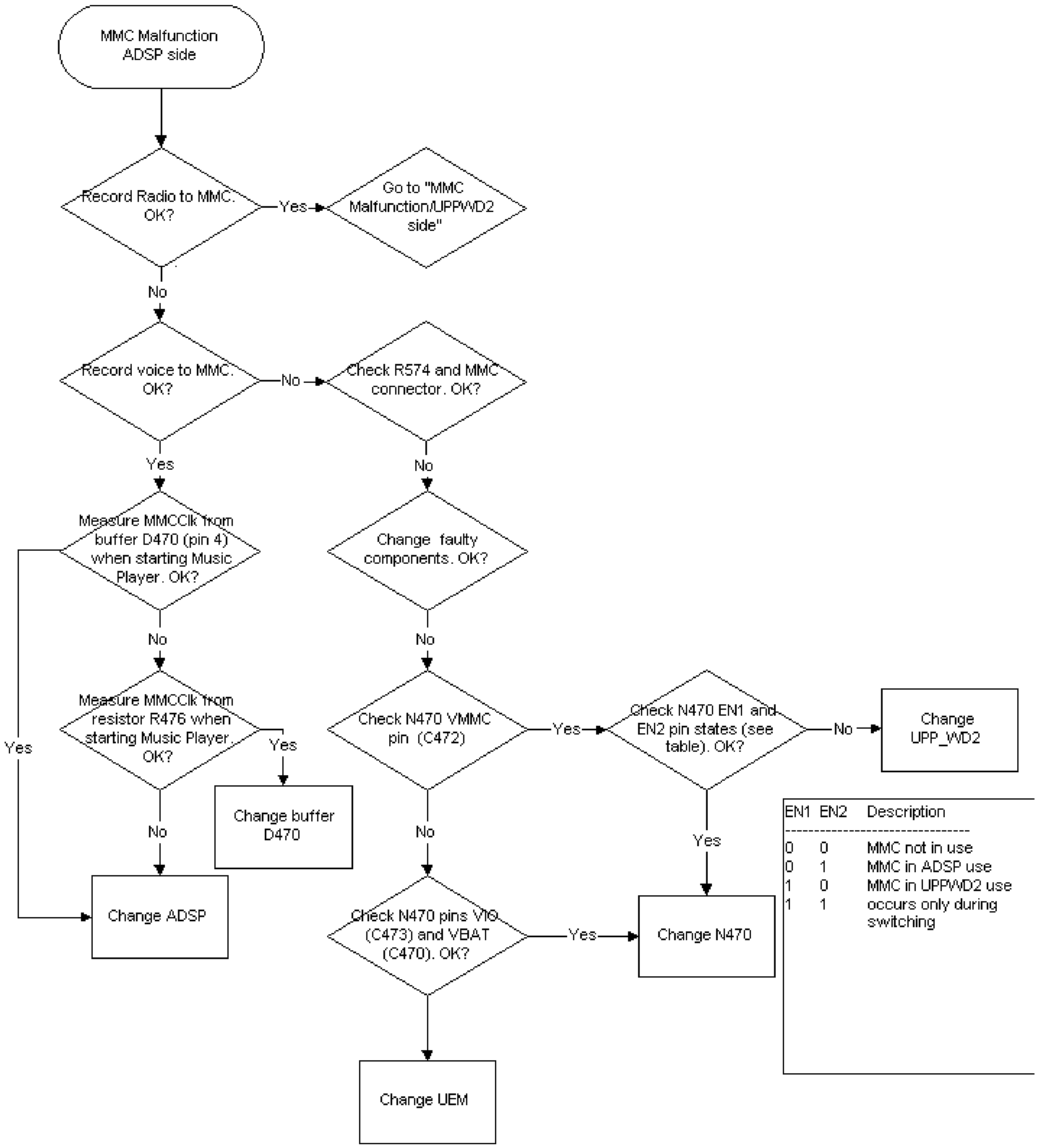
Memory Troubleshooting

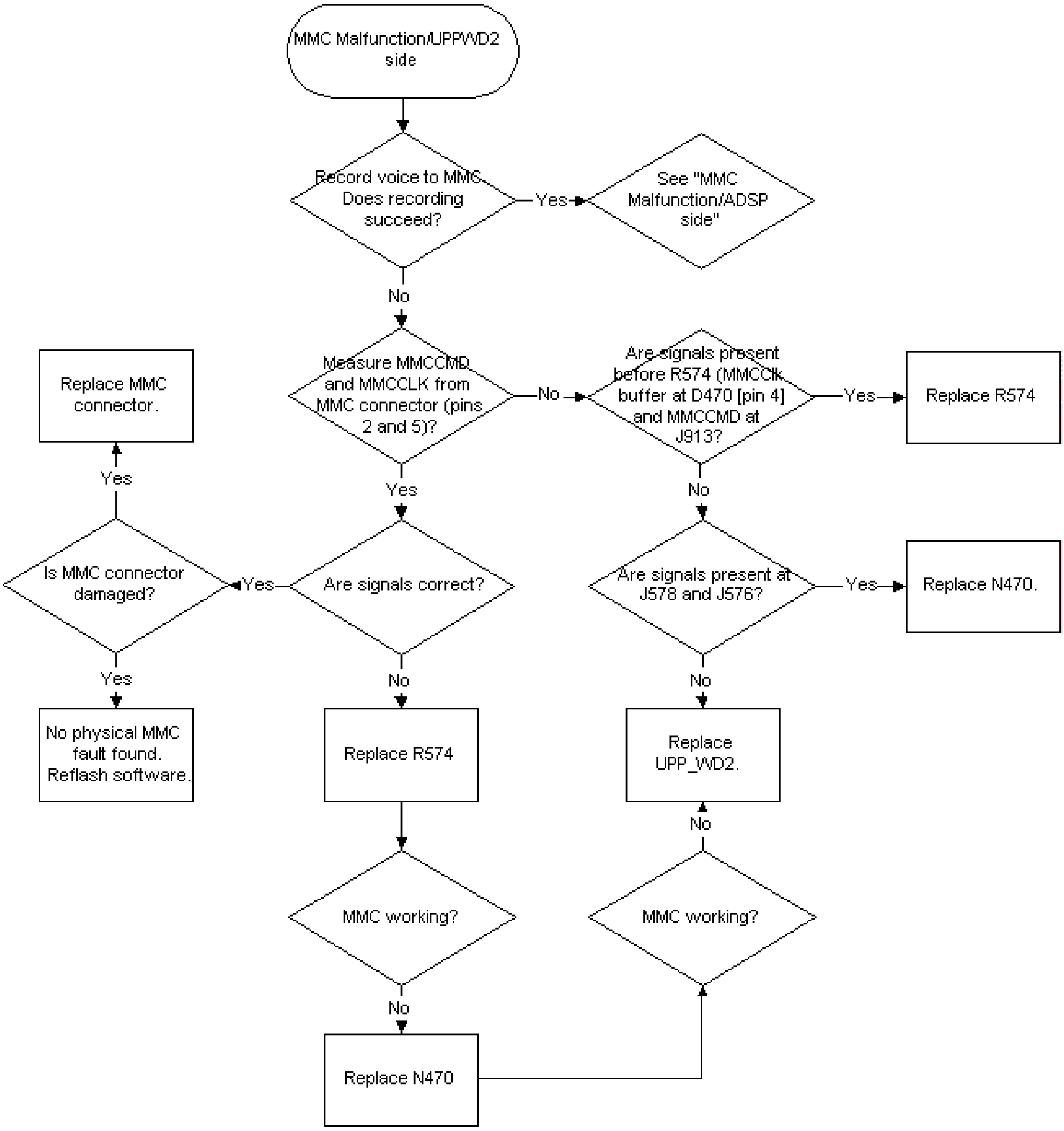
Most memory related errors are found through flashing the device, flashing the device is therefore recommended before any of the steps described in this chapter. Check flashing Troubleshooting section first.

There are however a few memory related errors that cannot be found through flashing.

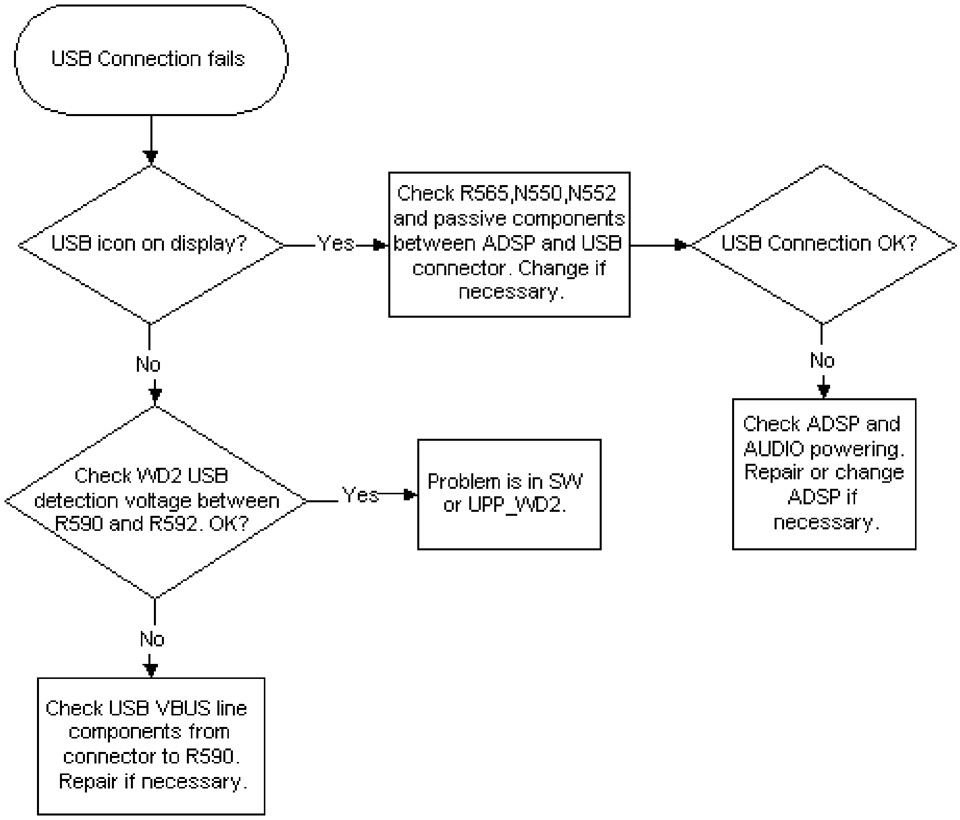
- SDRAM(D312) partially damaged. This can mean that the SDRAM component itself is partially damaged and all the memory locations cannot be successfully read or there is a soldering problem somewhere either under UPP or SDRAM. There is a BB self test for testing SDRAM component quite thoroughly, but the problem is that if SDRAM doesn't function properly one may not be able to run those tests as SDRAM is used during the device boot and selftest cannot be run if the device hasn't booted.
- DEVICE may inform about being "out of memory " more often than it should
- flash1 (D310) or flash 2 (D313) is partially/totally damaged. During flashing the manufacturer, device and revision id's are read, but flashing is done based on id's of the flash0 (D311). This means that one cannot see any error messages displayed on Phoenix window during flashing if flash1 or flash 2 is failing. Id's are however displayed on the Phoenix window and successful read of flash1 id's can be checked from there.

MMC Troubleshooting



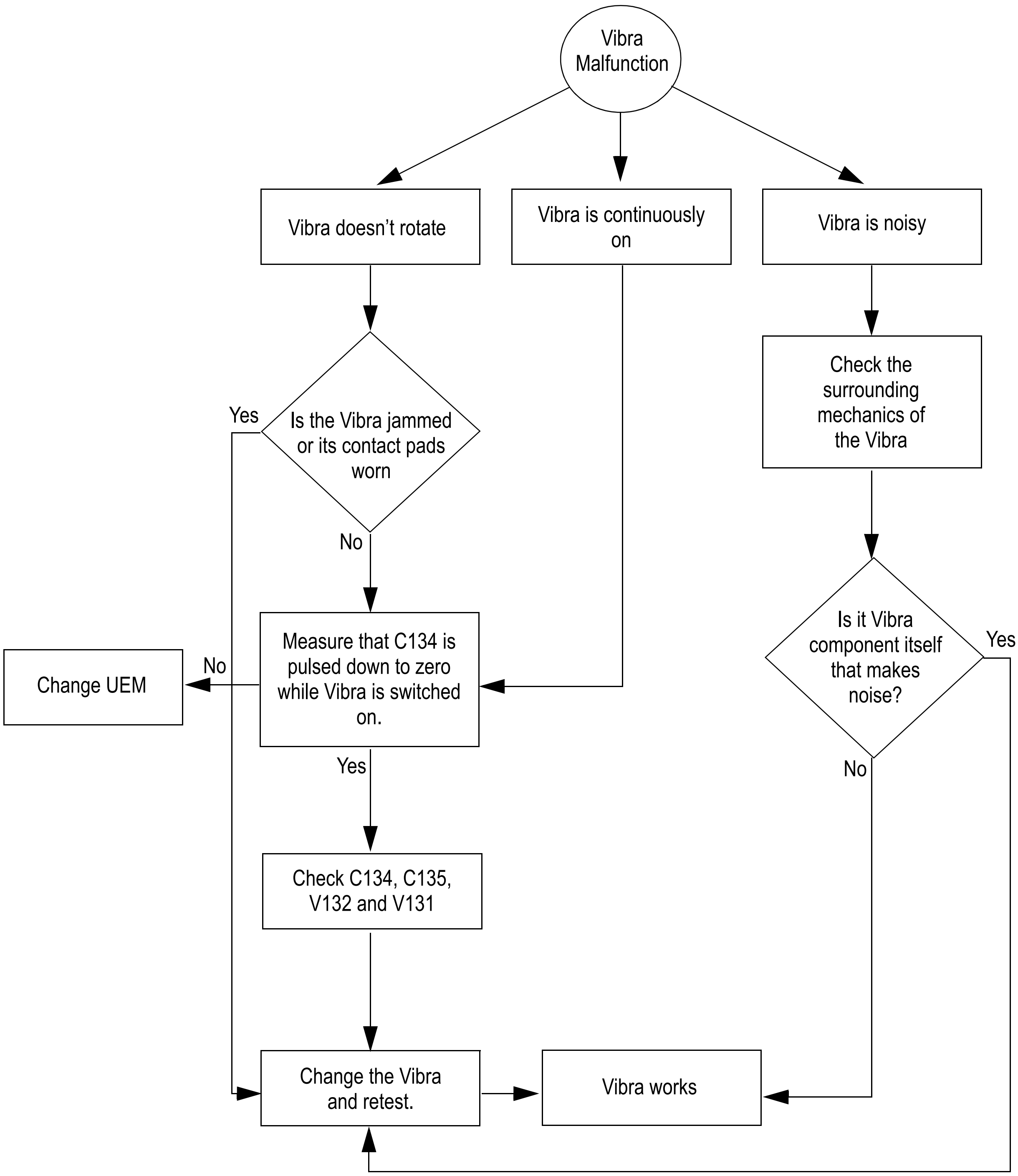

MMC Malfunction/UPPWD2 side
Record voice to MMC. Does recording succeed?
Yes
See "MMC Malfunction/ADSP side"
No
Measure MMCCMD and MMCCLK from MMC connector (pins 2 and 5)?
No
Are signals present before R574 (MMCClk buffer at D470 [pin 4] and MMCCMD at J913?
Yes
Replace R574
Replace MMC connector.
Yes
Yes
No
Is MMC connector damaged?
Yes
Are signals correct?
Are signals present at J578 and J576?
Yes
Replace N470.
Yes
No
No
No physical MMC fault found. Reflash software.
Replace R574
Replace UPP_WD2.
No
MMC working?
MMC working?
No
Replace N470

USB Troubleshooting

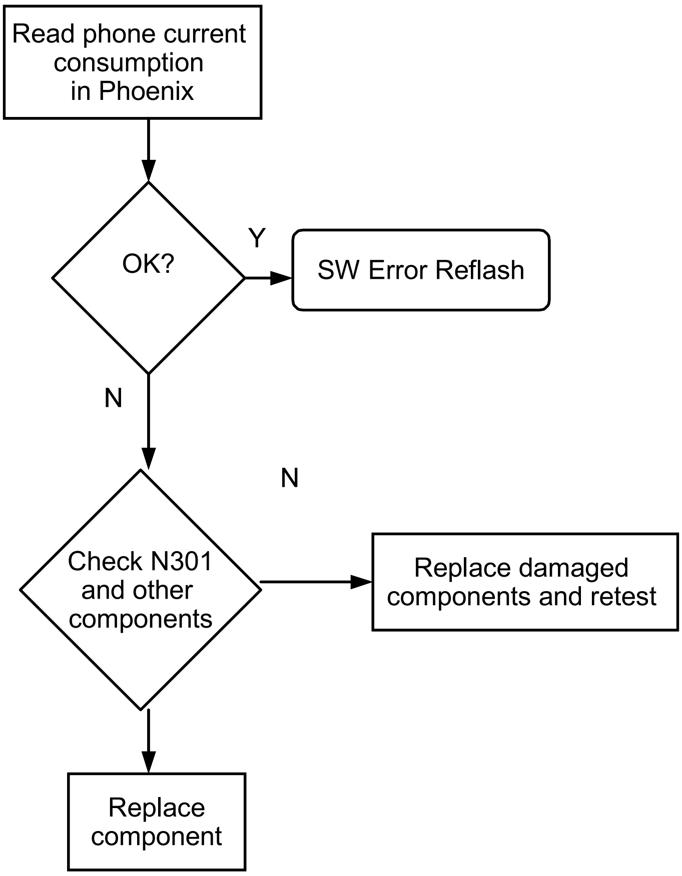


VIBRA

There may be three kind of problems concerning vibra; it doesn't rotate at all, it's noisy or it's continuously on. The noisiness is usually caused by the surrounding mechanics when the rotating mass has contact to it.



ZOCUS



UI Troubleshooting

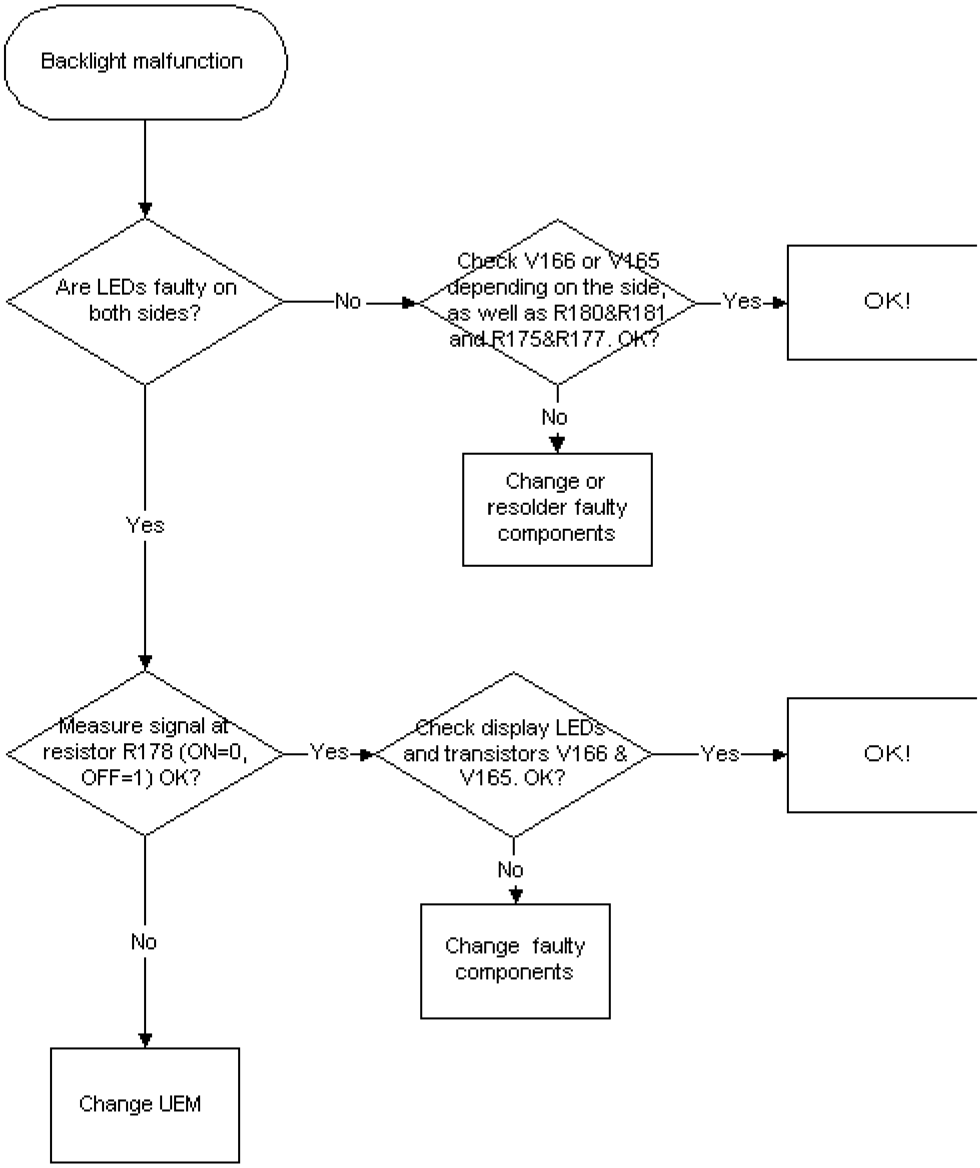
UI Troubleshooting cases

This document describes how the trouble shooting should be done if there is something wrong with the UI function. If the problem is due to the display or keymat PWB the whole UI module should be replaced. However, the earpiece maybe replaced. (see Audio Troubleshooting)

Keymat Backlight

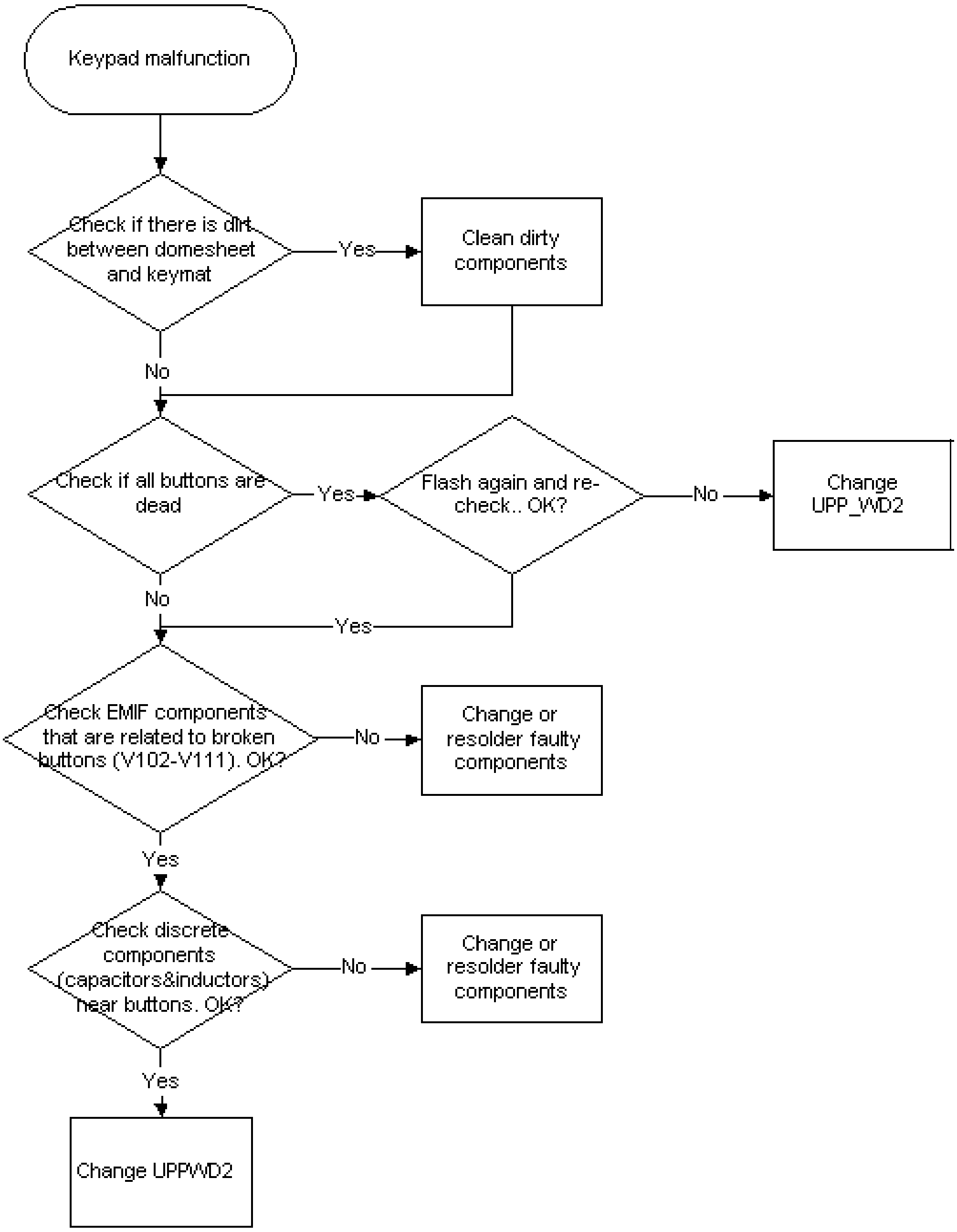
If the keymat backlight is non-functional and the backlight driver voltage is generated correctly, then there is either a problem with the connector or the UI module.

Note: that it is possible for an LED to be non-functional and for all other LEDs to still be working.

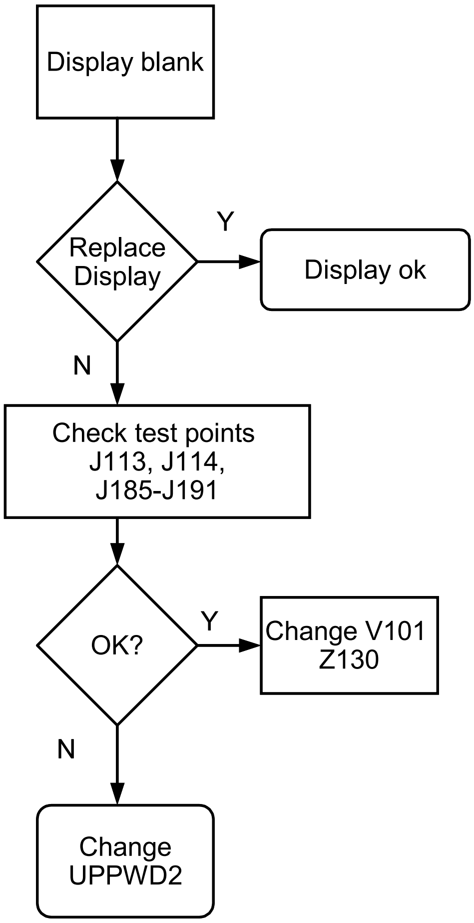


Keyboard

If keyboard doesn't work, follow the Troubleshooting flow chart below:

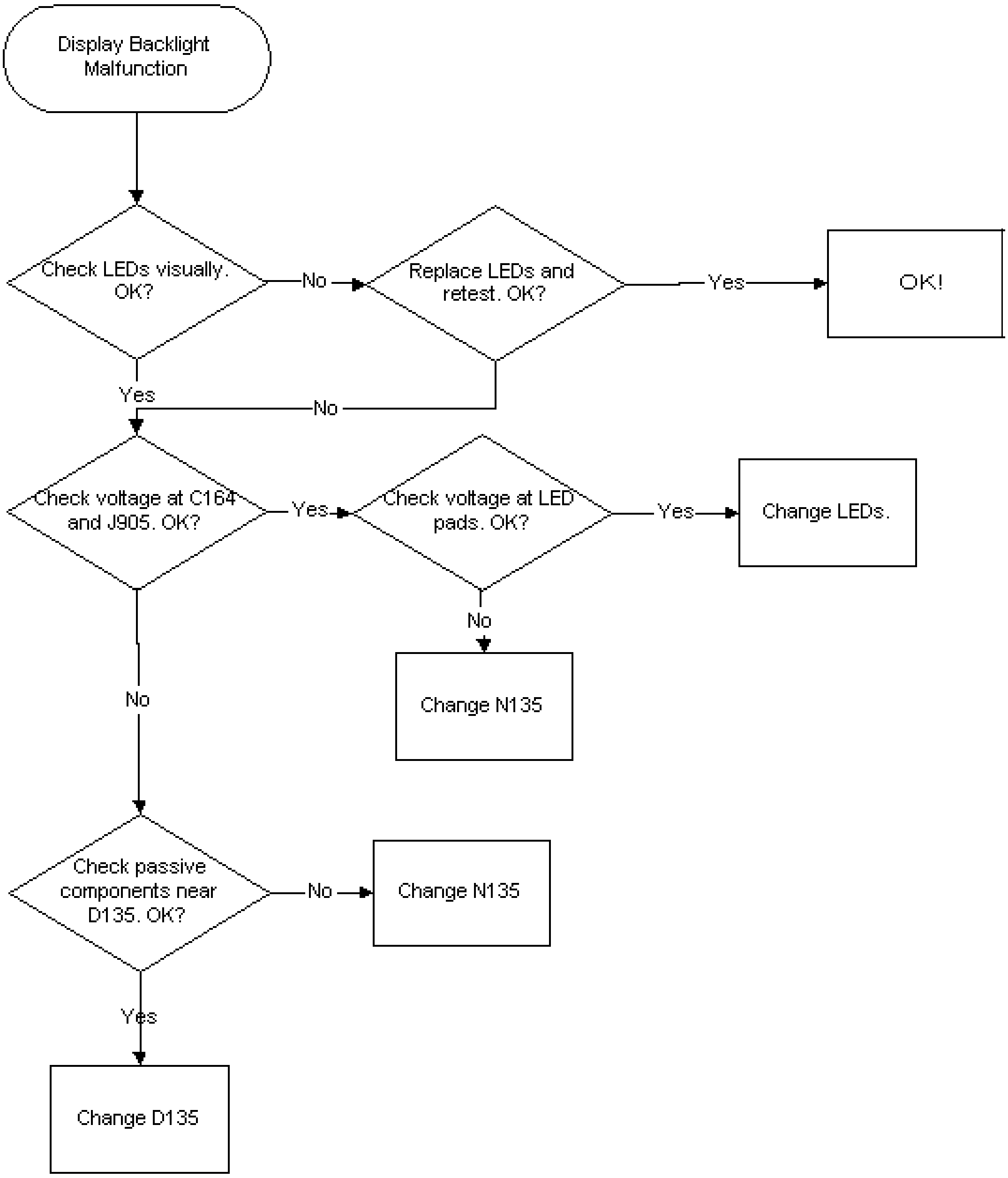


Display blank



Backlight does not turn on

Figure 8:



FM Radio Troubleshooting

FM Radio component layout

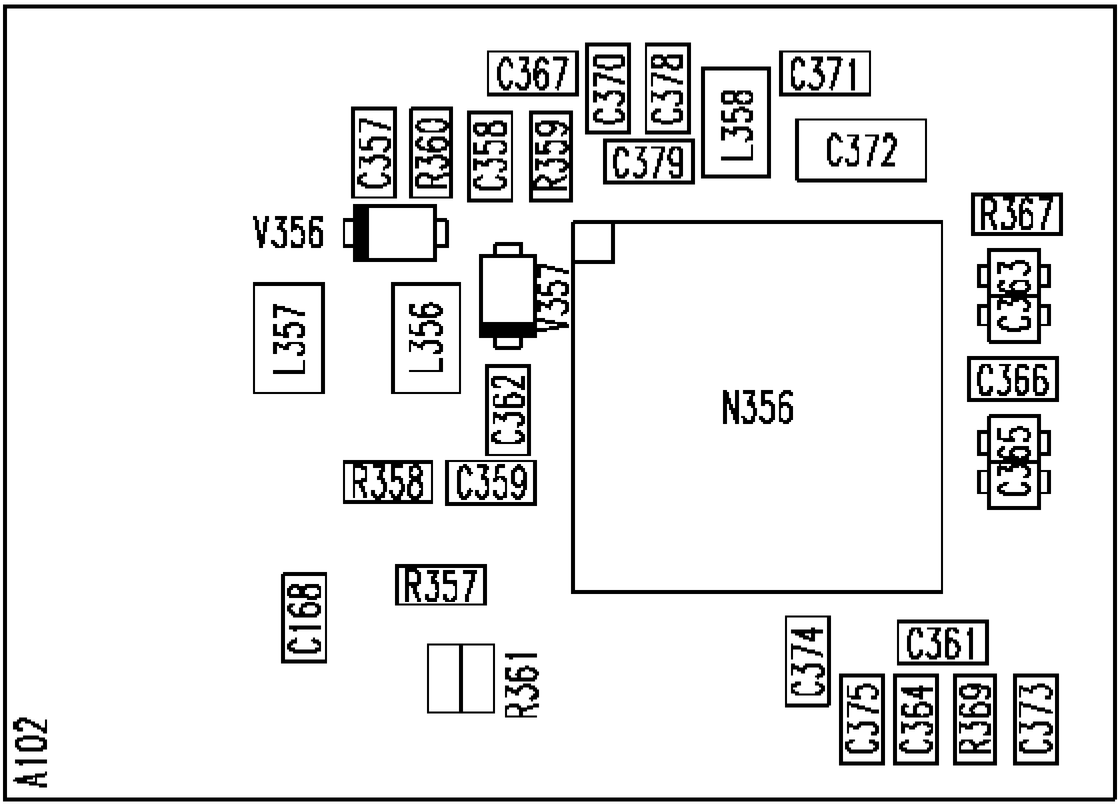


Figure 9: Component placement

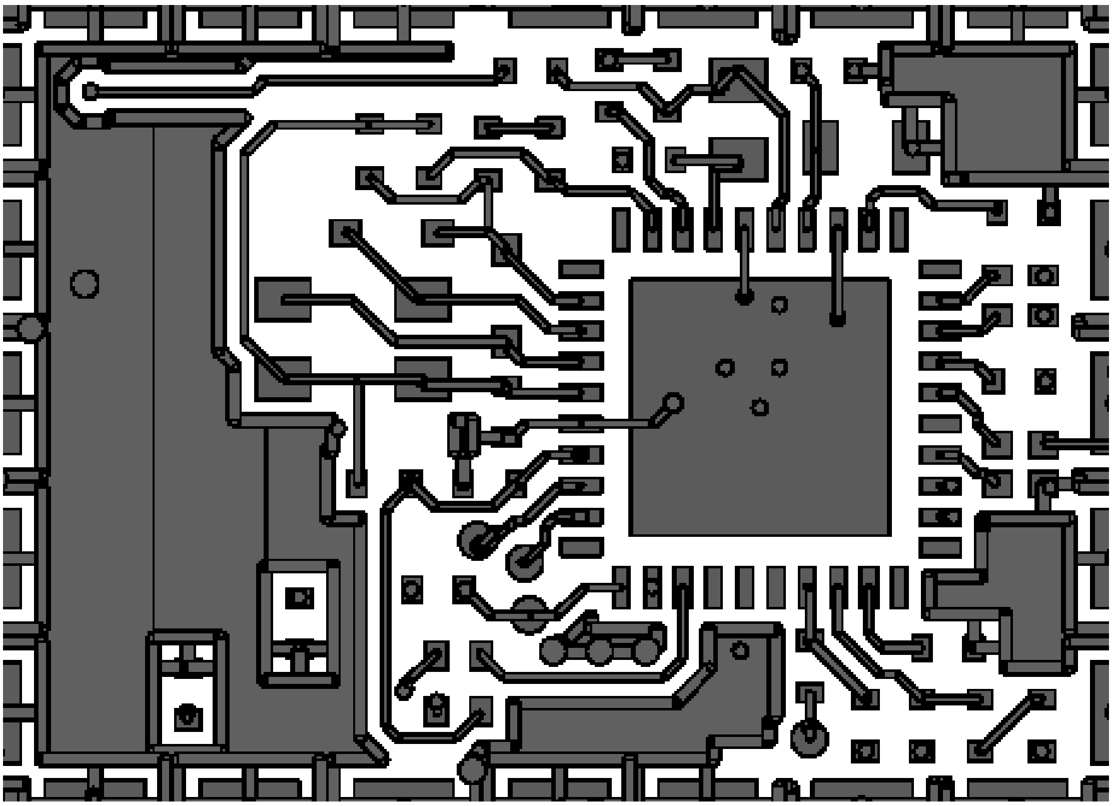


Figure 10: Trace layout.

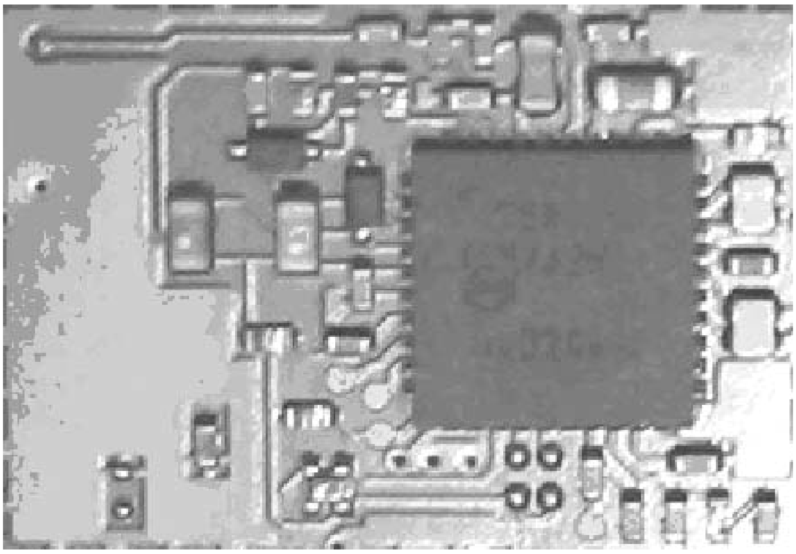


Figure 11: FM radio block layout.

Components C001 and C002 are not shown in the picture. Those components are placed near audio connector X002.

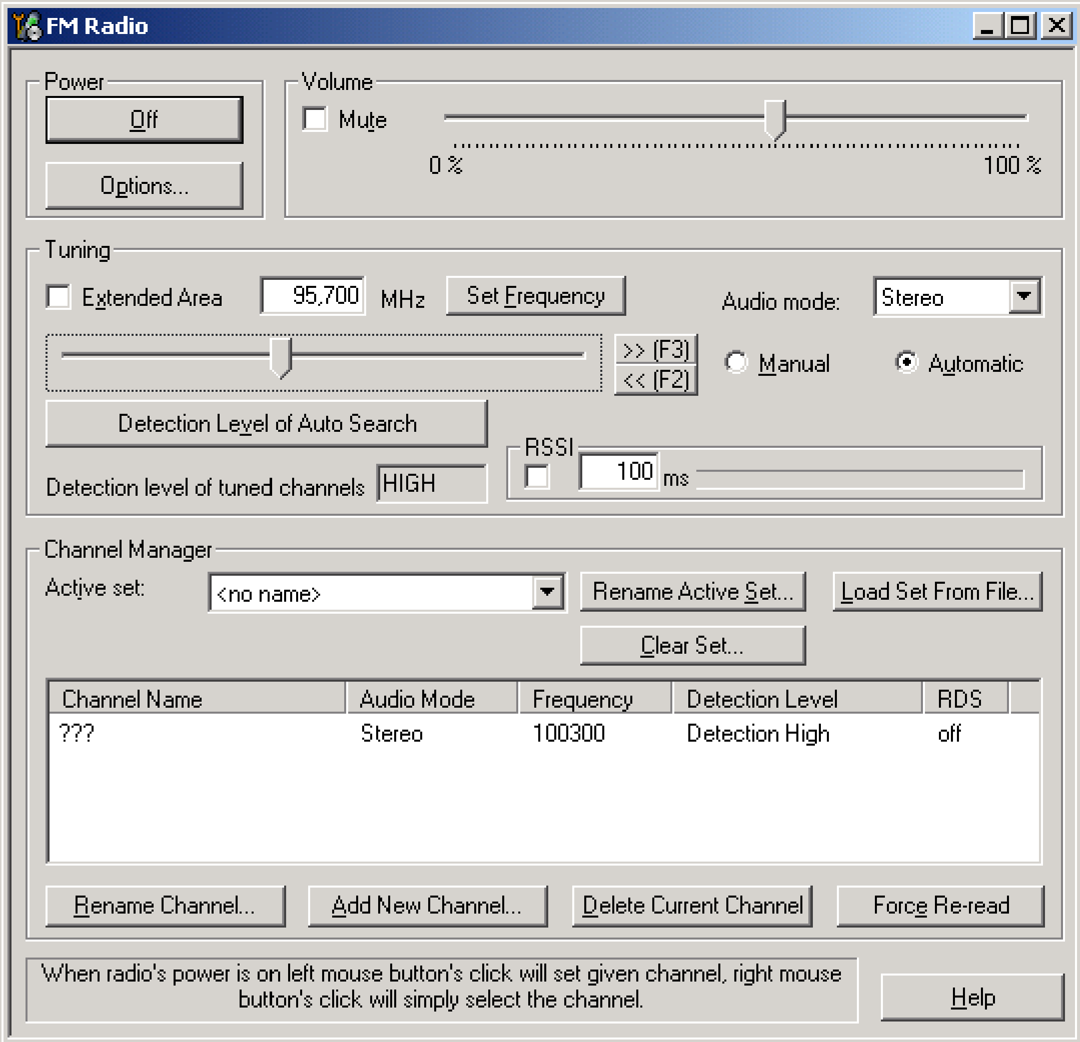


Figure 12: FM Radio control window.

FM Radio Troubleshooting diagram

Notes to "FM Radio Troubleshooting diagram"

Use 1MHz 1X probe when measuring Audio and clock signals with oscilloscope.

Use active RF probe when measuring frequencies with spectrum analyzer.

Note 1. RF test signal parameters:

- Amplitude, *A*, –67.0 dBm

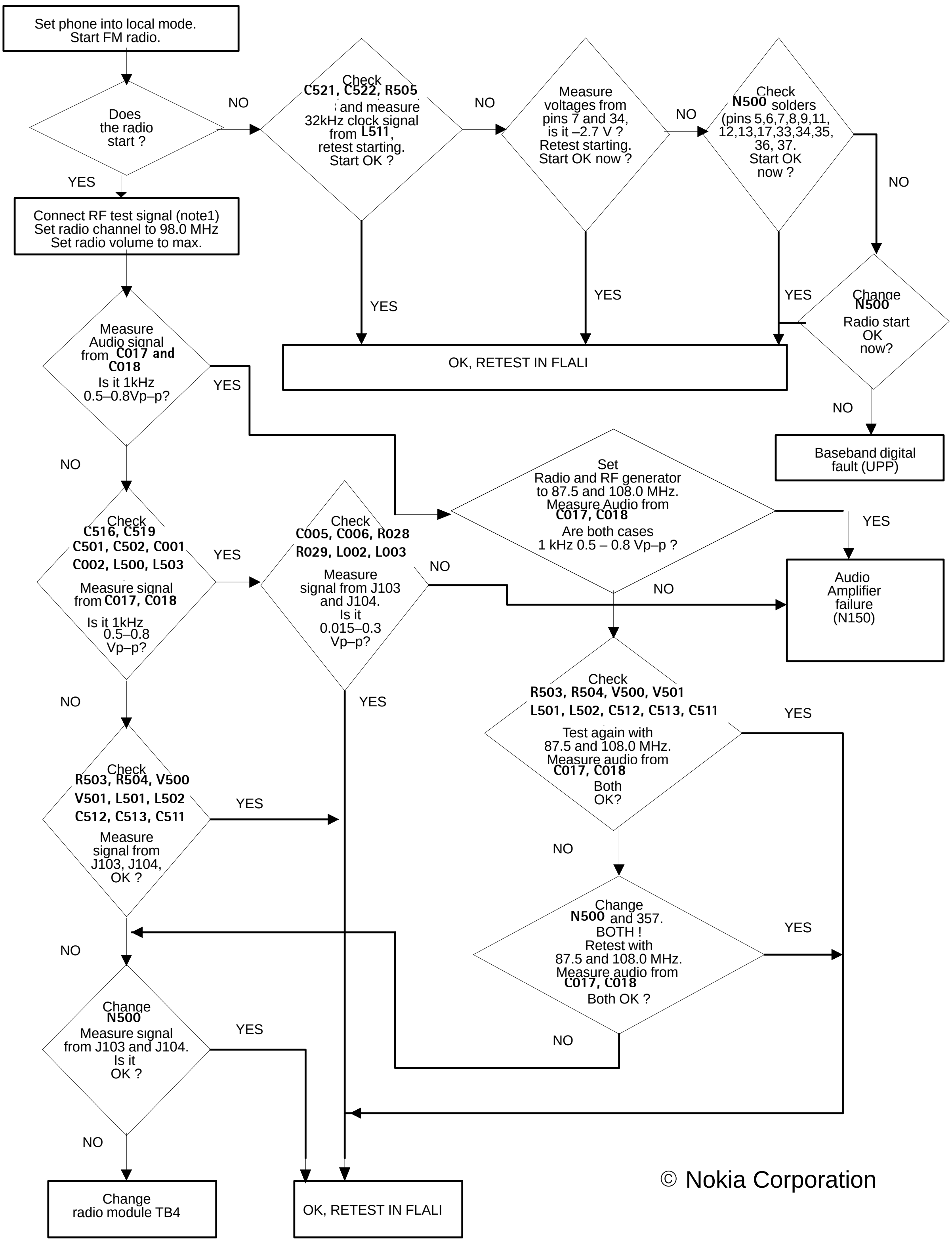
- Carrier frequency, f_c, 98,000 MHz

- Deviation, Δf, 75 kHz

- Modulating frequency f_m, 1,000 kHz (RF generator internal)

- FM stereo, mode R=L, pilot state ON

Figure 13: FM radio Troubleshooting diagram



Diagrams of FM radio signals

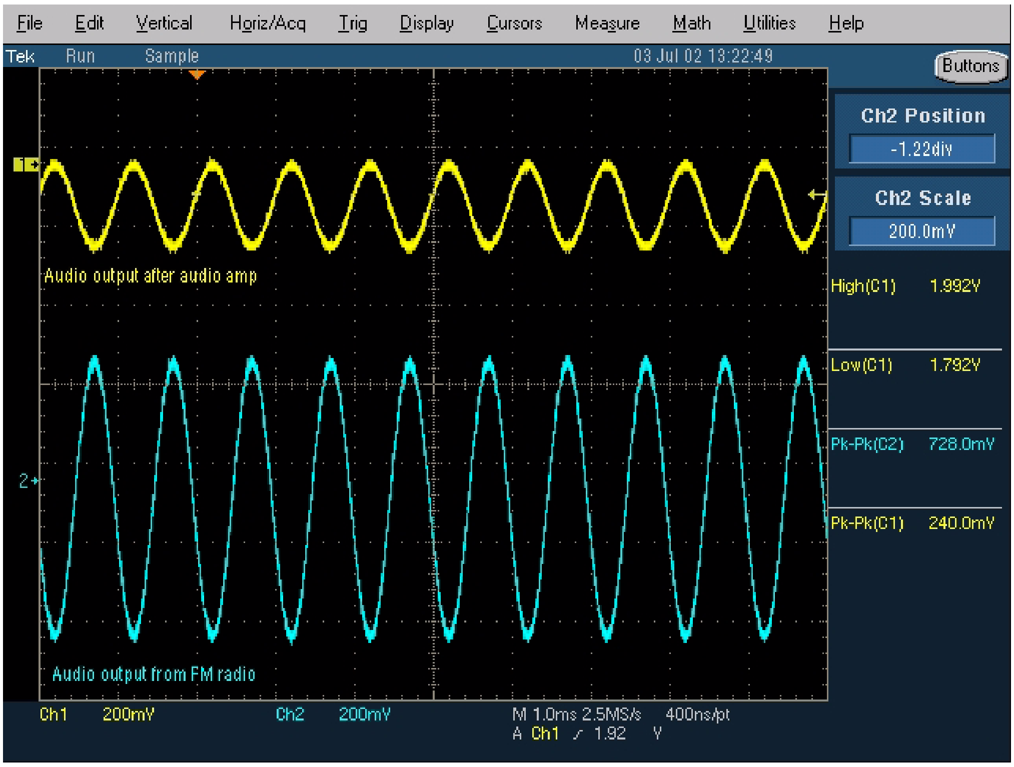


Figure 14: Oscilloscope screen shot, Audio output

Signal 1: Audio output from PWB test points J103 and J104, with FM test signal, volume 100%.

Signal 2: Audio output from FM radio pins 22 and 23(same as in C017 and C018), with FM test signal

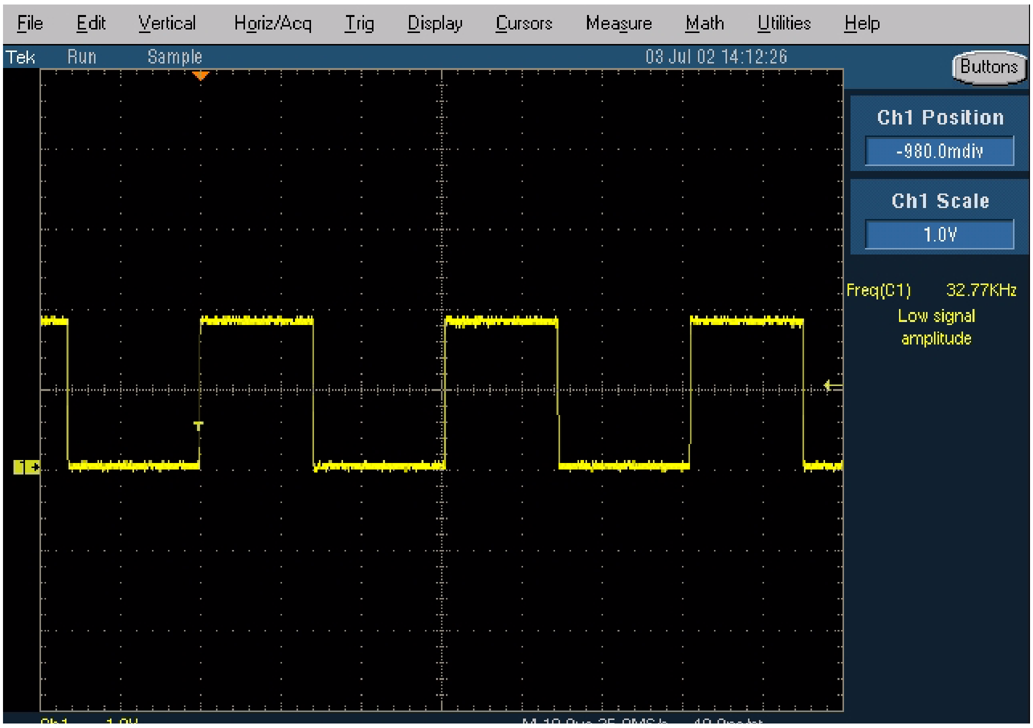


Figure 15: FM radio clock from L511, 32 kHz frequency clock signal, when radio is on.

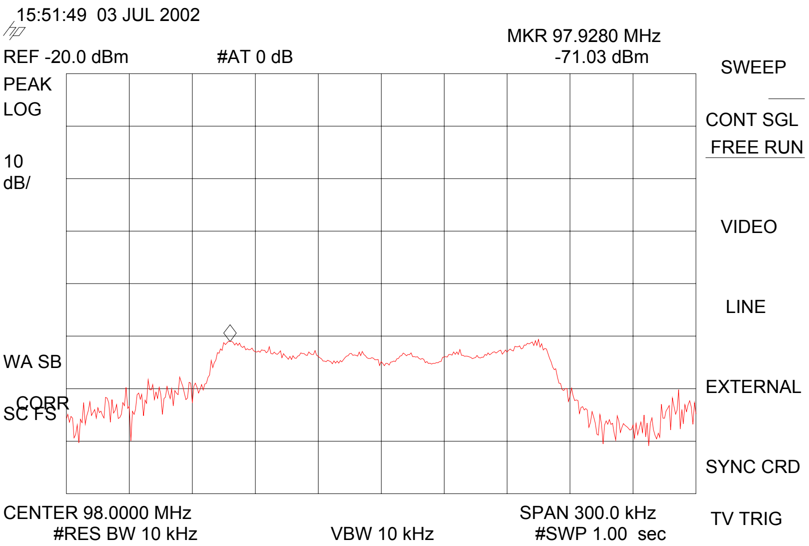


Figure 16: FM frequency from FM radio pin 37, the other end of L500, with FM test signal

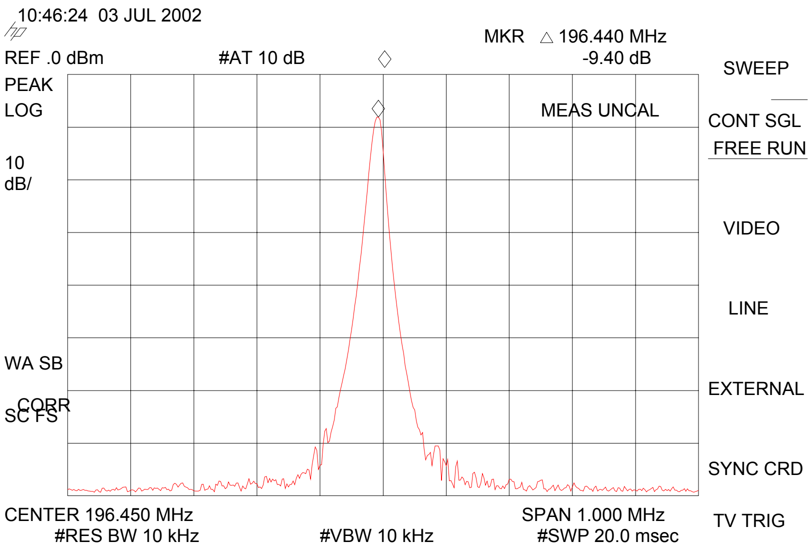


Figure 17: VCO frequency from FM radio pins 3 and 4, the other ends of V500 and V501, with FM test signal

RF Troubleshooting

Abbreviations in fault finding charts

BB	Base band
DCS/PCN	GSM1800
PCS	GSM1900
EGSM	Extended GSM900
ESD	Electro Static Discharge
GPRS	General Packed Radio Service
HSCSD	High Speed Circuit Switched Data
LO	Local Oscillator
PA	Power Amplifier
PWB	Printed Wired Board
PLL	Phase Locked Loop
RF	Radio Frequency
RX	Receiver
SA	Spectrum analyzer
TX	Transmitter
UHF	Ultra High Frequency
VCO	Voltage controlled oscillator
VHF	Very High Frequency

Introduction

Two types of measurements have to be done for repair of the phone boards:

- RF measurements shall be done using a Spectrum Analyzer together with a high-frequency probe. (Note, that signal will be significantly attenuated). Correct attenuation can be checked by using a "good" phone board, for example.
- LF (Low frequency) and DC measurements shall be done with a an oscilloscope together with an 10:1 probe.

Always make sure that the measurement set-up is calibrated when measuring RF parameters at the RF connector. Remember to include the correct losses in the module repair jig and the connecting cable when realigning the phone.

Most RF semiconductors are static discharge sensitive. ESD protection must be taken into account during repair (ground straps and ESD soldering irons).

Mjoelner RF ASIC is moisture sensitive. Therefore, Mjoelner RF ASIC must be pre-baked prior to soldering.

Rx calibration done via Phoenix software is temperature sensitive because of calibration of 26 MHz reference oscillator (VCXO). According to Mjoelner specification ambient temperature has to be in a range from 22°C to 36°C.

Apart from key-components described in this document there are a lot of discrete components (resistors, inductors and capacitors) for which Troubleshooting is done by checking if soldering of the component is done properly and checking if the component is missing from PWB. Capacitors can be checked for short-circuiting and resistors for value by means of an ohm-meter, but be aware in-circuit measurements should be evaluated carefully.

In the following both, the name EGSM and EGSM900 will be used for the low band. DCS or PCN and GSM1800 will be used for the mid band. PCS and GSM1900 will be used for the high band.

RF Key component placement

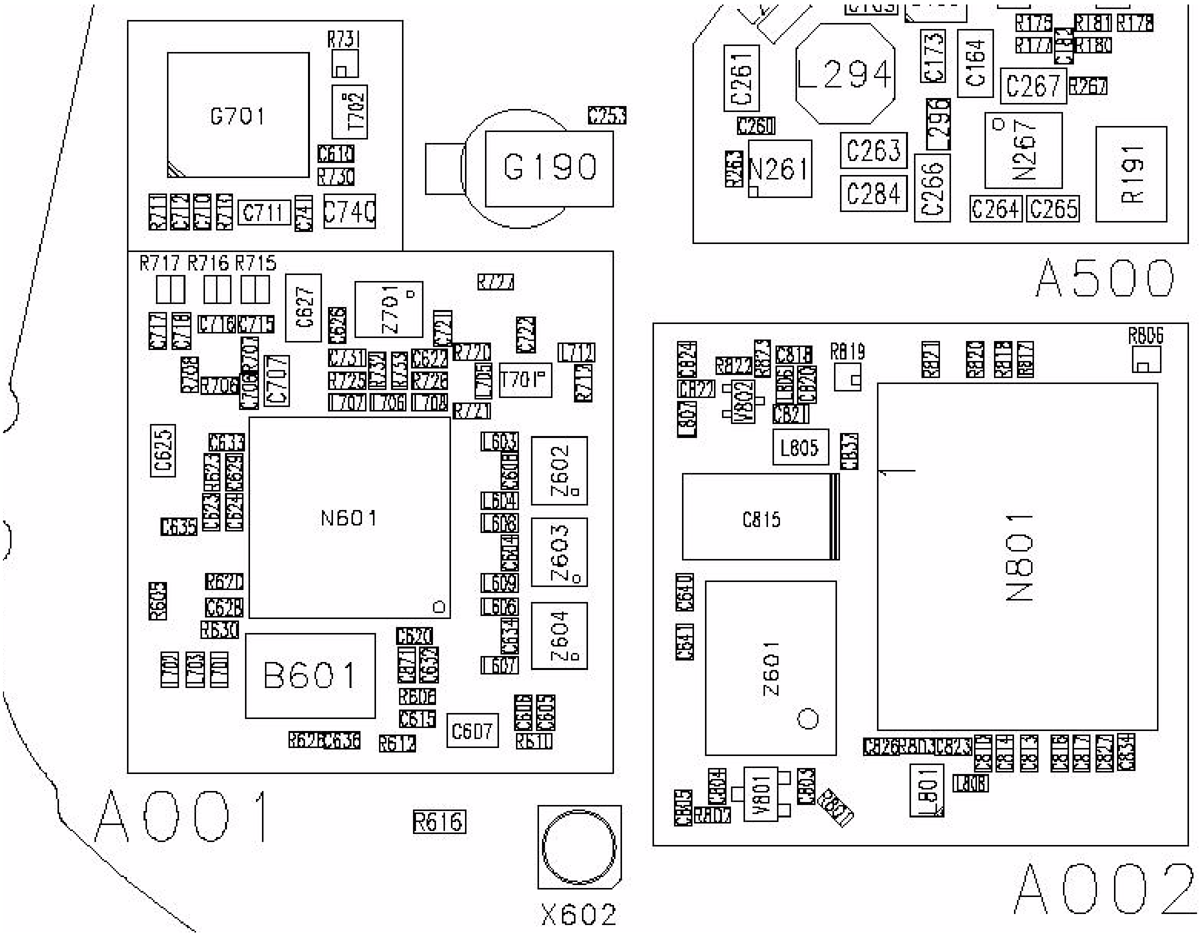


Figure 1: RF key component placement

Reference number	Name	Reference number	Name
N601	Mjoelner RF ASIC	X602	RF Connector
B601	26 MHz Xtal	L801	Directional Coupler
Z602	GSM1800 RX SAW	V801	Detector Diode
Z603	GSM1900 RX SAW	Z601	Antenna switch
Z604	EGSM RX SAW filter	N801	Power Amplifier
Z701	EGSM TX SAW filter		
T701	GSM1800/GSM1900 TX Balun		
V802	EGSM Pre-amplifier		
G701	3.7 GHz VCO		
T702	VCO Balun		

RF Measurement points

RF Supply points

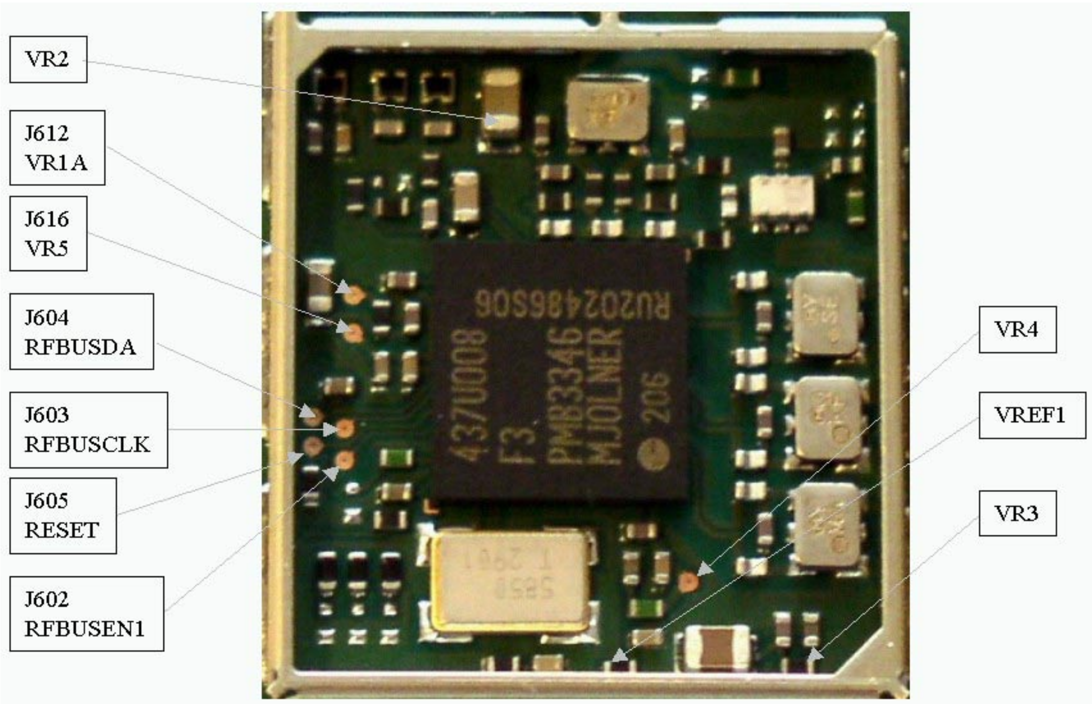


Figure 2: RF Supply points inside Mjoelner can

RF power supplies are generated in the UEM and can be measured either in the Mjoelner can or in the baseband can. Arrows mark the measurement points inside the pictures.

Measurement points in the receiver

Measurement points are indicated on the picture below.

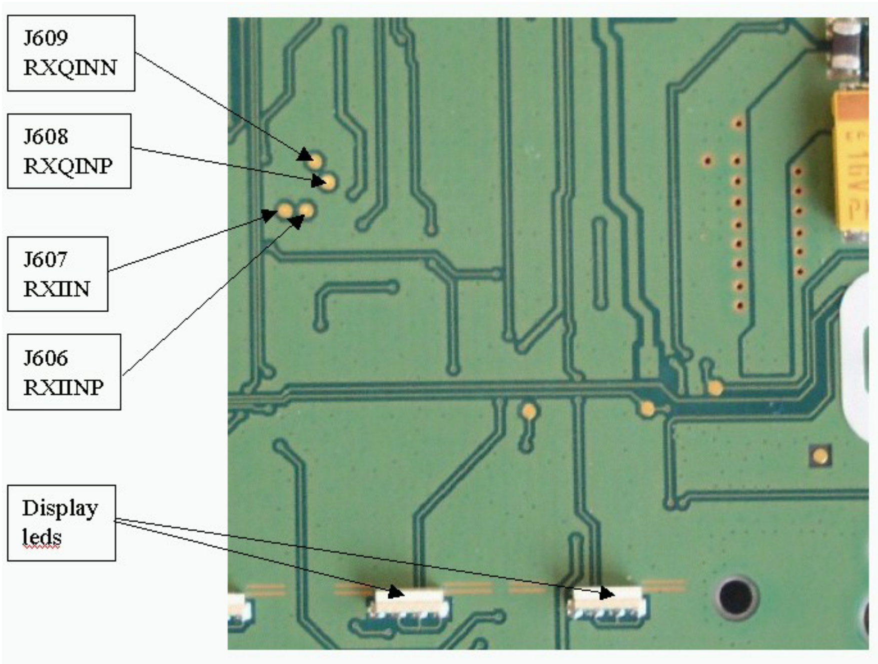


Figure 3: Rx I and Q measurement points

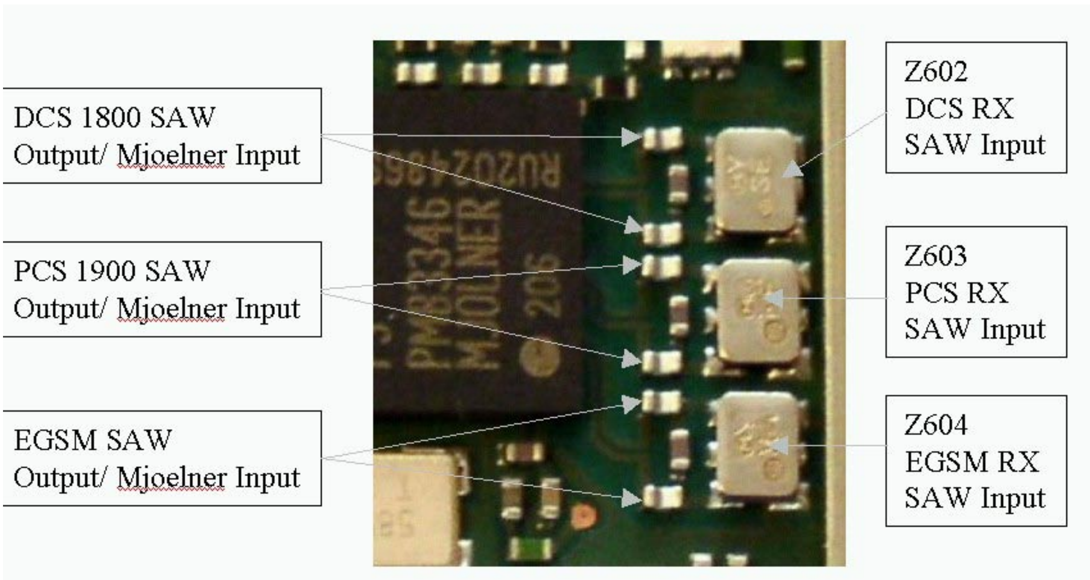


Figure 4: Rx measurement points at Rx SAW filters and Mjoelner RF ASIC

Measurement points in the transmitter

Measurement points are shown in the picture below,

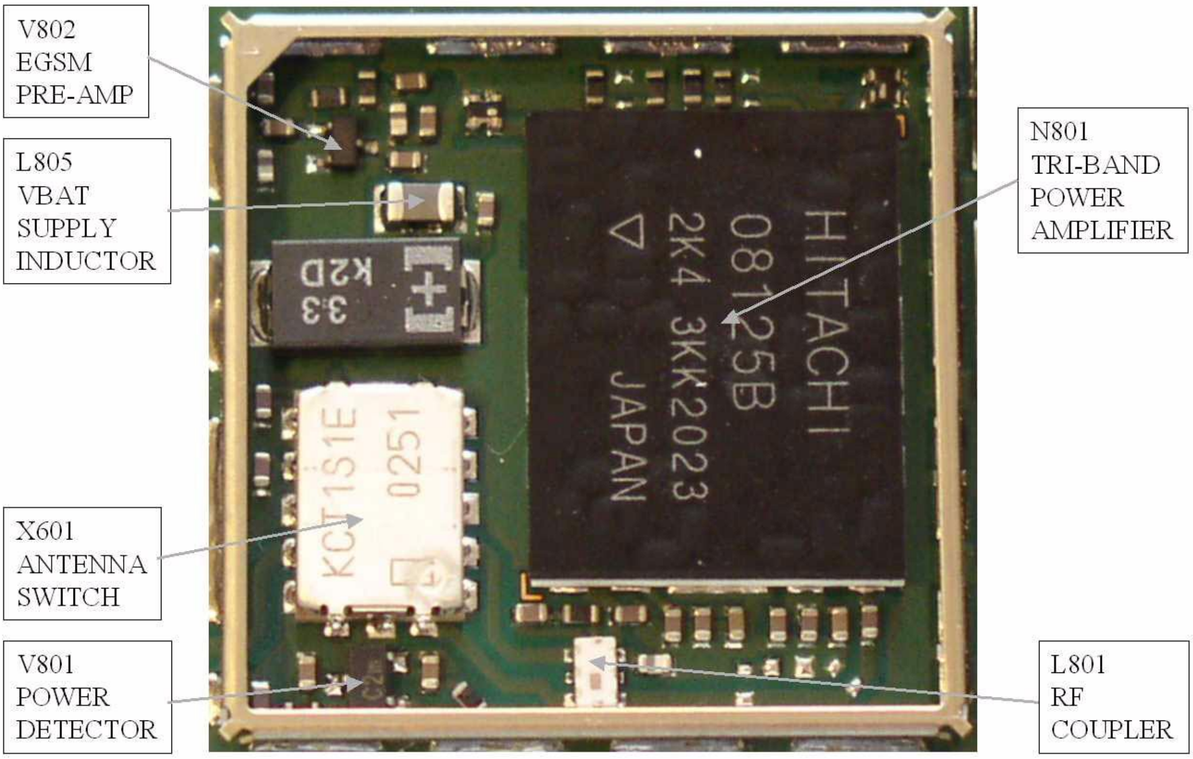


Figure 5: Tx measurement points inside PA can (bottom side of PWB)

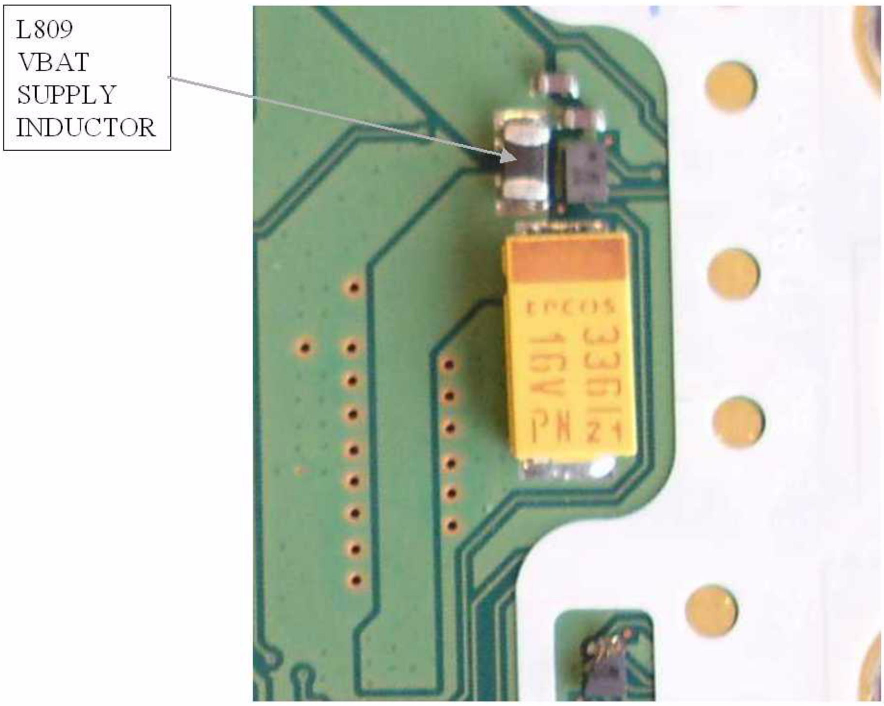


Figure 6: Tx measurement points on the top side of PWB

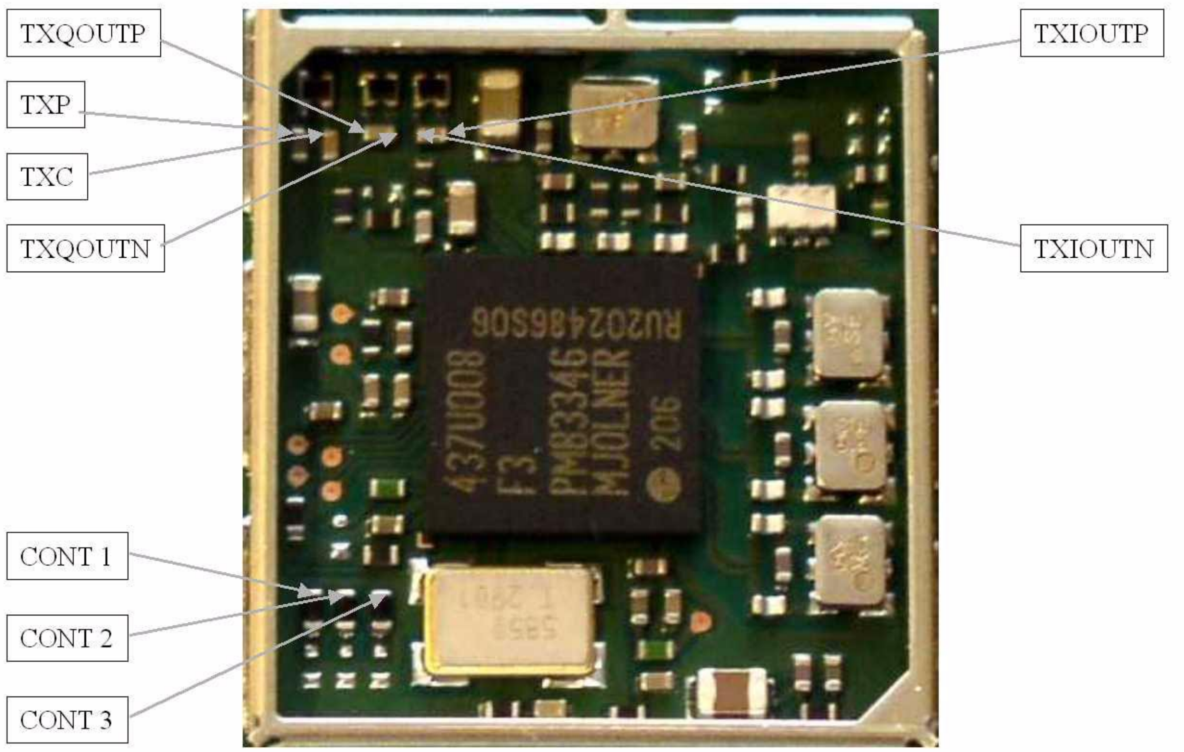


Figure 7: Tx measurement points inside Mjoelner can

RF in general

The RF part is a triple-band direct conversion transceiver. Using direct conversion no intermediate frequencies are used for up- or down- conversion.

The VCO is set to either twice or four times (depending on the band used) the wanted RX or TX frequency. The VCO frequency is divided by either 2 or 4 and fed to the mixers (down-conversion) or modulators (up-conversion). Up- or down- conversion is done in one step, directly between RF frequency and DC. All up and down-conversion takes place in the RF ASIC named Mjoelner (N601).

Mjoelner RF ASIC also contains PLL and LNAs for all used bands. A DC control section is included in to power and/or control EGSM TX buffer, detector and antenna switch. The Mjoelner RF ASIC is controlled via a serial bus.

Mjoelner RF ASIC contains an integrated VCXO which uses an external 26 MHz Xtal. No analogue AFC signal is needed. AFC is done via the serial interface of Mjoelner.

The interface between Mjoelner RF ASIC, UPP and Bluetooth uses a 26 MHz reference clock. An external 26 MHz reference clock buffer is used to drive Bluetooth module.

The RF supports HSCSD (High Speed Circuit Switched Data) and GPRS (General Packed Radio Service), meaning multi-slot operation, this will not require special equipment or procedures in repair situations.

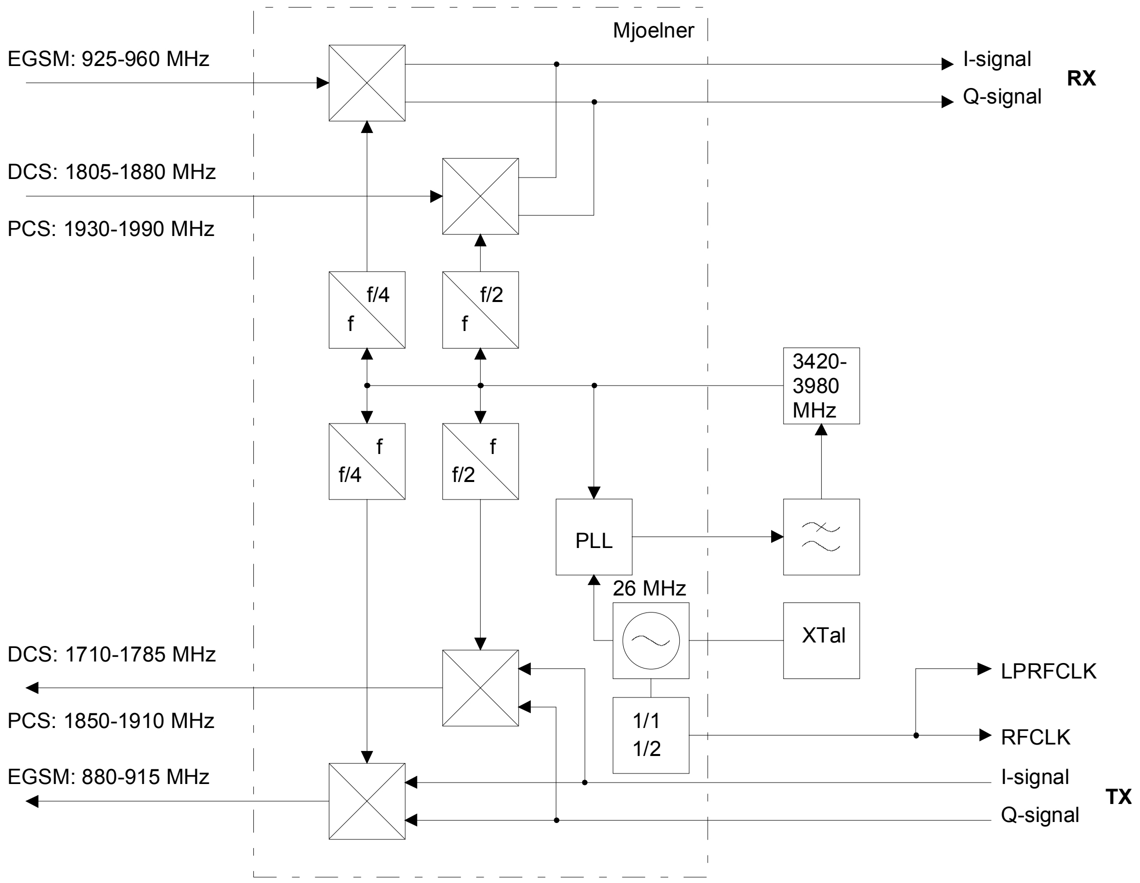


Figure 8: RF frequency plan

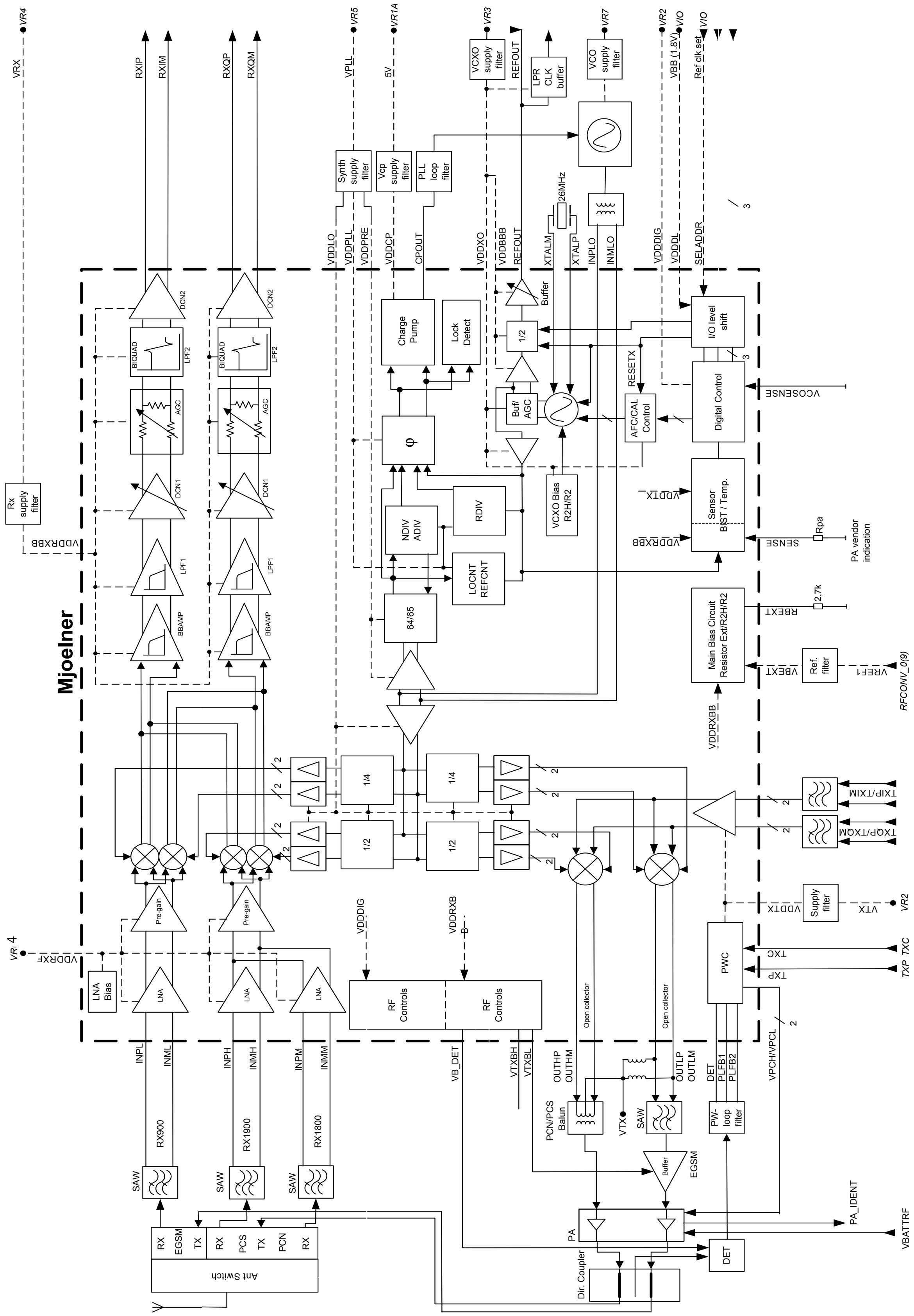


Figure 9: RF Block diagram

RF Power Supply Configuration

All power supplies for the RF Unit are generated in the UEM IC (D190). All RF supplies can be checked either in Mjoelner can or in BB can.

The power supply configuration used is shown in the block diagram below. Values of voltages are given as nominal outputs of UEM. Currents are typical values.

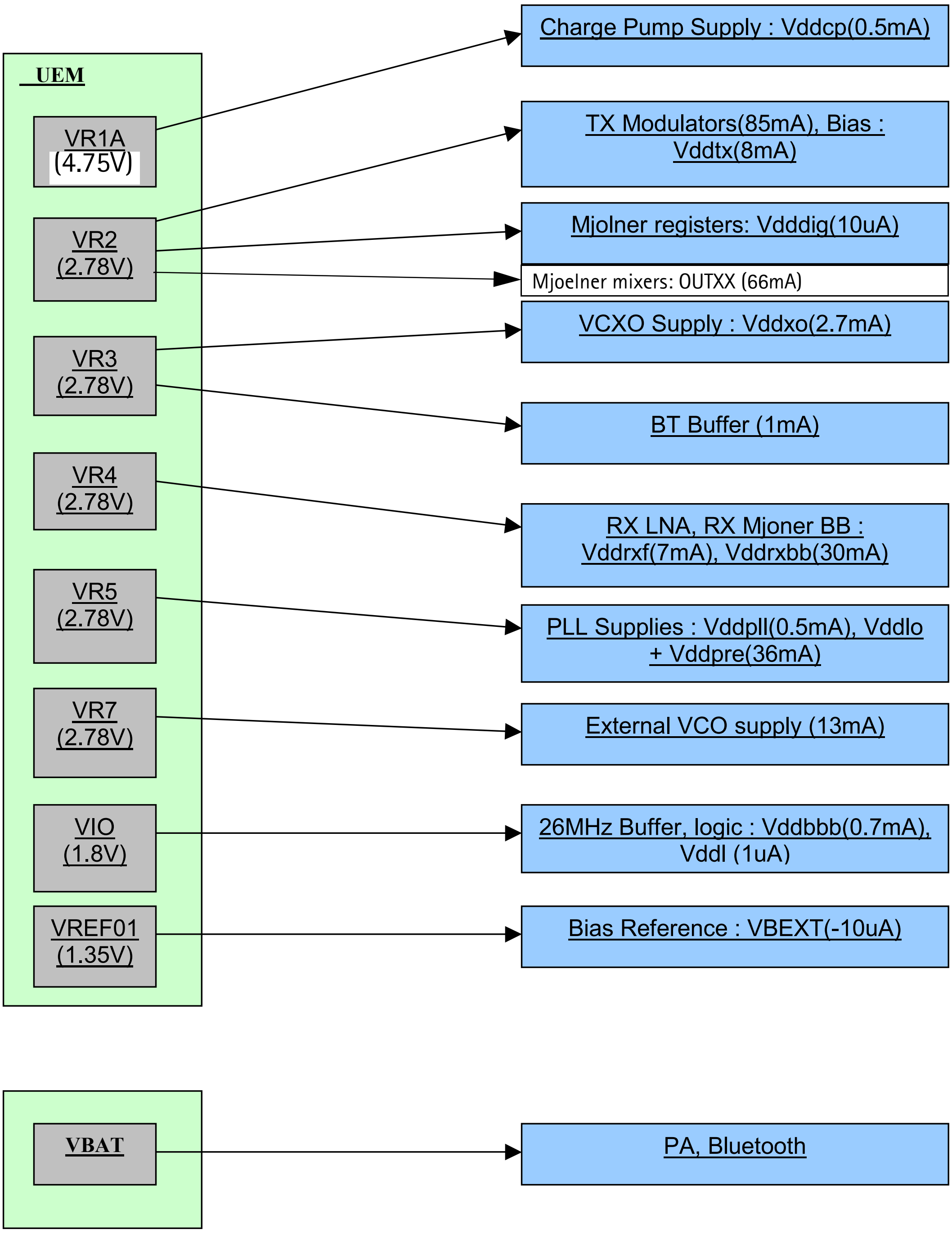


Figure 10: RF Power distribution diagram

Receiver

General instructions for RX Troubleshooting

Connect the phone to a PC with DAU-9S cable and dongle and follow the following instructions:

Measuring RX I/Q signals using RSSI reading

Start Phoenix Service Software

Log in with your user ID.

Select	File	[Alt-F]
	Manage Connections	[M]
	FBUS	Apply
	Close window	

Open the FBUS connection

Select	Scan Product	Ctrl-R

Wait until phone information shows in the lower right corner of the screen.

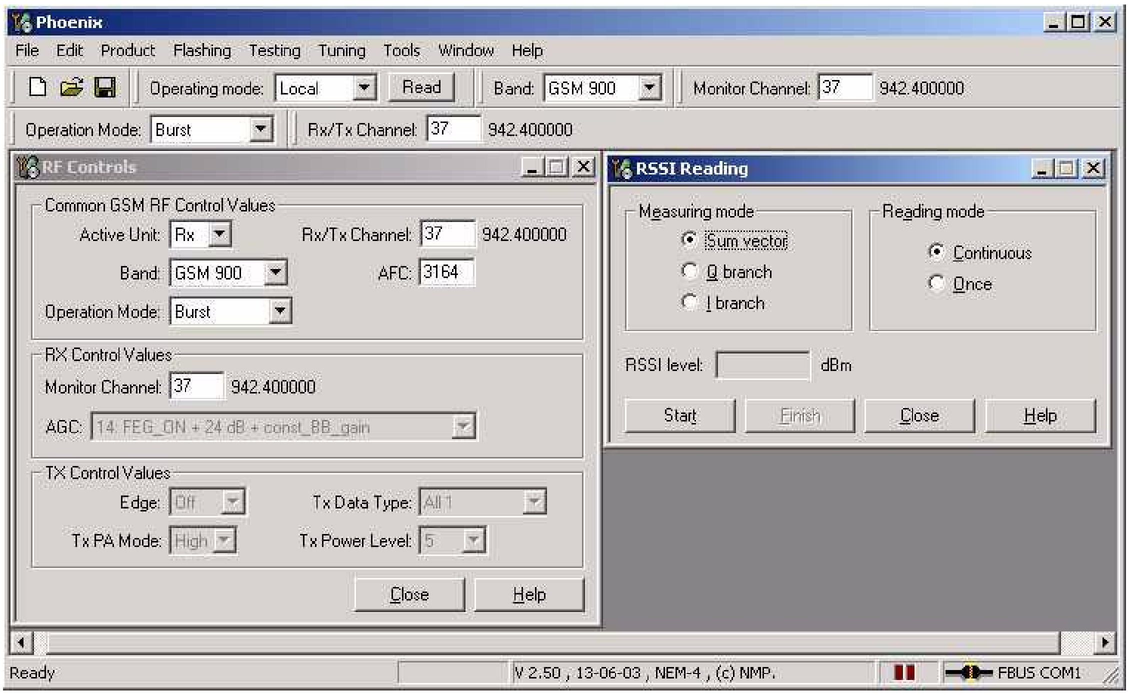
Set operating mode to local mode

Select	Testing	alt-S
	RF Controls	R

Wait until the RF Controls window pops up

Select	Band	GSM 900 or GMS 1800 or GSM 1900
	Active unit	RX
	Operation mode	Burst
	RX/TX Channel	37 or 700 or 661
Select	Testing	alt-S
	RSSI reading	g

The setup should now look like this:



Apply a signal with a frequency of

EGSM : 942.467 MHz (channel 37 + 67.710kHz offset)
GSM1800: 1842.867 MHz (channel 700 + 67.710kHz offset)
GSM1900: 1960.067 MHz (channel 661 + 67.710kHz offset)

and a power level of -80dBm to the RF-connector (remember to compensate for cable attenuation).

In RSSI reading click on Read now.

Measuring RX performance using SNR measurement

Start Phoenix Service Software

Open the FBUS connection

Select	Scan Product	Ctrl-R

Wait until phone information is shown in the lower right corner of the screen.

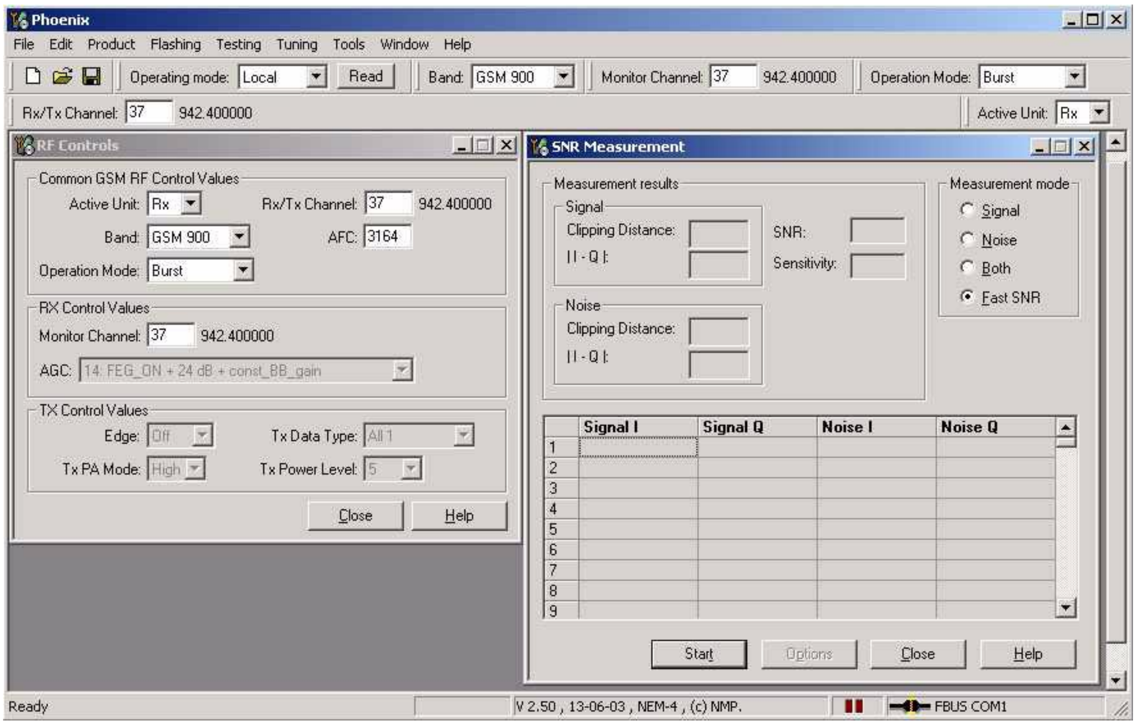
Set operating mode to local mode

Select	Testing	alt-S
	RF Controls	R

Wait until the RF Controls window pops up

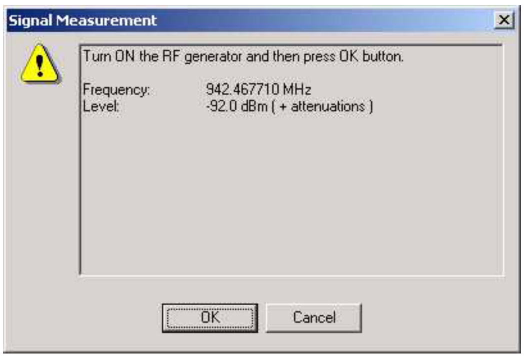
Select	Band	GSM 900 or GMS1800 or GSM1900
	Active unit	RX
	Operation mode	**Burst**
	RX/TX Channel	37 or 700 or 661
Select	Testing	alt-S
	SNR Measurement	N
	select Fast SNR	Radio Button

The setup should now look like this:



Choose respective band (EGSM900, GSM1800, GSM1900)

Press Start. A window pops up, e.g. for EGSM900 band:



Connect an external signal generator to the RF connector of the phone and set the generator as told in the window, taking care for external cable losses.

Press ok and the window closes.

Read the SNR result. SNR should be:	EGM900 >20dB
	GSM1800 >18dB
	GSM1900 >18dB

Measuring frontend power levels using Spectrum analyzer

Spectrum Analyzer (SA) level values depend on the probe type and should be validated using a good sample.
The levels that are given here are measured using a resistive probe (50Ohm semi-rigid cable).

Start Phoenix Service Software

Open the FBUS connection

Select	Scan Product	Ctrl-R

Wait until phone information shows in the lower right corner of the screen.

Set operating mode to local mode

Select	Testing	alt-S
	RF Controls	S

Wait until the RF Controls window pops up

Select	Band	GSM 900 or GMS1800 or GSM1900
	Active unit	RX
	Operation mode	**Continuous**
	RX/TX Channel	37 or 700 or 661

Please refer to the fault finding chart for proper levels at different test points.

Measuring analogue RX I/Q signal voltages using Oscilloscope

Measuring with an oscilloscope on “RXIINN” or “RXQINN” is recommended only if RSSI reading does not provide enough information. Use testpoints J606-J609. Input level = -80dBm

Start Phoenix Service Software

Select	Scan Product	Ctrl-R

Wait until phone information shows in the lower right corner of the screen.

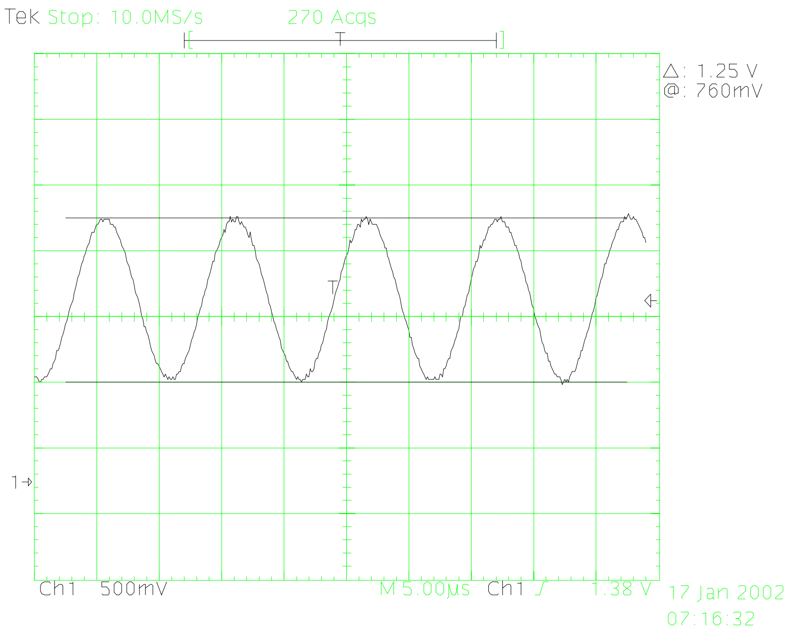
Set operating mode to local mode

Select	Testing	alt-S
	RF Controls	R

Wait until the RF Controls window pops up

Select	Band	GSM 900 or GMS1800 or GSM1900
	Active unit	RX
	Operation mode	**continuous**
	RX/TX Channel	37 or 700 or 661
	AGC	14

Following picture should be seen on a working EGSM receiver:



Signal amplitude	1.25V
DC offset	1,35V
Frequency	67kHz

Receiver fault finding

Set up Phoenix as if doing RSSI measurements.

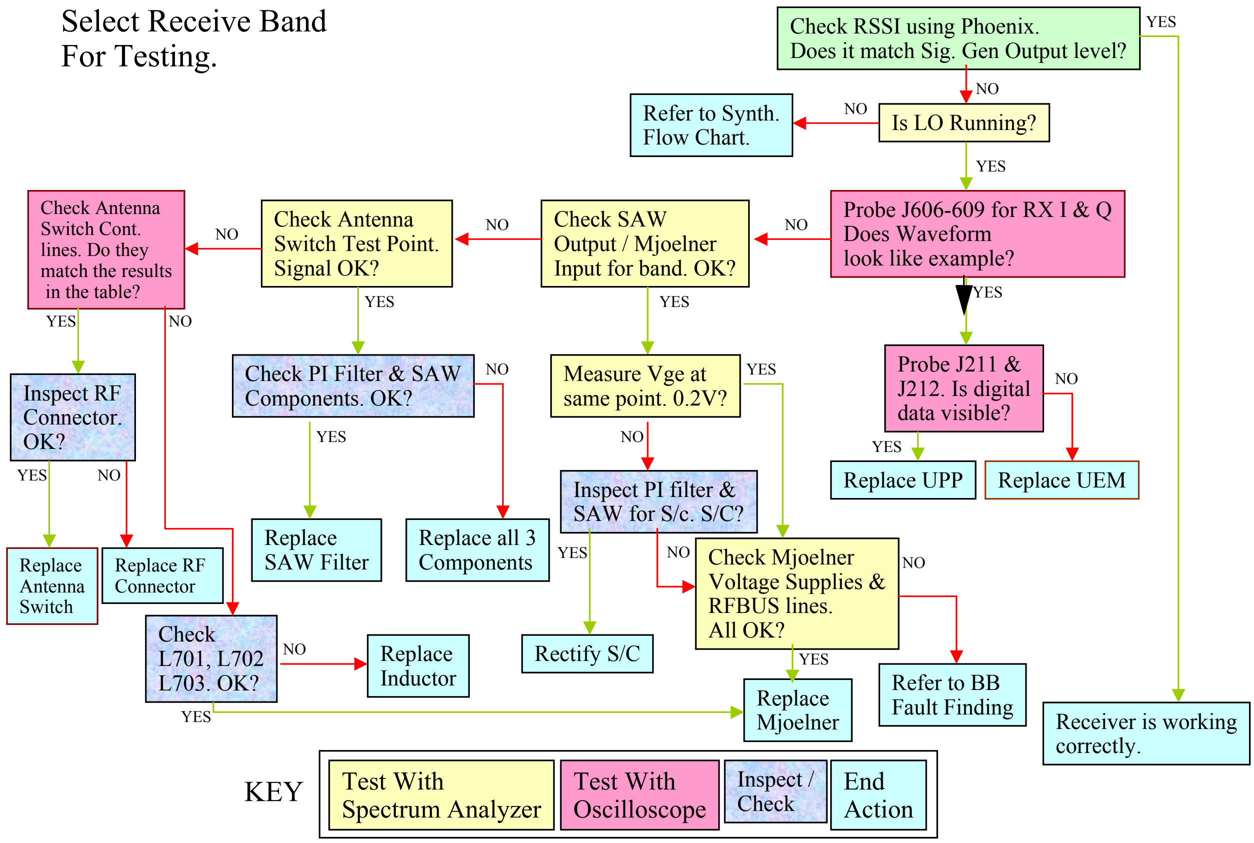
Ascertain which Rx band is faulty.

Refer to Rx fault finding flow chart.

Set signal generator frequency to 942.47MHz for EGSM, 1842.87MHz for DCS 1800 or 1960.07MHz for PCS 1900.

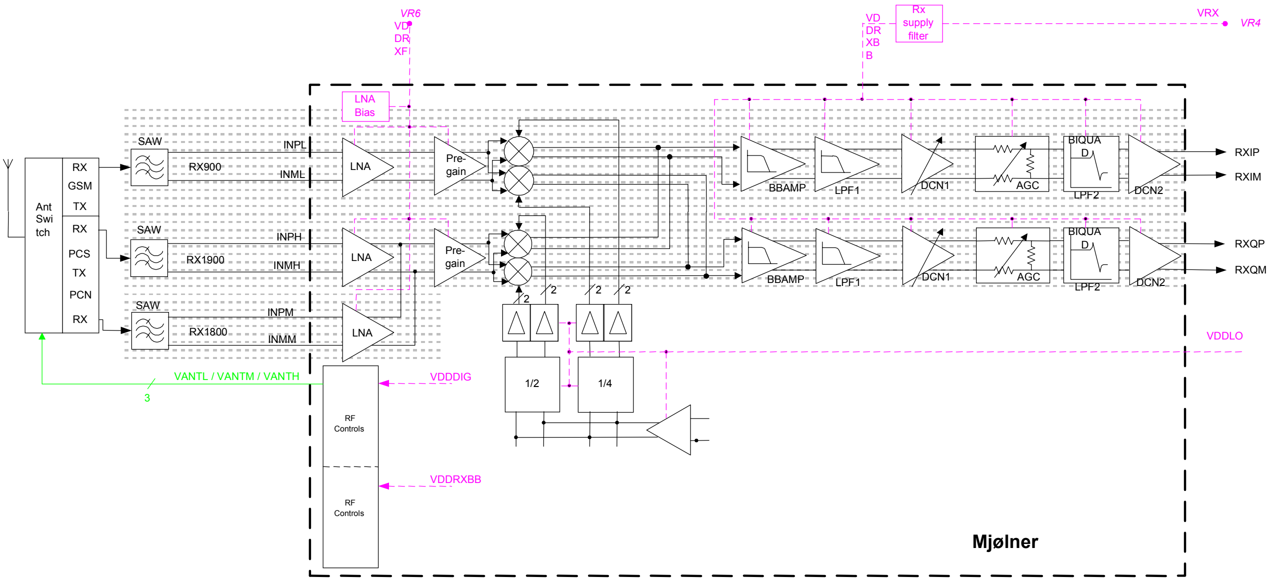
Set signal generator amplitude to -60dBm.

Note:That checking the RF inputs to SAW filters Z602, Z603 & Z604 will be extremely difficult with *the Mjoelner Can Shield in place. If this is impossible to get to, try checking the test points shown on the antenna switch Z601.*



Rx Signal paths

The signal paths of the receiver are shown in following block diagram. Note that the picture shows EGSM900 (EGSM) receiver (top), GSM1900 (PCS) receiver (middle) and GSM1800 (DCS/PCN) receiver (down).



Antenna switch (RX/TX Switch)

From the antenna-pad (X600) the RF signal is fed through the antenna connector (X602) to the RX/TX switch (Z601). The antenna connector represents a mechanical switch between internal antenna and external antenna feed.

The RX/TX switch (Z601) works as diplexer. EGSM900 input signals pass to GSM_Rx output. GSM1800 input signals pass to PCN_Rx output or PCS_Rx output, depending on the control signal VANTH (Cont2).

From RX1-GSM output of the antenna switch the RX signal is routed in the inner layers of the PWB to the EGSM900 SAW filter (Z604). From RX2-DCS output the GSM1800 RX signal is routed to the GSM1800 SAW filter (Z602). From RX3-PCS output the RX GSM1900 signal is routed to the GSM1900 SAW filter (Z603).

The RX/TX switch with routed lines has following typical insertion losses:

1.3dB@EGSM900, 1.6dB@GSM1800 and 1.6dB@GFSM1900.

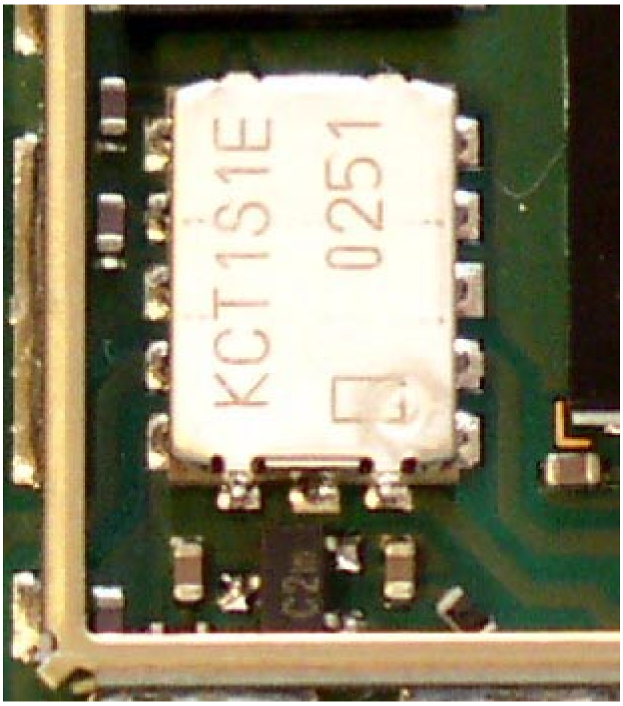


Figure 11: Antenna switch Rx test points

Front-end

The RX front end includes three SAW filters (EGSM900 (Z604), GSM1800 (Z602), GSM1900 (Z603)). Each of the SAW filters is matched with a differential matching circuit (LC-type) to the corresponding LNA input of Mjoelner RF ASIC (N601). The SAW filters provide out-of-band blocking immunity, the integrated LNAs provide the front-end gains. Each of the SAW filters has a single-ended input and a balanced output which provides a balanced RX signal to the corresponding input of the Mjoelner RF ASIC.

The SAW filters have maximum insertion losses of

3.5dB@EGSM900, 4.0dB@GSM1800 and 4.0dB@GSM1900.

RX paths of Mjoelner RF ASIC

The balanced RX signal is amplified by the integrated LNA and the subsequent Pre-Gain stage. After amplification the RX signal is down-converted with a LO signal coming from the local oscillator.

The RX paths of Mjoelner RF ASIC consist of following building blocks:

- Separate LNAs for each of the three bands: EGSM900, GSM1800 and GSM1900.
- Two PREGAIN amplifiers, one for EGSM900 and one common for GSM1800 and GSM1900.
- Two passive I/Q mixers (MIX), one for EGSM900 and one common for GSM1800 and GSM1900.

The resulting BB signal is further amplified in the BB chain. For that no external circuitry is required:

- Base band amplifiers (BBAMP1). That amplifiers implement the initial channel filtering.
- Low pass filters (LPF1).
- DC compensation / AGC amplifiers (DCN1). They implement gain steps from 0dB to 24dB in 6dB steps.
- Attenuators (AGC). They implement gain steps from -48dB to 0dB in 6dB steps, yielding a total gain range of 72dB together with DCN1.
- Bi-quad filters (LPF2).
- DC compensation amplifiers (DCN2).

The differential base band outputs are internally DC coupled and can be connected directly to the ADC inputs of the RF converter chip. The common mode level is set equal to the VBEXT reference voltage.

Transmitter

General instructions for EGSM TX Troubleshooting

Apply a RF-cable to the RF-connector to allow the transmitted signal to act as normal. RF-cable should be connected to measurement equipment (GSM Test equipment, Power-meter, Spectrum Analyzer, or similar). Be sure to use at least a 10-dB attenuator, otherwise the results may be incorrect.

Connect the phone to a PC with DAU-9S cable and dongle and follow the following instructions:

Set the mode switch to 'Local' and connect the phone to a power supply (3.6V). When using an MJS-80 module jig, a 4.2V supply is needed.

Open Phoenix and log in with your user ID.

Select File [Alt-F] -> Manage Connections [M] -> FBUS -> Apply -> Close window.

Select File -> Scan Product [Ctrl-R].

When the product has been found, the phone SW version can be read from the lower edge of the Phoenix screen.

If the Operation is not shown, click Read button to see that Local mode has been selected. Select Testing [Alt-S] -> RF controls [R].

Before choosing the band and Tx as Active Unit, and if the spectrum analyser is used, make sure that the spectrum analyser reference level is higher than the expected TX power.

Use the automatically selected channel.

Set Operation Mode to 'Burst'.

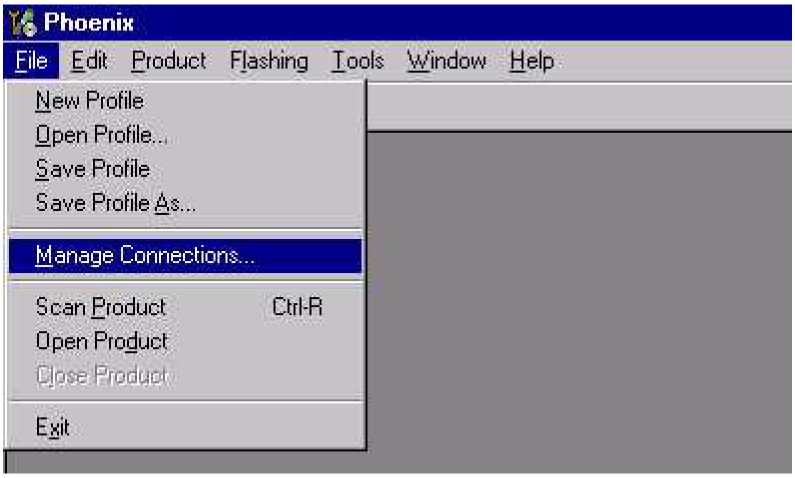
Choose the Power level you want the phone to operate at.

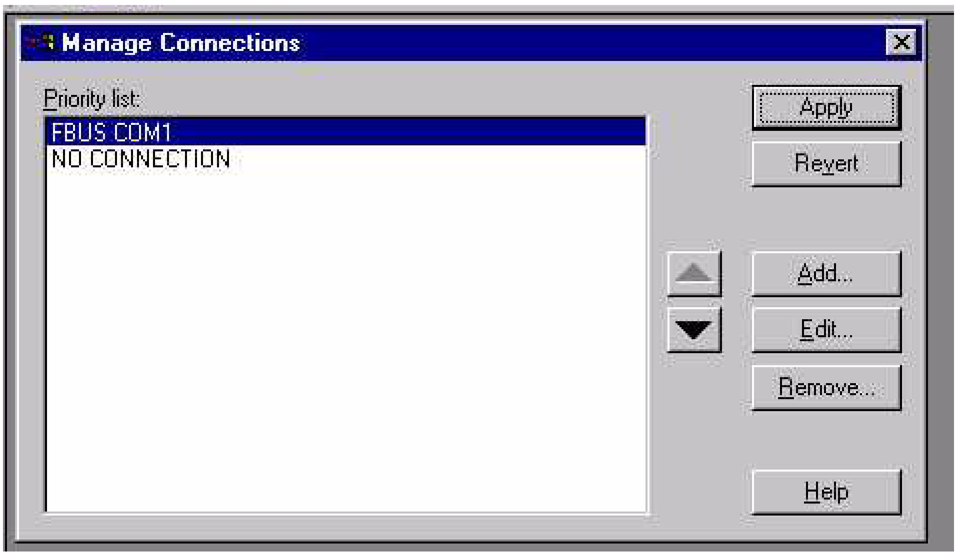
Set spectrum analyzer centre frequency, 897.4MHz for EGSM, 1747.8MHz for PCN 1800 & 1880MHz PCS 1900 and set Span to 1MHz.

Set Amplitude of spectrum analyzer reference level to one that you can clearly see the transmit pulse according to the kind of test probe you are using.

Diagnose as per fault finding flow chart.

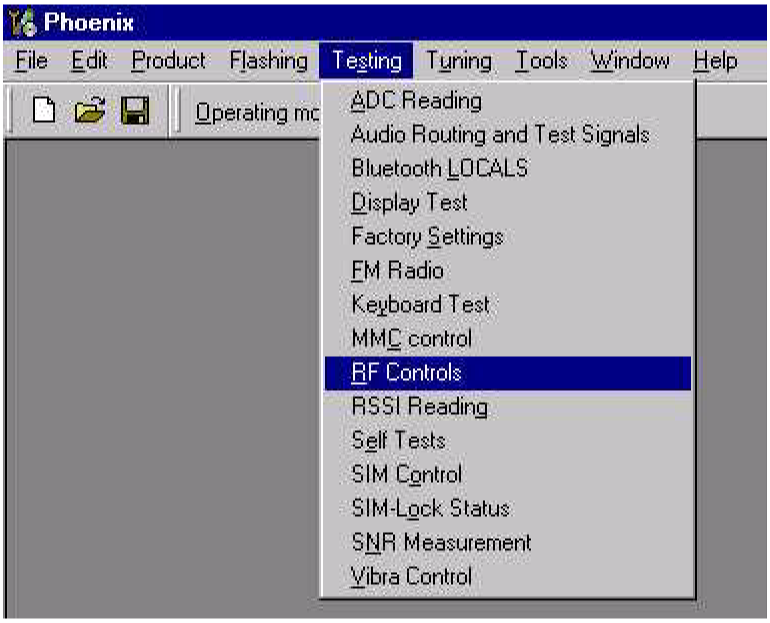
Note:Be careful when selecting the operation mode, if 'Continuous' is selected prolonged transmission may damage the phone.

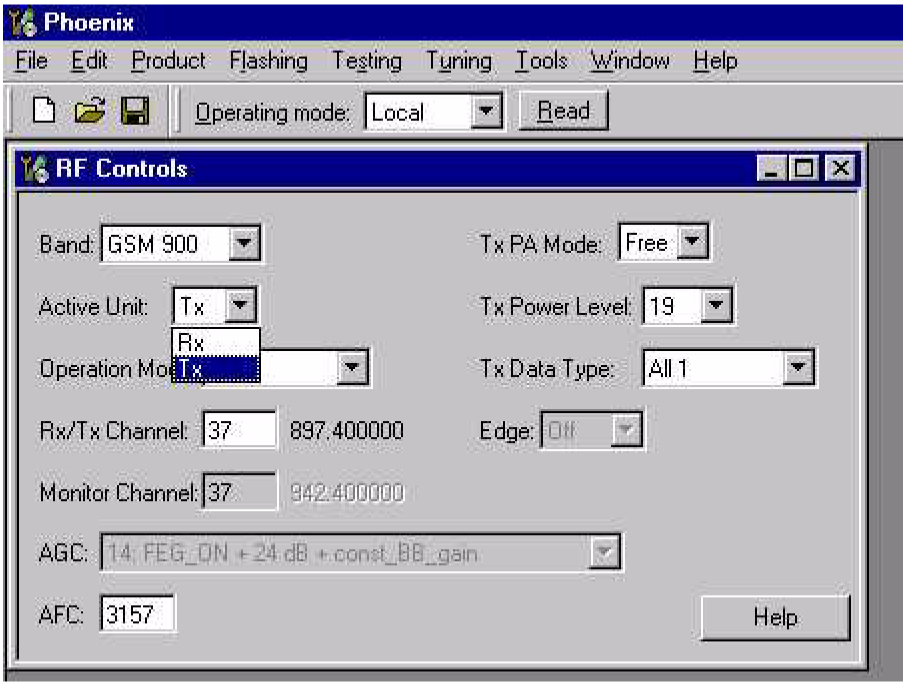


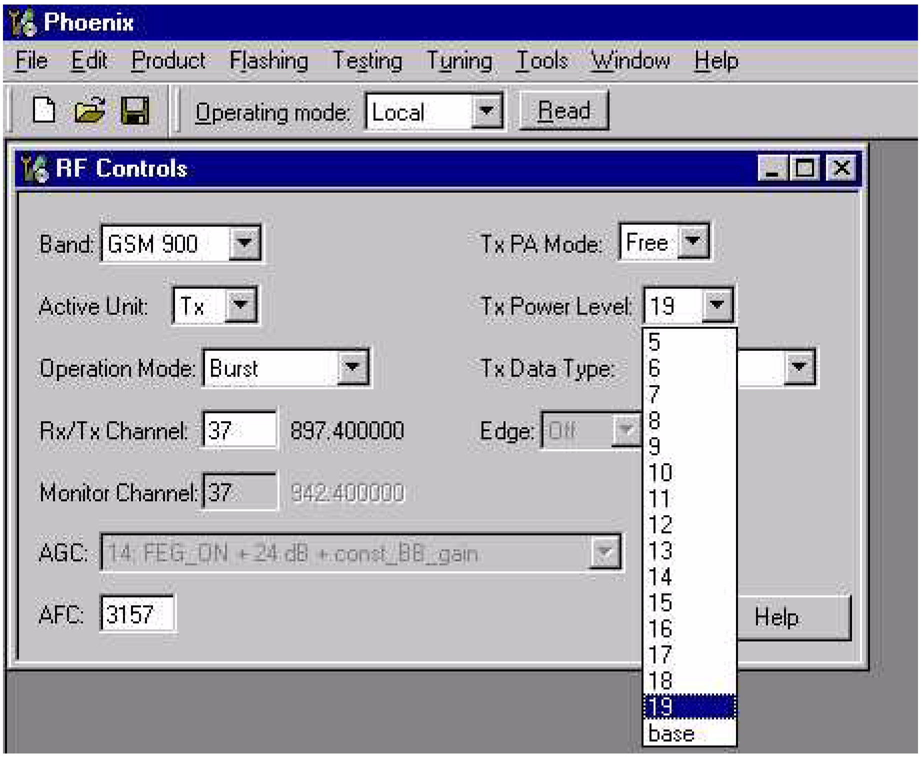



Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
New Profile
Open Profile...
Save Profile
Save Profile As...
Manage Connections...
Scan Product Ctrl-R
Open Product
Close Product
Exit
Read
Scan the connected product
V 2.22 , 28-04-03 , NEM-4 , (c) NMP.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mc
ADC Reading
Audio Routing and Test Signals
Bluetooth LOCALS
Display Test
Factory Settings
FM Radio
Keyboard Test
MMC control
RF Controls
RSSI Reading
Self Tests
SIM Control
SIM-Lock Status
SNR Measurement
Vibra Control


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
RF Controls
Band: GSM 900
Tx PA Mode: Free
Active Unit: Tx
Rx
Tx
Tx Power Level: 19
Operation Mo
Tx Data Type: All 1
Rx/Tx Channel: 37 897.400000
Edge: Off
Monitor Channel: 37 942.400000
AGC: 14: FEG_ON + 24 dB + const_BB_gain
AFC: 3157
Help


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
RF Controls
Band: GSM 900
Tx PA Mode: Free
Active Unit: Tx
Tx Power Level: 19
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
base
Operation Mode: Burst
Tx Data Type:
Rx/Tx Channel: 37 897.400000
Edge: Off
Monitor Channel: 37 942.400000
AGC: 14: FEG_ON + 24 dB + const_BB_gain
AFC: 3157
Help

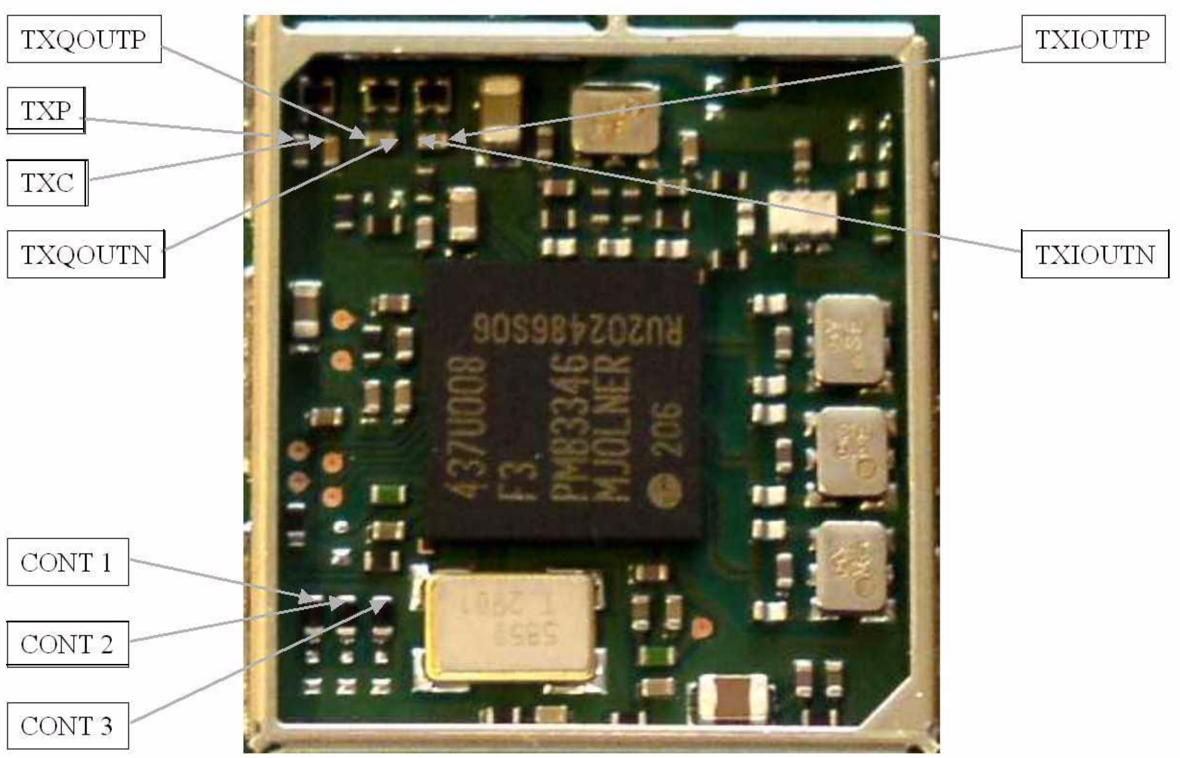
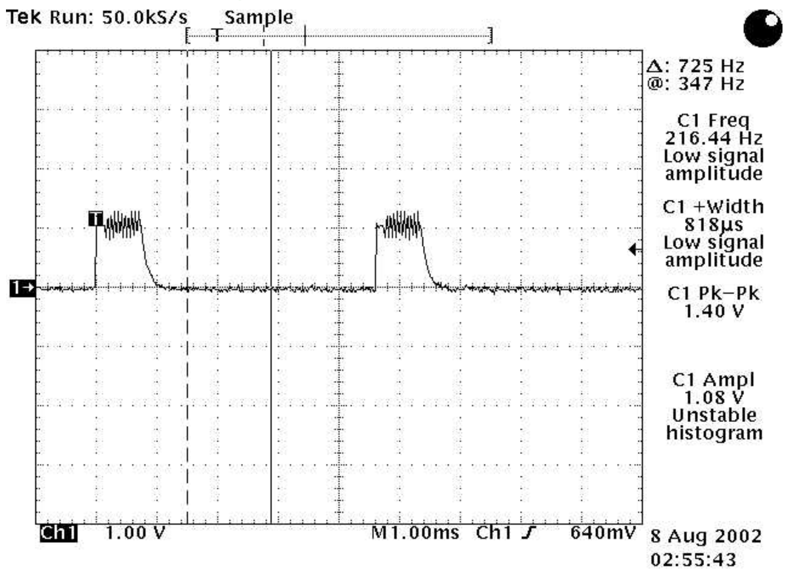
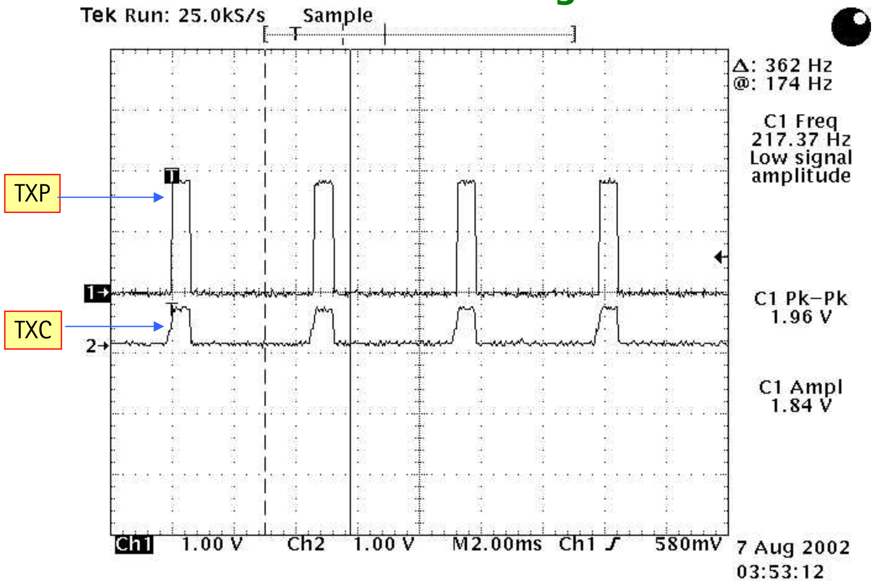


Figure 12: Mjoelner Can Tx Test Points

TX Analog I & Q Data, C715 & C716



TXP & TXC Lines during Transmission



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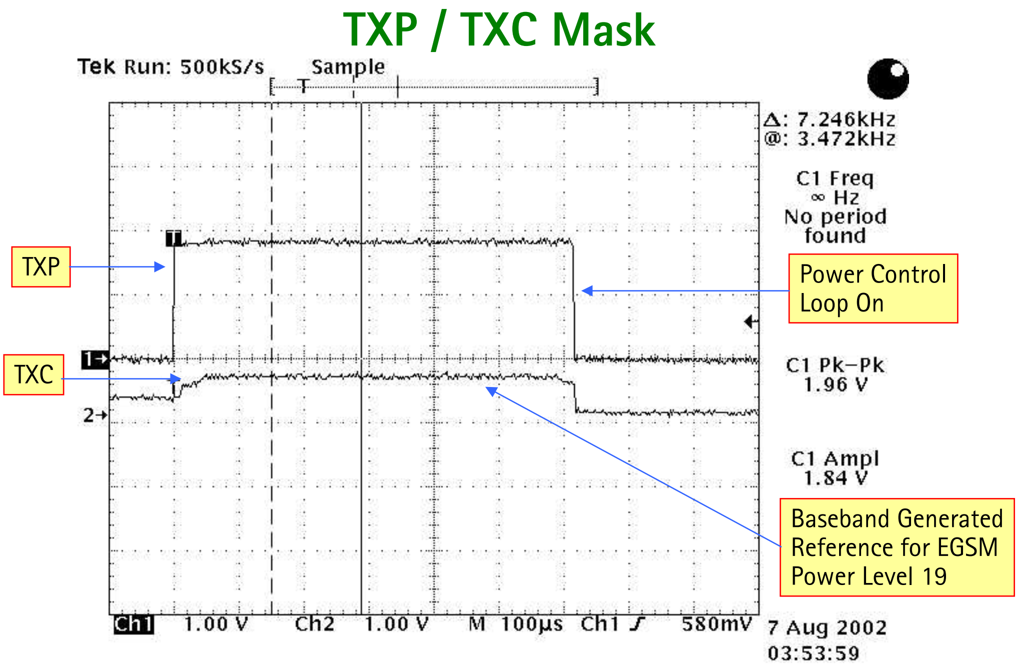


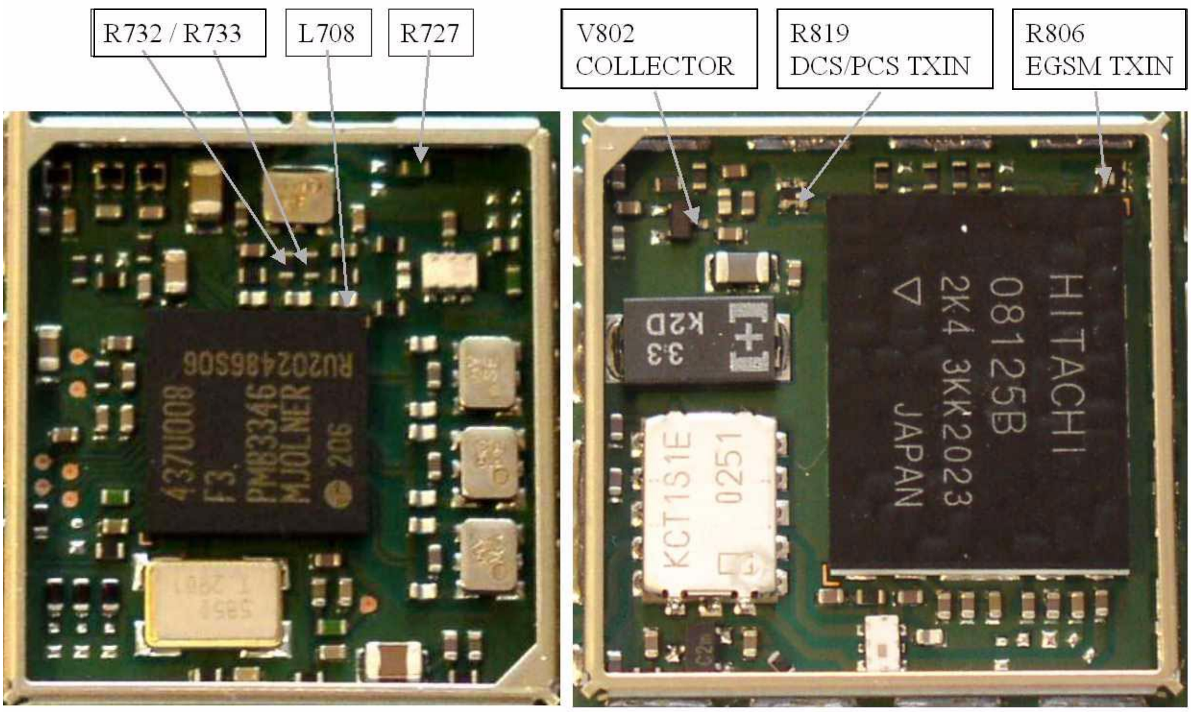
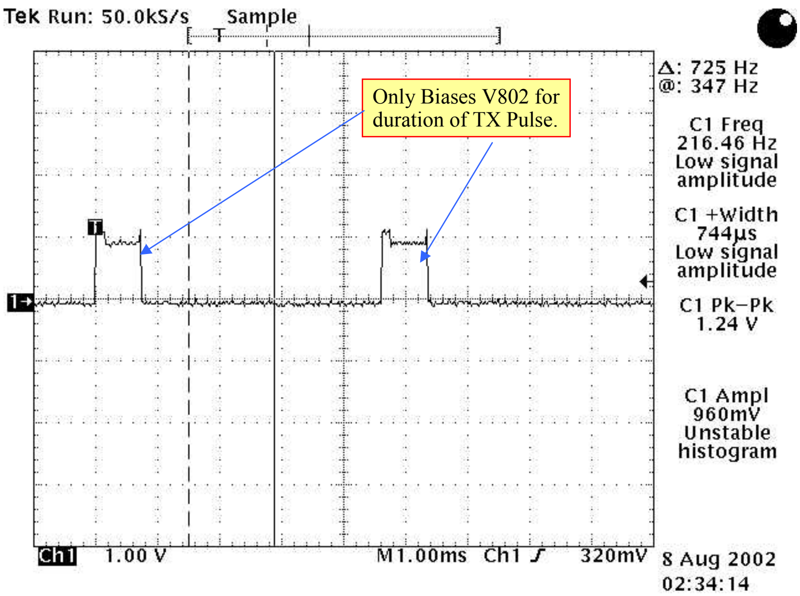
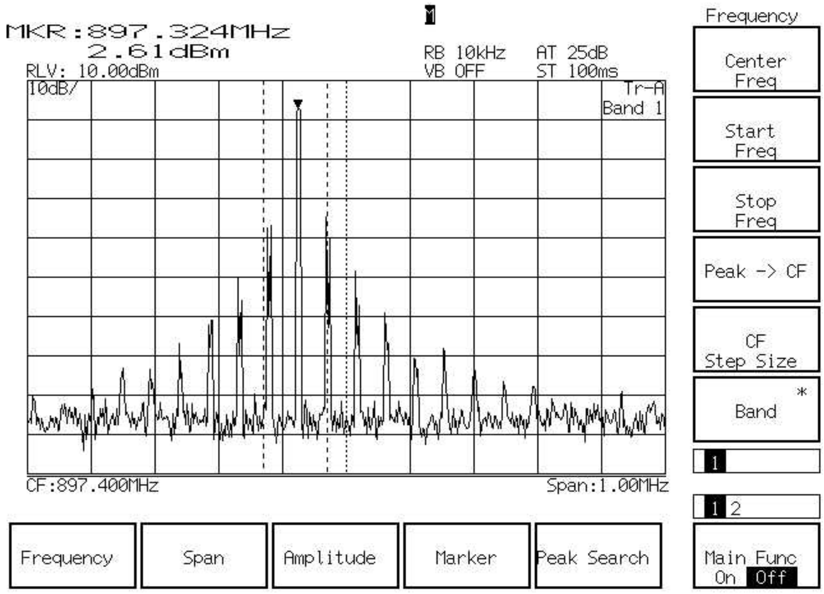


Figure 1: EGSM TX Can Test Points

VTXB_900 (EGSM V802 Pre-Amp Biasing Waveform)

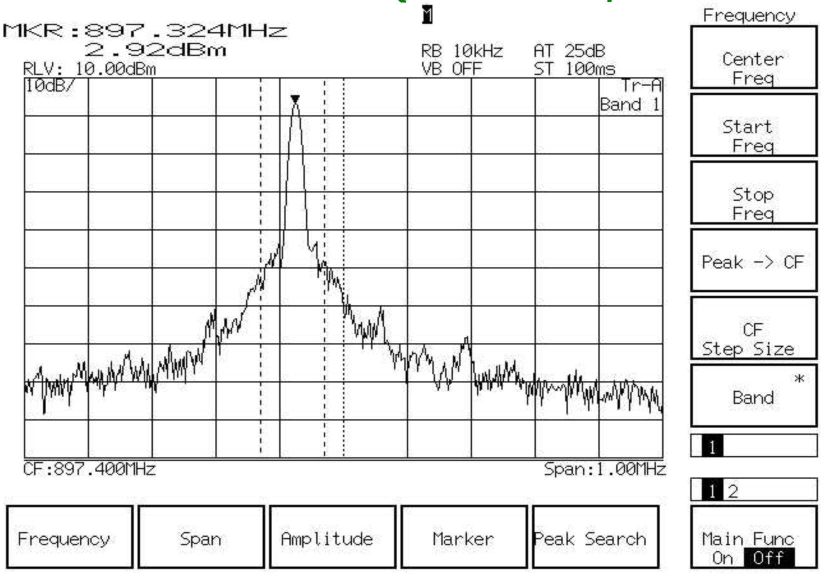


EGSM Transmit Waveform (Burst, Power Level 19)



Phone drew 140mA during Burst operation

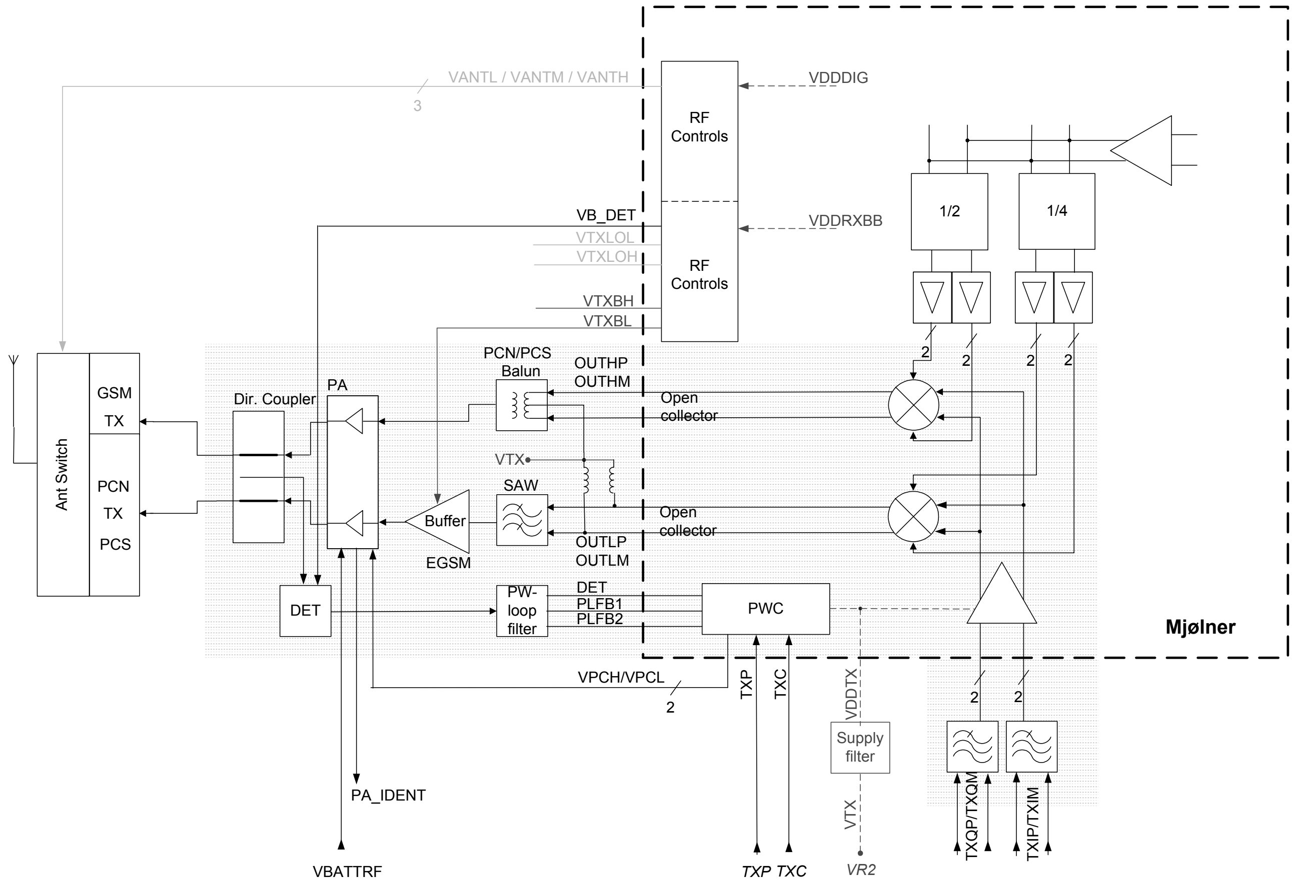
EGSM Transmit Waveform (Continuous, Power Level 19)



Was drawing over 600mA during continuous operation

TX Path of the transmitted EGSM900 signal

For easy error tracing it is important to know the signal path of the EGSM900 transmitter. The components can be grouped into blocks and drawn as shown below. Note that the following picture shows both EGSM900 transmitter (bottom) and GSM1800/GSM1900 transmitter (top).



EGSM900 TX path of Mjoelner RF ASIC

The balanced TX IQ signal is provided by the base band and is coming to the Mjoelner RF ASIC. The TX paths of the Mjoelner RF ASIC include mainly two RF modulators for up-conversion of the base band signals, one for EGSM900 and one common for GSM1800/ GSM1900. The base band signal is modulated with the LO signal corresponding to the wanted TX channel. The GSM TX output of the Mjoelner RF ASIC is a balanced signal.

From the output of the Mjoelner RFASIC the signal is fed through the EGSM TX SAW filter (balanced to single-ended), a 900MHz buffer, and a 5-db pad to the PA EGSM input.

EGSM900 TX path of the Power Amplifier (PA)

The PA EGSM900 part has a maximum output power of app. 35dBm. Voltage supply is coming directly from the Battery connectors.

The EGSM900 output is controlled by the power control loop. From the EGSM900 output of the PA the RF signal is fed through the directional coupler (one of the power control loop components) to the antenna switch.

Antenna Switch (TX/RX switch)

The antenna Switch works as a diplexer for the RX and TX signals. Moreover, it suppresses the TX harmonics generated by the PA. The antenna switch is controlled by the Mjoelner RF ASIC using the control signals CONT1, CONT2 and CONT3. The following table shows the possible different states.

CONT1 [Volt]	CONT2 [Volt]	CONT3 [Volt]	EGSM Rx	DCS Rx	PCS Rx	EGSM Tx	DCS/PCS Tx
0	0	0	X				
0	0	0		X			
0	0	2.7				X	
0	2.7	0			X		
2.7	0	0					X

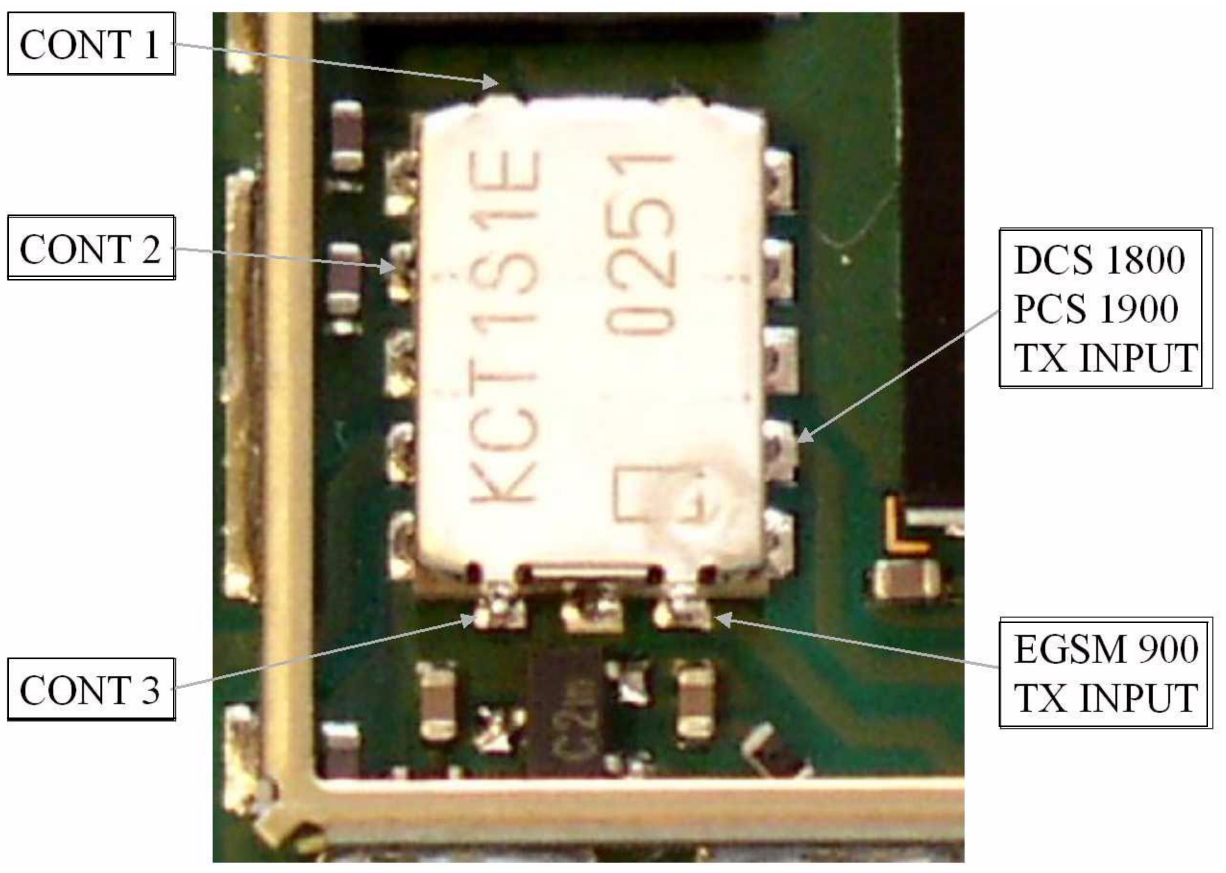
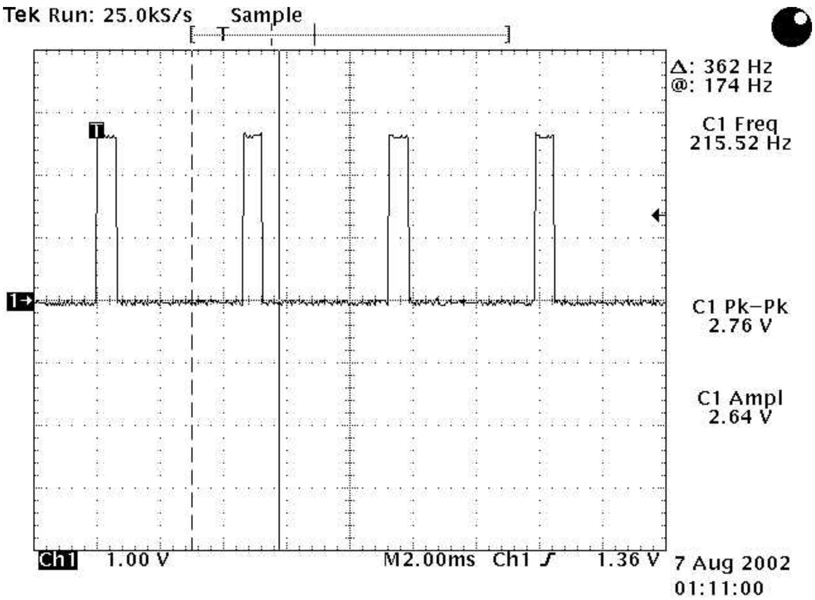
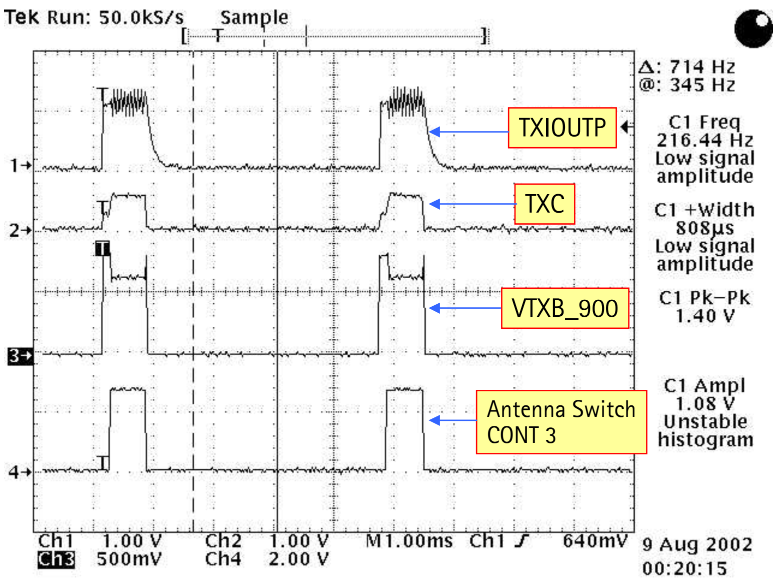


Figure 2: Antenna Switch Test Points

Antenna Switch Control Line (CONT3) During EGSM Transmission



Transmit Timing

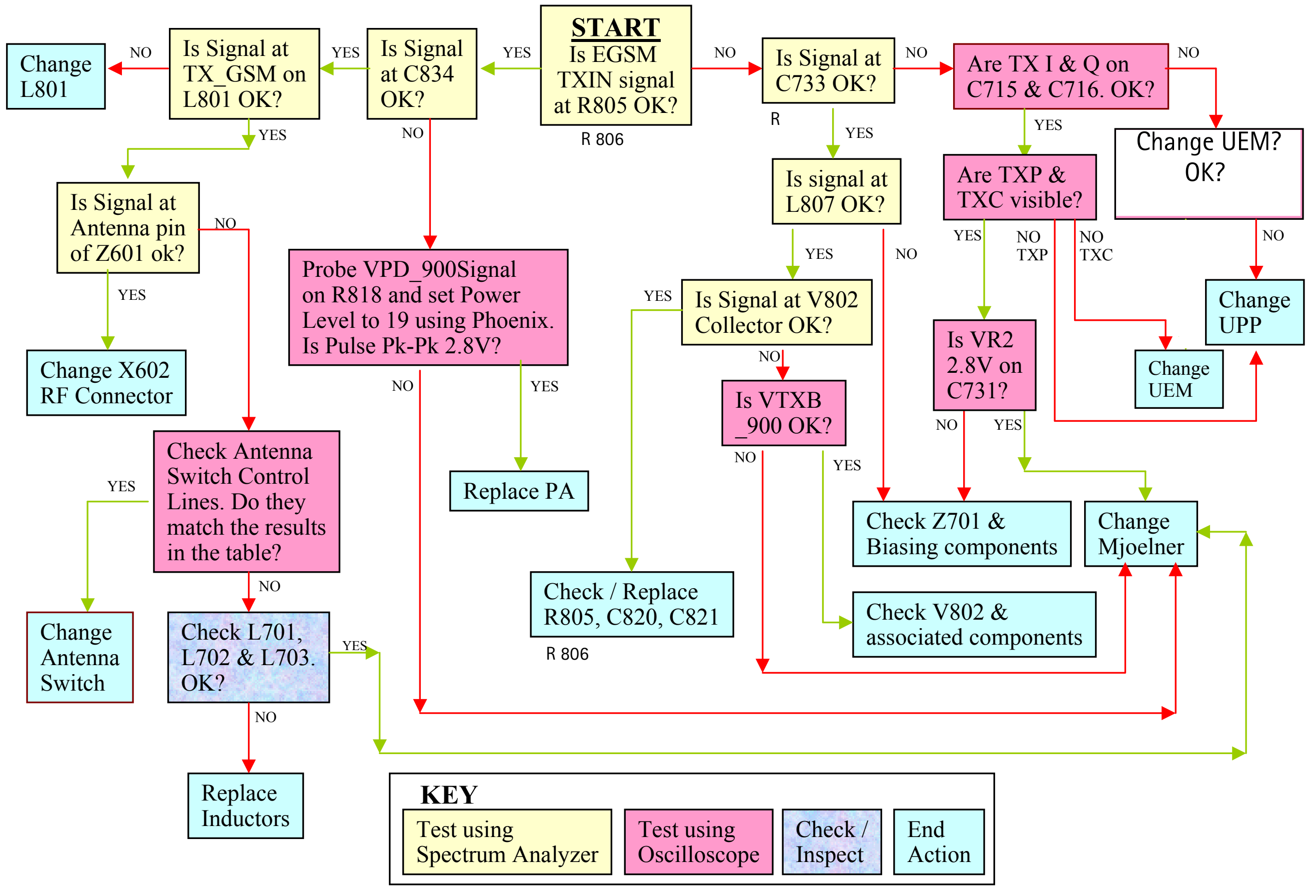


EGSM Tx fault finding flow chart

The first flow diagram assumes the following:

- Phoenix has been set up as shown on page 24 (the Tx power level may be increased using Phoenix if it makes the Tx pulse easier to see).
- Relevant components have been visually inspected for orientation, placement, etc.
- The transmit signal has been checked with a spectrum analyzer at RF connector, X602 and was found to be too low or non-existent.
- The VCO is running correctly.

- The power amplifier is getting a correct VBATRF supply via L805 & L809.
- Mjoelner's supply voltages VR1A, VR2, VR3, VR4, VR5 & VR7 are all working correctly.



General instructions for GSM1800/1900 TX Troubleshooting

Apply an RF-cable to the RF-connector to allow the transmitted signal to act as normal. RF-cable should be connected to measurement equipment (GSM Test equipment, Powermeter, Spectrum Analyzer, or similar).

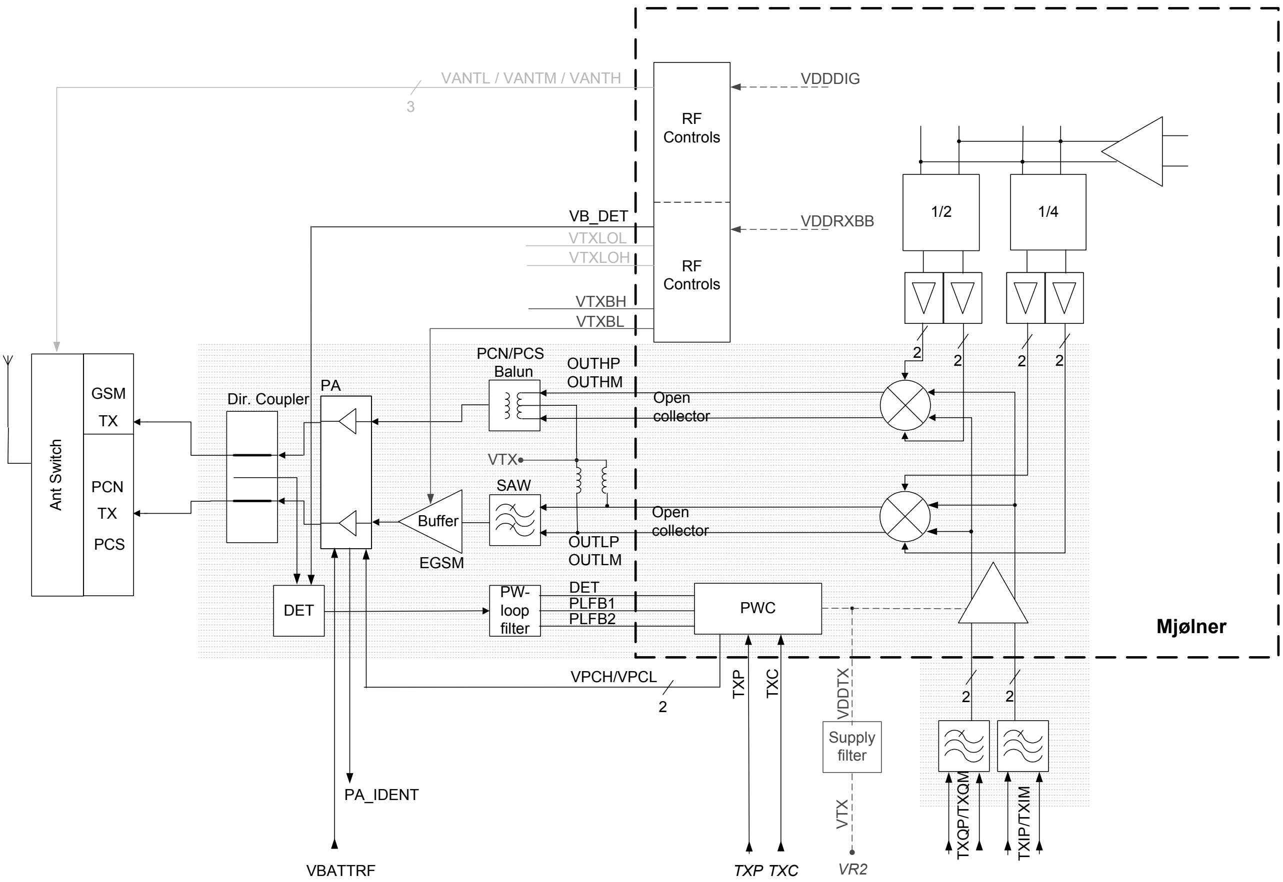
DCS 1800/PCS 1900 Tx fault finding flow chart

The following diagram assumes the following:

- Phoenix has been set up as shown previously (selecting DCS 1800 in the RF control box).
- Relevant components have been visually inspected for orientation, placement etc.
- The Transmit Signal has been checked with a Spectrum Analyzer at the RF connector, X602 and was found to be low or non-existent.
- The VCO is running correctly.
- The Power Amplifier is getting a correct VBATRF supply via L805 & L809.
- Mjoelner's supply voltages VR1A, VR2, VR3, VR4, VR5 & VR7 are all working correctly.

Path of the transmitted GSM1800/1900 signal

For easy error tracking it is important to know the signal path of the GSM1800/ GSM1900 transmitter. The components can be grouped into blocks and drawn as shown below. Note that the picture shows both EGSM transmitter (bottom) and GSM1800/ GSM1900 transmitter (top).



The path of Mjoelner RF ASIC

The balanced TX IQ signal from base band is coming to Mjoelner RF ASIC. The GSM1900 path includes an common RF modulator for GSM1800 and GSM1900. The BB signal is up-converted with the LO signal corresponding to the wanted TX channel. The GSM1800/ GSM1900 TX output of Mjoelner is a balanced signal.

From the output of Mjoelner the signal is fed through the Balun T701 (Balanced to single ended) and an 3 dB pad to the PA GSM1800/1900 input.

The path of the PA

The GSM1800/GSM1900 part of the PA has a maximum output of app. 33dBm. The supply is coming directly from the Battery connectors.

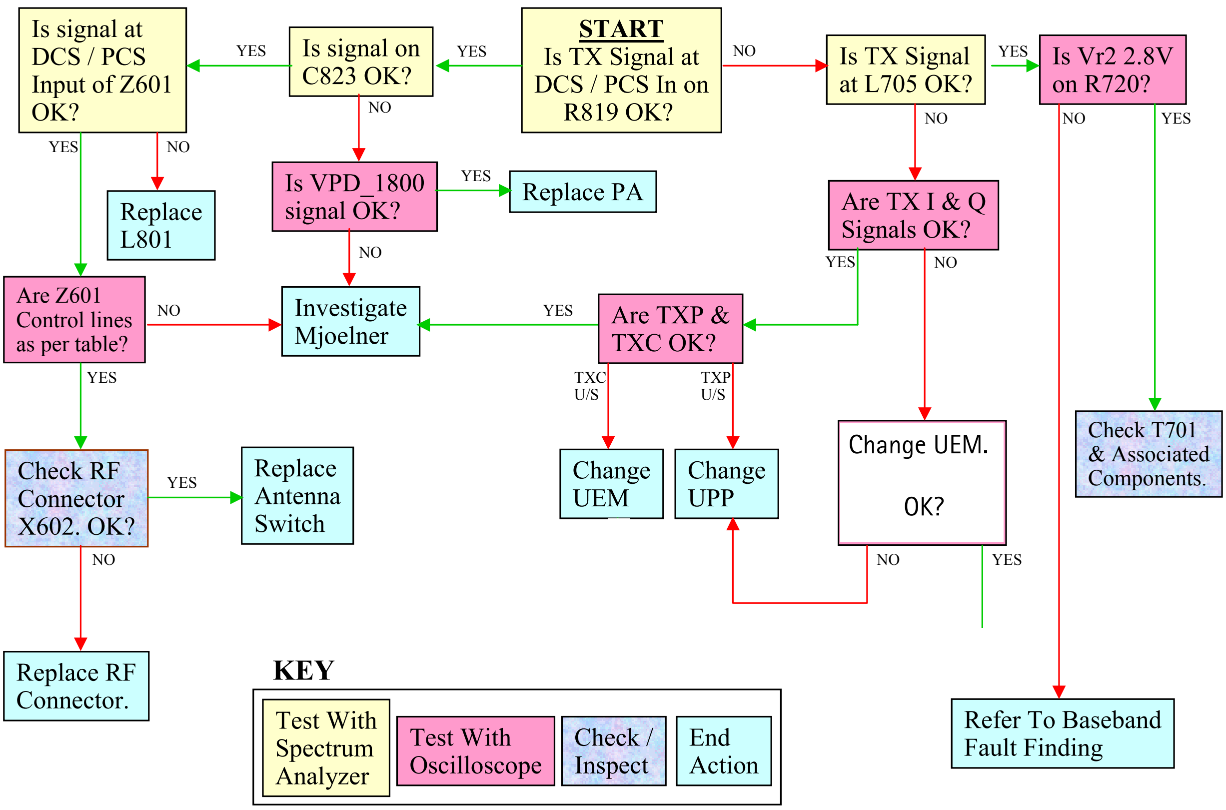
The output is controlled by the power control loop. From the output of the PA the signal goes through the directional coupler (one of the power control loop components) to the Antenna Switch.

Antenna Switch

The Antenna Switch works as a diplexer between RX and TX Bands. Moreover, it partly suppresses the harmonics generated by the PA. Mjoelner RF ASIC controls the antenna switch by three voltages CONT1, CONT2 and CONT3. The following table shows the different states.

CONT1 [Volt]	CONT2 [Volt]	CONT3 [Volt]	EGSM Rx	DCS Rx	PCS Rx	EGSM Tx	DCS/PCS Tx
0	0	0	X				
0	0	0		X			
0	0	2.7				X	
0	2.7	0			X		
2.7	0	0					X

Fault finding chart for GSM1800/GSM1900 transmitter

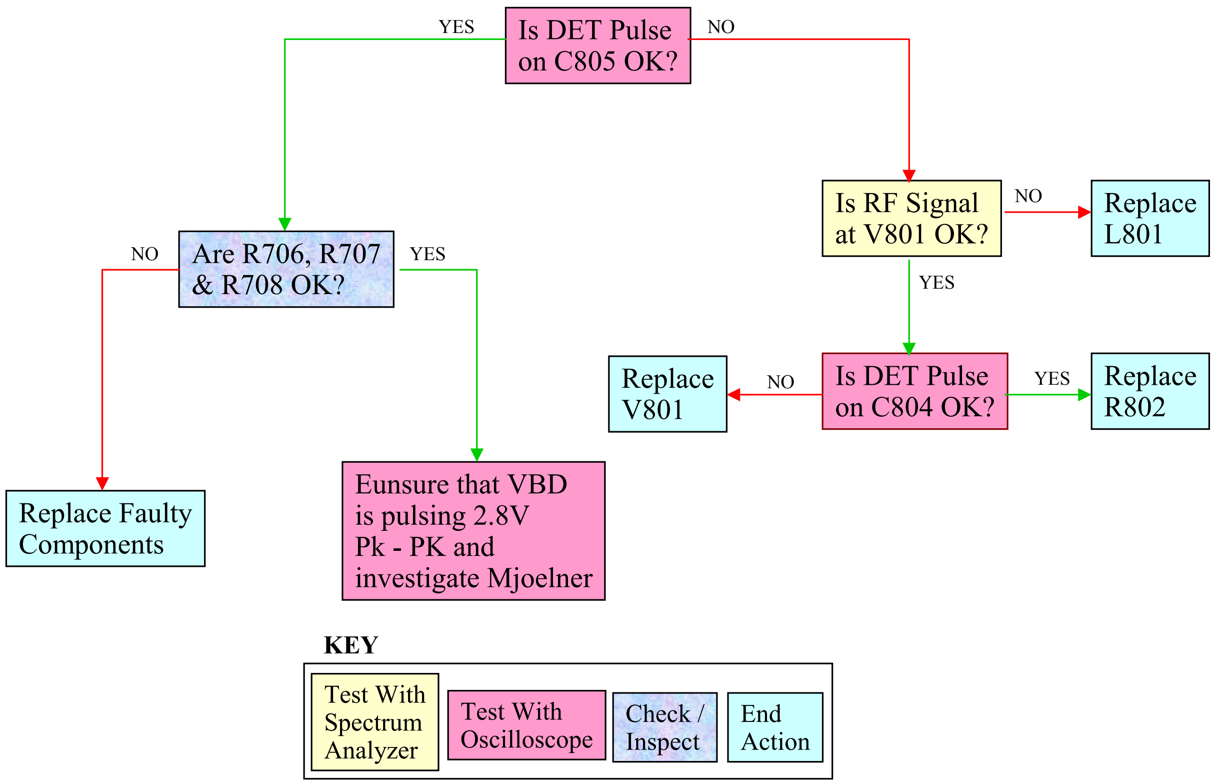


If the Tx output is too high, then it is most likely that there is a problem within the Power Control loop.

Mjoelner is receiving the Reference TXC from Baseband and not getting any feedback from DET to compare with TXC. The result is that Mjoelner drives VDP_900/VPD_1800 high to try and increase the power output so that the DET signal is matching TXC. With a break in the Power Control loop, the DET signal never reaches Mjoelner so it assumes that the PA is not outputting enough power so it tries to compensate by increasing the gain.

When checking the Power Control loop, make sure that (C803) is pulsing at 2.8V Peak to Peak. Check the DET pulse at Mjoelner input on R706.

This case is the same for EGSM, DCS1800 & DCS1900.



NEM-4 Synthesizer

There is only one PLL synthesizer generating frequencies for both Rx and Tx for all three bands (EGSM900, GSM1800 and GSM1900). VCO frequency is divided by 2 or by 4 in Mjoelner depending on which band is active.

General instructions for Synthesizer Troubleshooting

Connect the phone to a PC with DAU-9P cable and dongle and follow these instructions:

Start Phoenix Service Software (dongle needed):

Open FBUS connection

Select	Scan Product	Ctrl-R
or	File	Alt-F
	Scan Product	P

Wait until phone information shows in the lower right corner of the screen.

Set operating mode to local mode.

Start RF Control window:

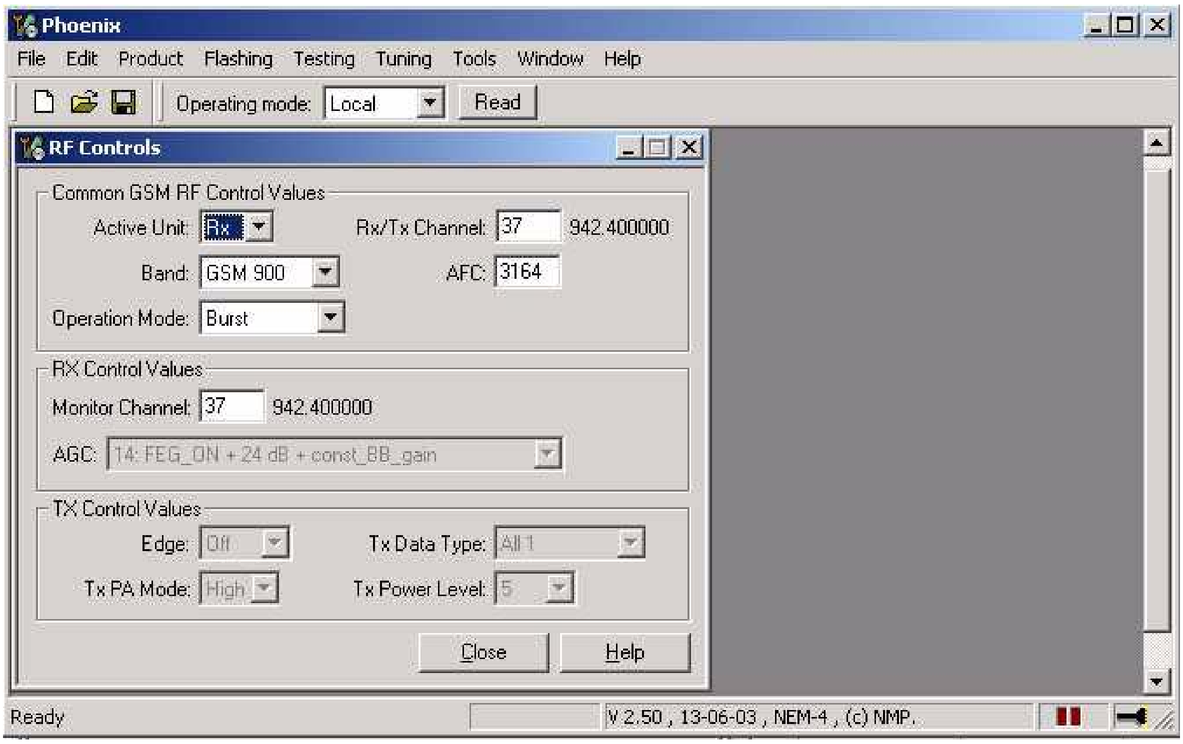
Select	Testing	Alt-S
	RF Controls	R

Wait until the RF Controls window pops up

Set the synthesizer to the following mode:

Select	Band	GSM 900
	Active unit	RX
	Operation mode	Continuous
	RX/TX Channel	37

The setup should now look like this:



Since VCO chamber is completely shielded, it is not easy to measure frequency of 3769.6MHz at the output of the VCO (G701) using a resistive probe and a spectrum analyzer. It is possible to measure tuning voltage at charge pump output (C710) easily. For f_{VCO} = 3769.6MHz the tuning voltage should be 2.3V_{DC} .. 2.8V_{DC} (Tuning sensitivity of VCO is 240MHz/V typ.).

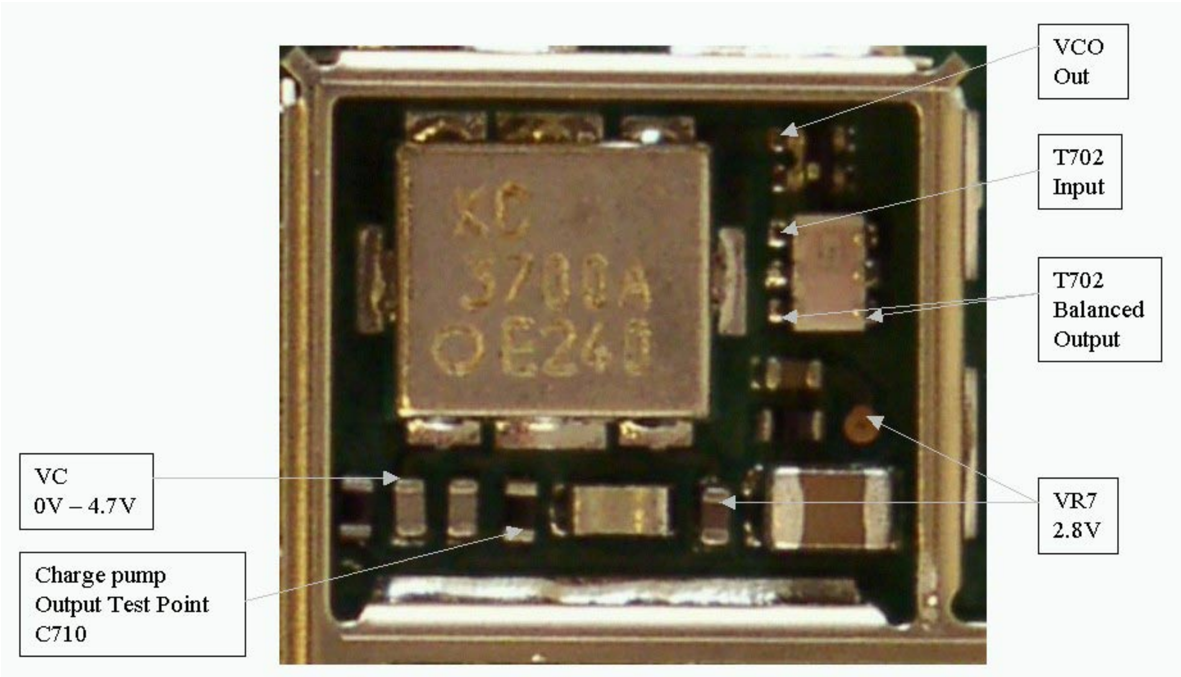


Figure 3: PLL Synthesizer Test Points

If this is not the case, then go to Fault finding chart in this document for Troubleshooting.

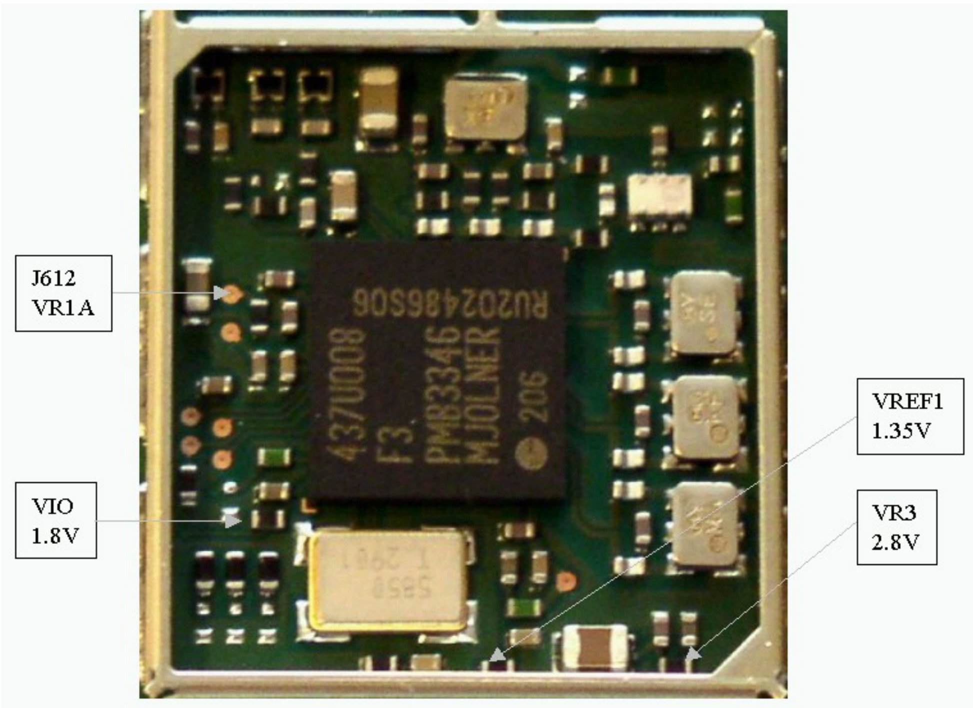


Figure 4: Mjoelner Can Test Points

26 MHz reference oscillator (VCXO)

The 26 MHz reference oscillator (VCXO) is part of Mjoelner RF-ASIC (N601). It needs only an external 26 MHz Xtal (B601) as external circuitry.

The reference oscillator has three functions:

- Reference frequency for the PLL synthesizer.
- System clock for BB (RFCLK_I = 26 MHz).
- 26 MHz Reference clock (LPRFCLK_I) for Bluetooth Module (N430) via buffer V601.

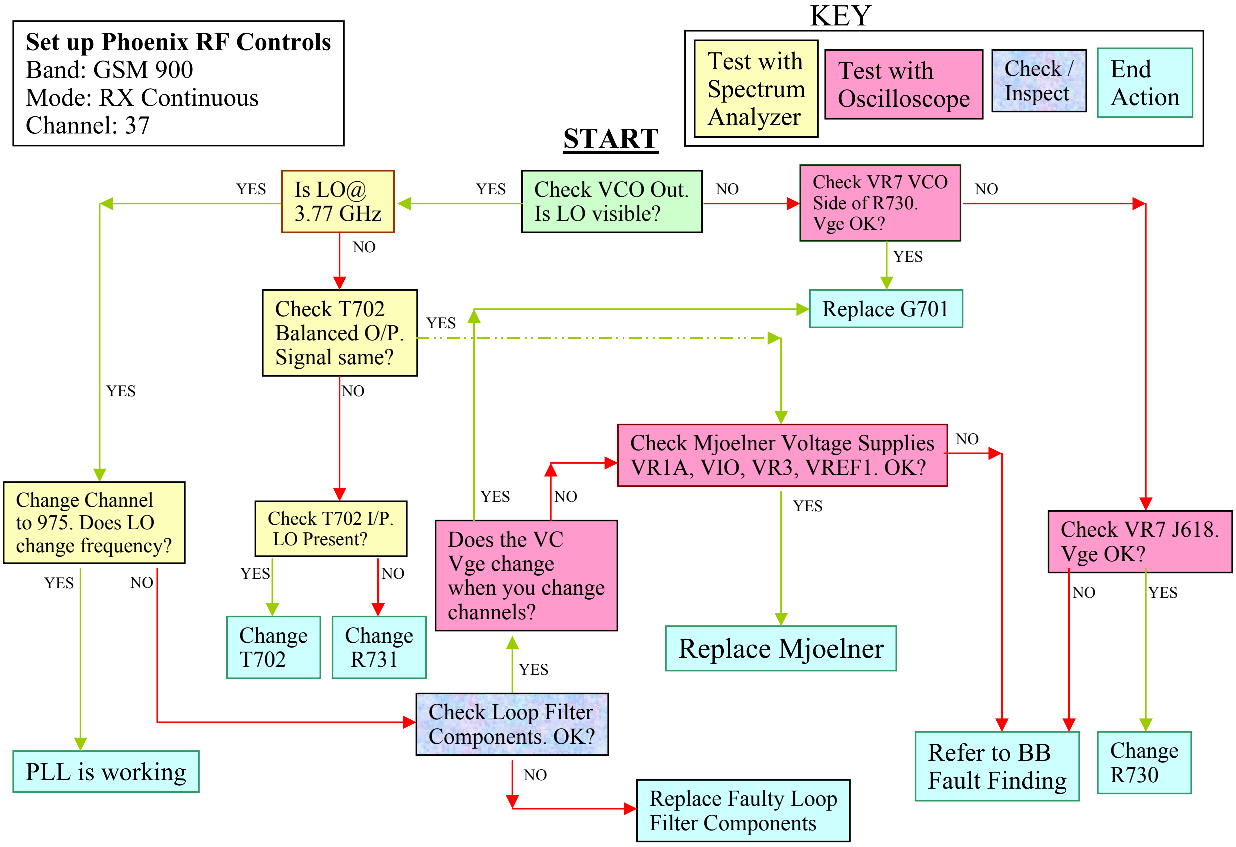
For an error free initial synchronization, the 26MHz frequency of the VCXO must be accurate enough. Therefore, a **VCXO-calibration (cal)** value is written via the serial Bus into the RefOSCCAL register of Mjoelner and an additional bit in the RefOSCCntl register of the Mjoelner. That is necessary for the rough calibration of the VCXO.

The VCXO is fine tuned by programming the AFC value via the serial bus of Mjoelner. The necessary AFC value is written into the RefOSCAFC register in Mjoelner.

VCO

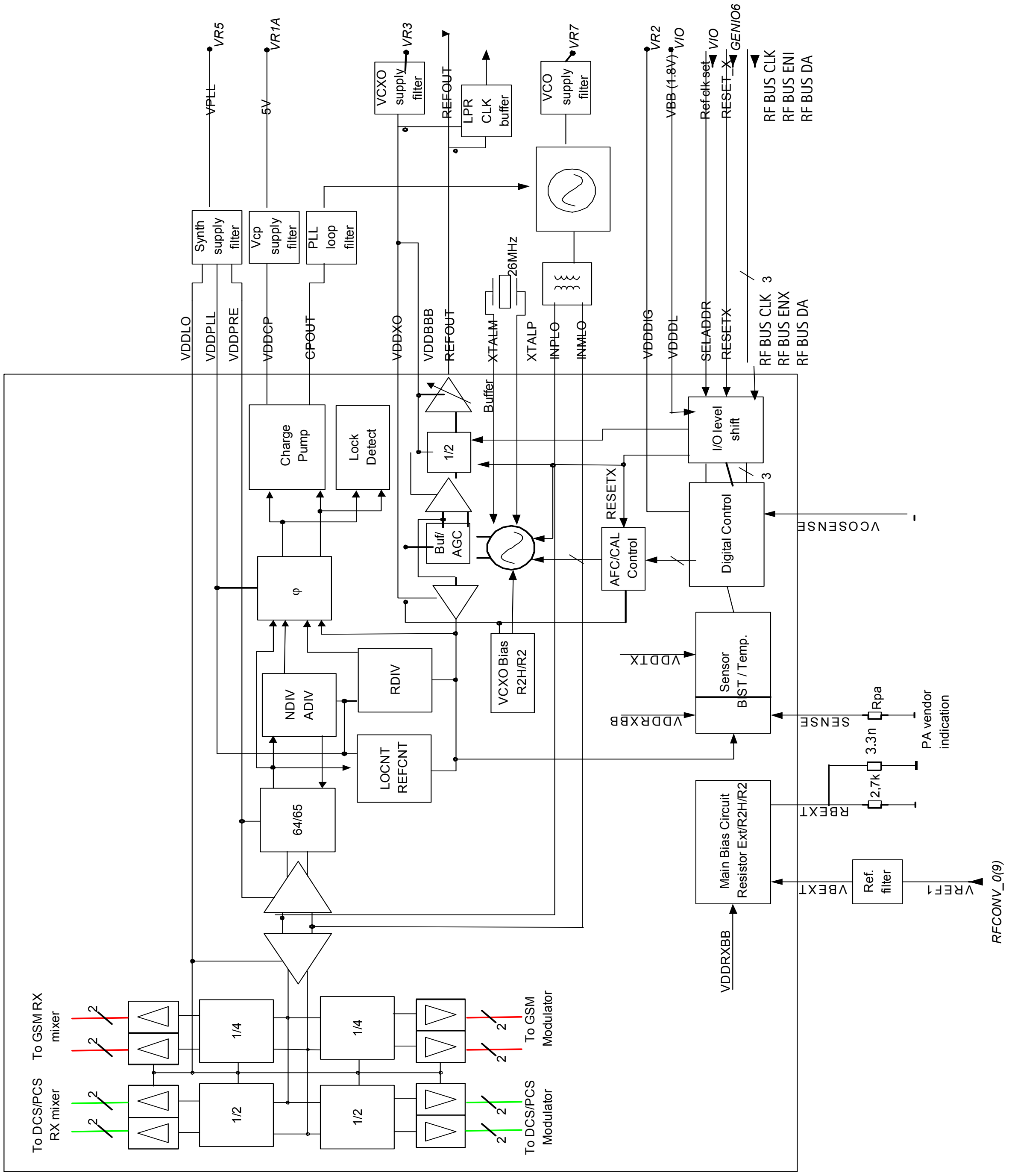
The VCO is able to generate frequencies in the range from 3420MHz to 3980MHz when PLL is in function. The frequency of the VCO signal is divided by 2 or by 4 in Mjoelner RF-ASIC. So it is possible to generate the frequency of all channels in EGSM900, GSM1800 and GSM1900 (both RX and TX). Frequency of the VCO is controlled by DC voltage (Vc) coming from the PLL loop filter. Range of Vc when PLL is in function is 0.7V– 3.8V. Typical tuning sensitivity of the VCO is 240MHz/V. Even if PLL is not working (Vc out of range) there is a frequency at the output of the VCO, which is between 3 and 4 GHz (if the VCO itself is ok).

Fault finding chart for PLL Synthesizer

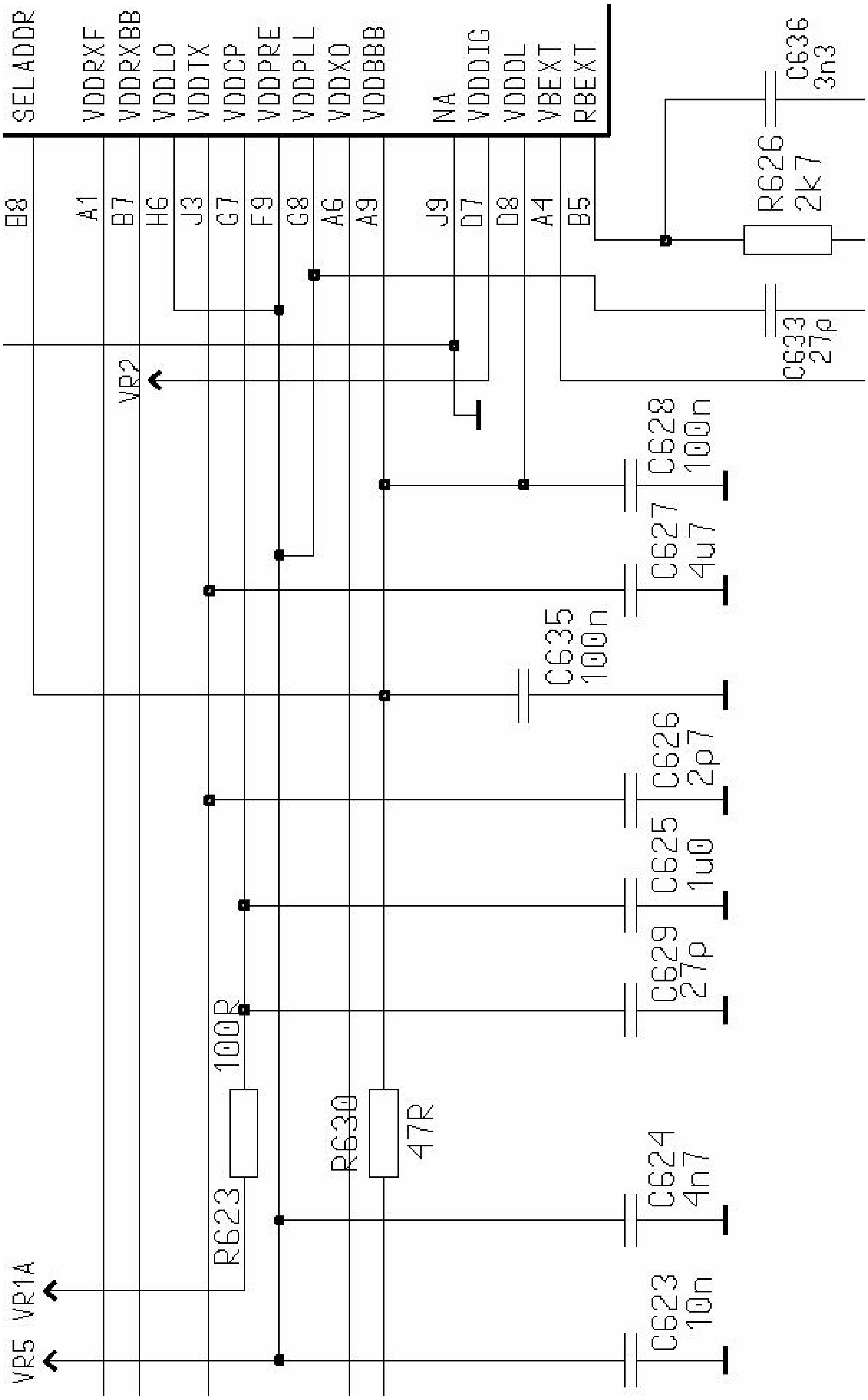


It is important to say that power supply for VCXO (VR3) is only switched 'OFF' in the so-called 'Deep Sleep Mode' and power supply for VCO (G701 VR7) is switched 'OFF' in so-called 'Sleep Mode'.

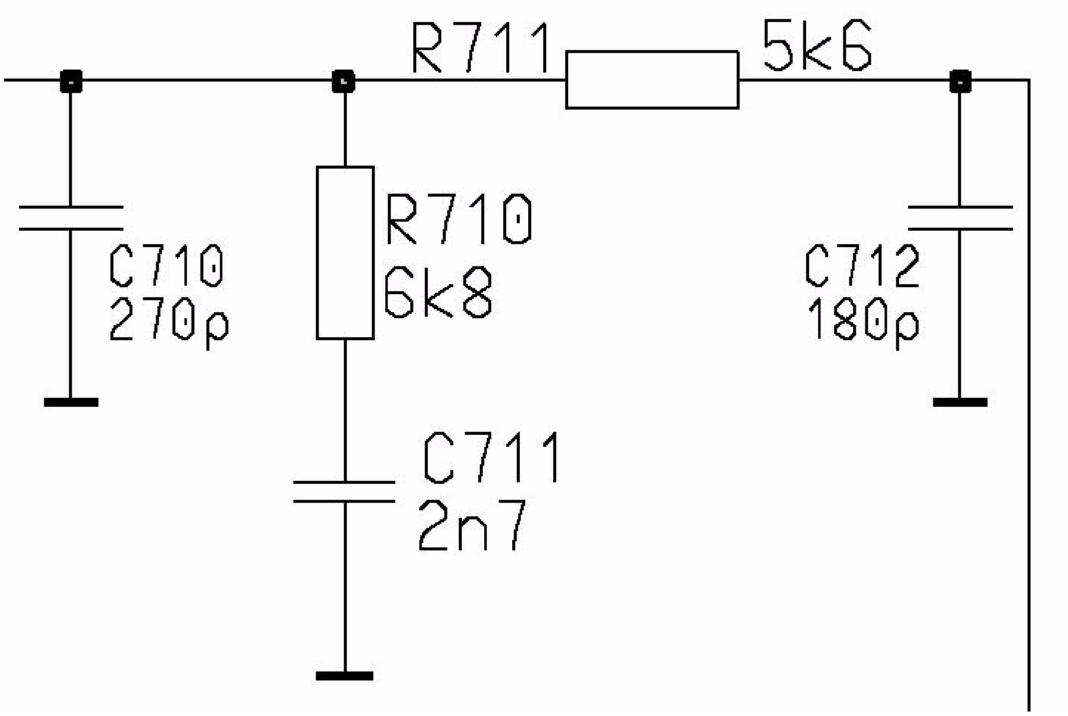
PLL Block diagram



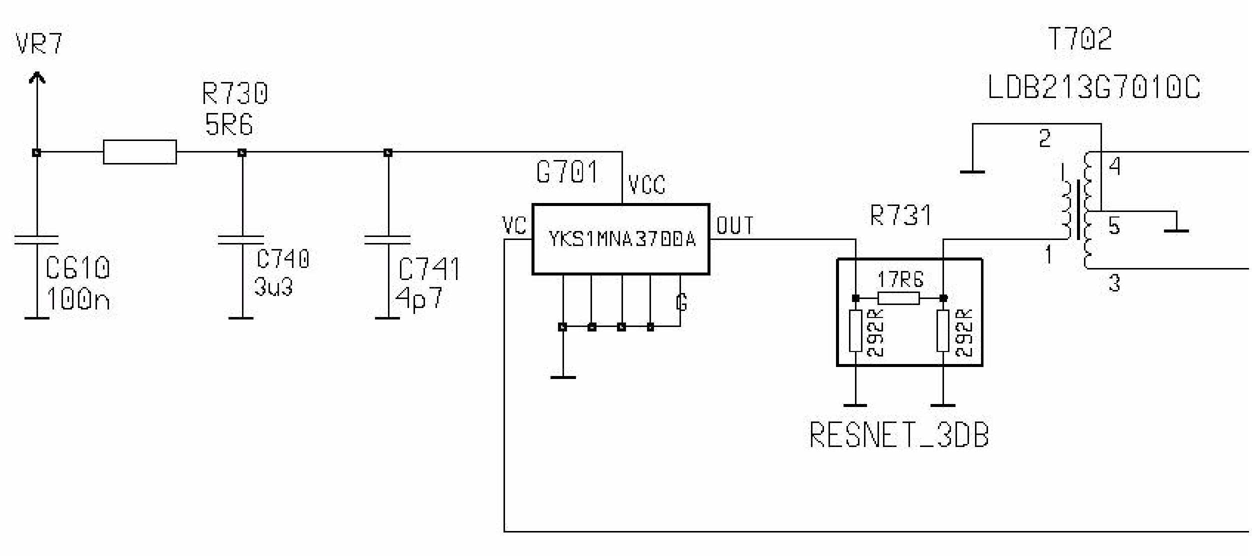
PLL power supply



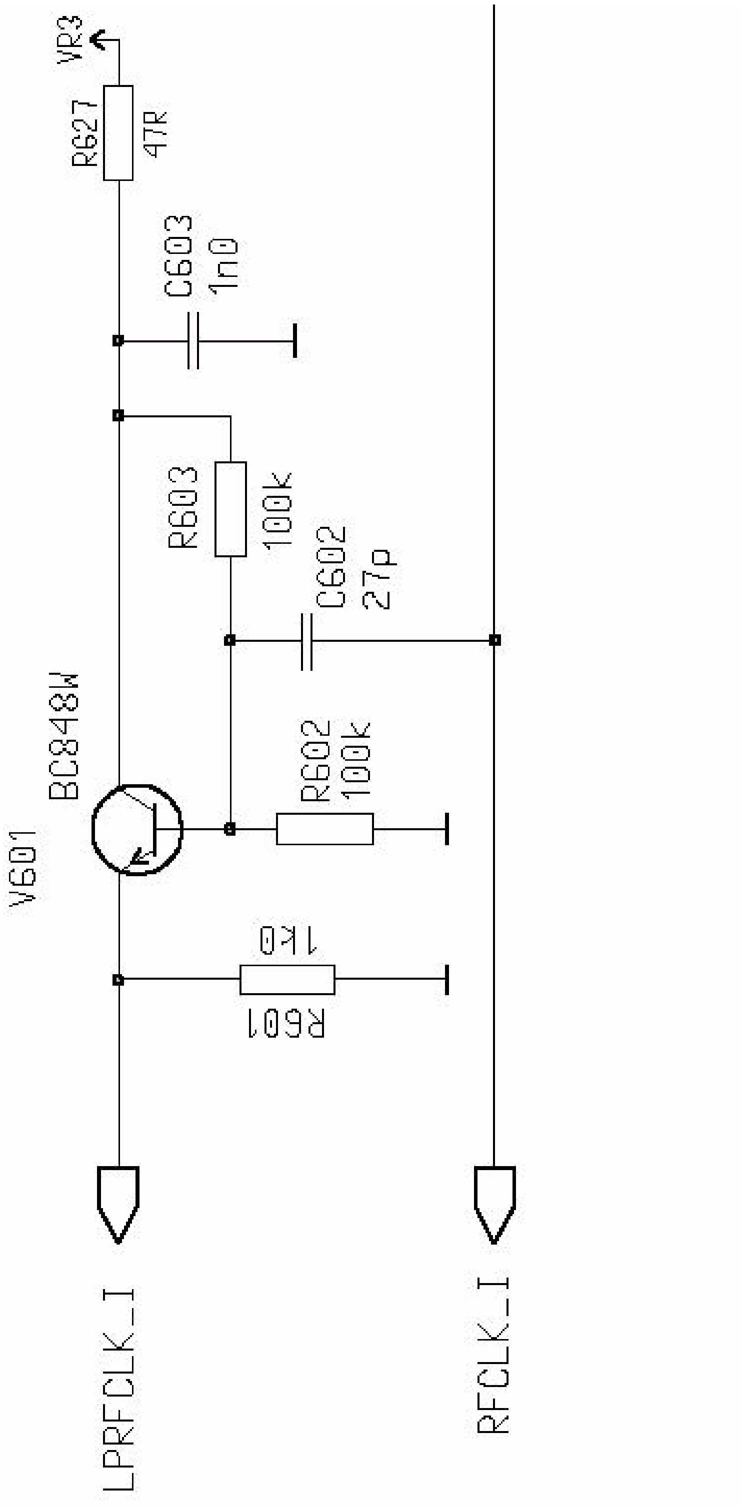
Loop Filter



VCO and power supply



26MHz Bluetooth buffer



Frequency lists

EGSM900

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880.2	925.2	3520.8	3700.8	1	890.2	935.2	3560.8	3740.8	63	902.6	947.6	3610.4	3790.4
976	880.4	925.4	3521.6	3701.6	2	890.4	935.4	3561.6	3741.6	64	902.8	947.8	3611.2	3791.2
977	880.6	925.6	3522.4	3702.4	3	890.6	935.6	3562.4	3742.4	65	903.0	948.0	3612.0	3792.0
978	880.8	925.8	3523.2	3703.2	4	890.8	935.8	3563.2	3743.2	66	903.2	948.2	3612.8	3792.8
979	881.0	926.0	3524.0	3704.0	5	891.0	936.0	3564.0	3744.0	67	903.4	948.4	3613.6	3793.6
980	881.2	926.2	3524.8	3704.8	6	891.2	936.2	3564.8	3744.8	68	903.6	948.6	3614.4	3794.4
981	881.4	926.4	3525.6	3705.6	7	891.4	936.4	3565.6	3745.6	69	903.8	948.8	3615.2	3795.2
982	881.6	926.6	3526.4	3706.4	8	891.6	936.6	3566.4	3746.4	70	904.0	949.0	3616.0	3796.0
983	881.8	926.8	3527.2	3707.2	9	891.8	936.8	3567.2	3747.2	71	904.2	949.2	3616.8	3796.8
984	882.0	927.0	3528.0	3708.0	10	892.0	937.0	3568.0	3748.0	72	904.4	949.4	3617.6	3797.6
985	882.2	927.2	3528.8	3708.8	11	892.2	937.2	3568.8	3748.8	73	904.6	949.6	3618.4	3798.4
986	882.4	927.4	3529.6	3709.6	12	892.4	937.4	3569.6	3749.6	74	904.8	949.8	3619.2	3799.2
987	882.6	927.6	3530.4	3710.4	13	892.6	937.6	3570.4	3750.4	75	905.0	950.0	3620.0	3800.0
988	882.8	927.8	3531.2	3711.2	14	892.8	937.8	3571.2	3751.2	76	905.2	950.2	3620.8	3800.8
989	883.0	928.0	3532.0	3712.0	15	893.0	938.0	3572.0	3752.0	77	905.4	950.4	3621.6	3801.6
990	883.2	928.2	3532.8	3712.8	16	893.2	938.2	3572.8	3752.8	78	905.6	950.6	3622.4	3802.4
991	883.4	928.4	3533.6	3713.6	17	893.4	938.4	3573.6	3753.6	79	905.8	950.8	3623.2	3803.2
992	883.6	928.6	3534.4	3714.4	18	893.6	938.6	3574.4	3754.4	80	906.0	951.0	3624.0	3804.0
993	883.8	928.8	3535.2	3715.2	19	893.8	938.8	3575.2	3755.2	81	906.2	951.2	3624.8	3804.8
994	884.0	929.0	3536.0	3716.0	20	894.0	939.0	3576.0	3756.0	82	906.4	951.4	3625.6	3805.6
995	884.2	929.2	3536.8	3716.8	21	894.2	939.2	3576.8	3756.8	83	906.6	951.6	3626.4	3806.4
996	884.4	929.4	3537.6	3717.6	22	894.4	939.4	3577.6	3757.6	84	906.8	951.8	3627.2	3807.2
997	884.6	929.6	3538.4	3718.4	23	894.6	939.6	3578.4	3758.4	85	907.0	952.0	3628.0	3808.0
998	884.8	929.8	3539.2	3719.2	24	894.8	939.8	3579.2	3759.2	86	907.2	952.2	3628.8	3808.8
999	885.0	930.0	3540.0	3720.0	25	895.0	940.0	3580.0	3760.0	87	907.4	952.4	3629.6	3809.6
1000	885.2	930.2	3540.8	3720.8	26	895.2	940.2	3580.8	3760.8	88	907.6	952.6	3630.4	3810.4
1001	885.4	930.4	3541.6	3721.6	27	895.4	940.4	3581.6	3761.6	89	907.8	952.8	3631.2	3811.2
1002	885.6	930.6	3542.4	3722.4	28	895.6	940.6	3582.4	3762.4	90	908.0	953.0	3632.0	3812.0
1003	885.8	930.8	3543.2	3723.2	29	895.8	940.8	3583.2	3763.2	91	908.2	953.2	3632.8	3812.8
1004	886.0	931.0	3544.0	3724.0	30	896.0	941.0	3584.0	3764.0	92	908.4	953.4	3633.6	3813.6
1005	886.2	931.2	3544.8	3724.8	31	896.2	941.2	3584.8	3764.8	93	908.6	953.6	3634.4	3814.4
1006	886.4	931.4	3545.6	3725.6	32	896.4	941.4	3585.6	3765.6	94	908.8	953.8	3635.2	3815.2
1007	886.6	931.6	3546.4	3726.4	33	896.6	941.6	3586.4	3766.4	95	909.0	954.0	3636.0	3816.0
1008	886.8	931.8	3547.2	3727.2	34	896.8	941.8	3587.2	3767.2	96	909.2	954.2	3636.8	3816.8
1009	887.0	932.0	3548.0	3728.0	35	897.0	942.0	3588.0	3768.0	97	909.4	954.4	3637.6	3817.6
1010	887.2	932.2	3548.8	3728.8	36	897.2	942.2	3588.8	3768.8	98	909.6	954.6	3638.4	3818.4
1011	887.4	932.4	3549.6	3729.6	37	897.4	942.4	3589.6	3769.6	99	909.8	954.8	3639.2	3819.2
1012	887.6	932.6	3550.4	3730.4	38	897.6	942.6	3590.4	3770.4	100	910.0	955.0	3640.0	3820.0
1013	887.8	932.8	3551.2	3731.2	39	897.8	942.8	3591.2	3771.2	101	910.2	955.2	3640.8	3820.8
1014	888.0	933.0	3552.0	3732.0	40	898.0	943.0	3592.0	3772.0	102	910.4	955.4	3641.6	3821.6
1015	888.2	933.2	3552.8	3732.8	41	898.2	943.2	3592.8	3772.8	103	910.6	955.6	3642.4	3822.4
1016	888.4	933.4	3553.6	3733.6	42	898.4	943.4	3593.6	3773.6	104	910.8	955.8	3643.2	3823.2
1017	888.6	933.6	3554.4	3734.4	43	898.6	943.6	3594.4	3774.4	105	911.0	956.0	3644.0	3824.0
1018	888.8	933.8	3555.2	3735.2	44	898.8	943.8	3595.2	3775.2	106	911.2	956.2	3644.8	3824.8
1019	889.0	934.0	3556.0	3736.0	45	899.0	944.0	3596.0	3776.0	107	911.4	956.4	3645.6	3825.6
1020	889.2	934.2	3556.8	3736.8	46	899.2	944.2	3596.8	3776.8	108	911.6	956.6	3646.4	3826.4
1021	889.4	934.4	3557.6	3737.6	47	899.4	944.4	3597.6	3777.6	109	911.8	956.8	3647.2	3827.2
1022	889.6	934.6	3558.4	3738.4	48	899.6	944.6	3598.4	3778.4	110	912.0	957.0	3648.0	3828.0
1023	889.8	934.8	3559.2	3739.2	49	899.8	944.8	3599.2	3779.2	111	912.2	957.2	3648.8	3828.8
0	890.0	935.0	3560.0	3740.0	50	900.0	945.0	3600.0	3780.0	112	912.4	957.4	3649.6	3829.6
					51	900.2	945.2	3600.8	3780.8	113	912.6	957.6	3650.4	3830.4
					52	900.4	945.4	3601.6	3781.6	114	912.8	957.8	3651.2	3831.2
					53	900.6	945.6	3602.4	3782.4	115	913.0	958.0	3652.0	3832.0
					54	900.8	945.8	3603.2	3783.2	116	913.2	958.2	3652.8	3832.8
					55	901.0	946.0	3604.0	3784.0	117	913.4	958.4	3653.6	3833.6
					56	901.2	946.2	3604.8	3784.8	118	913.6	958.6	3654.4	3834.4
					57	901.4	946.4	3605.6	3785.6	119	913.8	958.8	3655.2	3835.2
					58	901.6	946.6	3606.4	3786.4	120	914.0	959.0	3656.0	3836.0
					59	901.8	946.8	3607.2	3787.2	121	914.2	959.2	3656.8	3836.8
					60	902.0	947.0	3608.0	3788.0	122	914.4	959.4	3657.6	3837.6
					61	902.2	947.2	3608.8	3788.8	123	914.6	959.6	3658.4	3838.4
					62	902.4	947.4	3609.6	3789.6	124	914.8	959.8	3659.2	3839.2

GSM1800

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	794	1766.6	1861.6	3533.2	3723.2
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	795	1766.8	1861.8	3533.6	3723.6
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	796	1767.0	1862.0	3534.0	3724.0
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	797	1767.2	1862.2	3534.4	3724.4
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	798	1767.4	1862.4	3534.8	3724.8
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	799	1767.6	1862.6	3535.2	3725.2
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	800	1767.8	1862.8	3535.6	3725.6
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	801	1768.0	1863.0	3536.0	3726.0
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	802	1768.2	1863.2	3536.4	3726.4
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	803	1768.4	1863.4	3536.8	3726.8
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	804	1768.6	1863.6	3537.2	3727.2
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	805	1768.8	1863.8	3537.6	3727.6
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	806	1769.0	1864.0	3538.0	3728.0
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	807	1769.2	1864.2	3538.4	3728.4
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	808	1769.4	1864.4	3538.8	3728.8
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	809	1769.6	1864.6	3539.2	3729.2
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	810	1769.8	1864.8	3539.6	3729.6
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	811	1770.0	1865.0	3540.0	3730.0
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	812	1770.2	1865.2	3540.4	3730.4
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	813	1770.4	1865.4	3540.8	3730.8
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	814	1770.6	1865.6	3541.2	3731.2
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	815	1770.8	1865.8	3541.6	3731.6
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	816	1771.0	1866.0	3542.0	3732.0
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	817	1771.2	1866.2	3542.4	3732.4
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	818	1771.4	1866.4	3542.8	3732.8
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	819	1771.6	1866.6	3543.2	3733.2
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	820	1771.8	1866.8	3543.6	3733.6
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	821	1772.0	1867.0	3544.0	3734.0
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	822	1772.2	1867.2	3544.4	3734.4
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	823	1772.4	1867.4	3544.8	3734.8
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	824	1772.6	1867.6	3545.2	3735.2
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	825	1772.8	1867.8	3545.6	3735.6
544	1716.6	1811.5	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	826	1773.0	1868.0	3546.0	3736.0
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	827	1773.2	1868.2	3546.4	3736.4
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	828	1773.4	1868.4	3546.8	3736.8
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	829	1773.6	1868.6	3547.2	3737.2
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	830	1773.8	1868.8	3547.6	3737.6
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	831	1774.0	1869.0	3548.0	3738.0
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	832	1774.2	1869.2	3548.4	3738.4
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	833	1774,4	1869.4	3548.8	3738.8
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	834	1774.6	1869.6	3549.2	3739.2
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	835	1774.8	1869.8	3549.6	3739.6
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	836	1775.0	1870.0	3550.0	3740.0
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	837	1775.2	1870.2	3550.4	3740.4
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	754	1756.6	1851.6	3513.2	3703.2	838	1775.4	1870.4	3550.8	3740.8
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	839	1775.6	1870.6	3551.2	3741.2
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	840	1775.8	1870.8	3551.6	3741.6
559	1719.6	1814.6	3449.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	841	1776.0	1871.0	3552.0	3742.0
560	1719.8	1814.8	3449.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	842	1776.2	1871.2	3552.4	3742.4
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	843	1776.4	1871.4	3552.8	3742.8
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	844	1776.6	1871.6	3553.2	3743.2
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	845	1776.8	1871.8	3553.6	3743.6
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	846	1777.0	1872.0	3554.0	3744.0
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	847	1777.2	1872.2	3554.4	3744.4
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	848	1777.4	1872.4	3554.8	3744.8
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	849	1777.6	1872.6	3555.2	3745.2
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	850	1777.8	1872.8	3555.6	3745.6
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	851	1778.0	1873.0	3556.0	3746.0
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	852	1778.2	1873.2	3556.4	3746.4
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	853	1778.4	1873.4	3556.8	3746.8
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	854	1778.6	1873.6	3557.2	3747.2
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	855	1778.8	1873.8	3557.6	3747.6
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	856	1779.0	1874.0	3558.0	3748.0
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	857	1779.2	1874.2	3558.4	3748.4
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	858	1779.4	1874.4	3558.8	3748.8
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	859	1779.6	1874.6	3559.2	3749.2
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	860	1779.8	1874.8	3559.6	3749.6
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	861	1780.0	1875.0	3560.0	3750.0
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	862	1780.2	1875.2	3560.4	3750.4
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	863	1780.4	1875.4	3560.8	3750.8
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	864	1780.6	1875.6	3561.2	3751.2
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	865	1780.8	1875.8	3561.6	3751.6
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	866	1781.0	1876.0	3562.0	3752.0
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	867	1781.2	1876.2	3562.4	3752.4
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	868	1781.4	1876.4	3562.8	3752.8
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	869	1781.6	1876.6	3563.2	3753.2
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	870	1781.8	1876.8	3563.6	3753.6
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	871	1782.0	1877.0	3564.0	3754.0
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	872	1782.2	1877.2	3564.4	3754.4
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	873	1782.4	1877.4	3564.8	3754.8
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	874	1782.6	1877.6	3565.2	3755.2
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	875	1782.8	1877.8	3565.6	3755.6
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	876	1783.0	1878.0	3566.0	3756.0
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	877	1783.2	1878.2	3566.4	3756.4
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	878	1783.4	1878.4	3566.8	3756.8
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	879	1783.6	1878.6	3567.2	3757.2
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	880	1783.8	1878.8	3567.6	3757.6
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	881	1784.0	1879.0	3568.0	3758.0
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	882	1784.2	1879.2	3568.4	3758.4
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	883	1784.4	1879.4	3568.8	3758.8
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	884	1784.6	1879.6	3569.2	3759.2
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	885	1784.8	1879.8	3569.6	3759.6
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					
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2	793	1766.4	1861.4	3532.8	3722.8					

GSM1900

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					
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					

Phoenix tuning

Before any tuning the phone should be synchronized with the PC.

Connect the phone to a PC with DAU-9P cable and dongle and follow the following instructions:

Provide the phone with power supply

Start Phoenix Service Software and open FBUS connection

Select File Scan Product

Wait until phone information is shown in the lower right corner of the screen.

RF tuning after repairs

Different repairs require different tuning. In general it is necessary to determine in which section the repair was done to select which tunings to perform. To determine if RF tuning is necessary after repair it is important that the functionality of the repaired circuit is understood well.

- In general repairs in the TX part will require "TX Power Level Tuning" and "TX IQ Tuning".
- In general repairs in the RX part or PLL part always require "RX Calibration", “Rx Band Filter Response Calibration”.
- If Mjoelner is changed all calibrations have to be done.

Other parts interfacing to TX, RX or PLL might require tuning, but common sense should be used, e.g. if a component that has no influence on RF performance has been changed, e.g. the microphone, on/off key, mechanical parts or similar, there is no need to do any RF tuning.

RX Calibration (incl. VCXO Calibration)

The "RX calibration" is used to determine gain at different gain-settings for front-end and Mjoelner and needs to be done in all three bands. The procedure begins with EGSM and continues with GSM1800 and GSM1900.

RX-calibration requires an external signal generator.

RX-calibration in EGSM900 combines two tunings, VCXO-calibration and AGC-calibration:

Calibration of GSM1800 and GSM1900 band only determines AGC values.

The **VCXO-calibration** finds out a calibration value for VCXO control, an AFC initial value and 3 AFC-slope coefficients.

A value (RF_TEMP), which represents the RF hardware temperature, is determined during RX Calibration. This temperature value is used by DSP to RSSI reporting in Normal mode of the phone. It is not visible in the calibration process.

AGC-calibration:

The AGC-calibration finds the gain values of the RX-gain system.
The AGC consists of RF LNA, which can be either on or off (gain difference between on and off state is nominally 30dB) and BB gain which can be controlled in 6dB steps. This gives 15 gain steps RSSI0 to RSSI14. LNA is off for steps RSSI0 to RSSI4.
AGC-calibration measures the gain at gain step RSSI4 and RSSI7. The other gain values are calculated.

VCXO-calibration:

The VCXO-calibration ensures the function of an **initial** synchronization (before location update is done) when the mobile station is in Normal mode. For an error free initial synchronization, the 26MHz frequency of the VCXO must be accurate enough. Therefore, a **VCXO cal** value is written into the RefOSCCAL register of the Mjoelner.

During VCXO-calibration, the **VCXO cal** value is changed by a DSP-algorithm until a synchronization is possible. This means the VCXO oscillates at 26 MHz with a sufficient minimum frequency error.

To further minimize the frequency error, an initial **AFC value** is determined by the DSP and written into RefOSCAFC register of the Mjoelner.

Also the DSP algorithm determines 3 AFC slope coefficients **Slope C1...3** during VCXO calibration. One AFC slope value is not sufficient for Mjoelner **F3**, because the AFC slope is non-linear in this chip.

EGSM

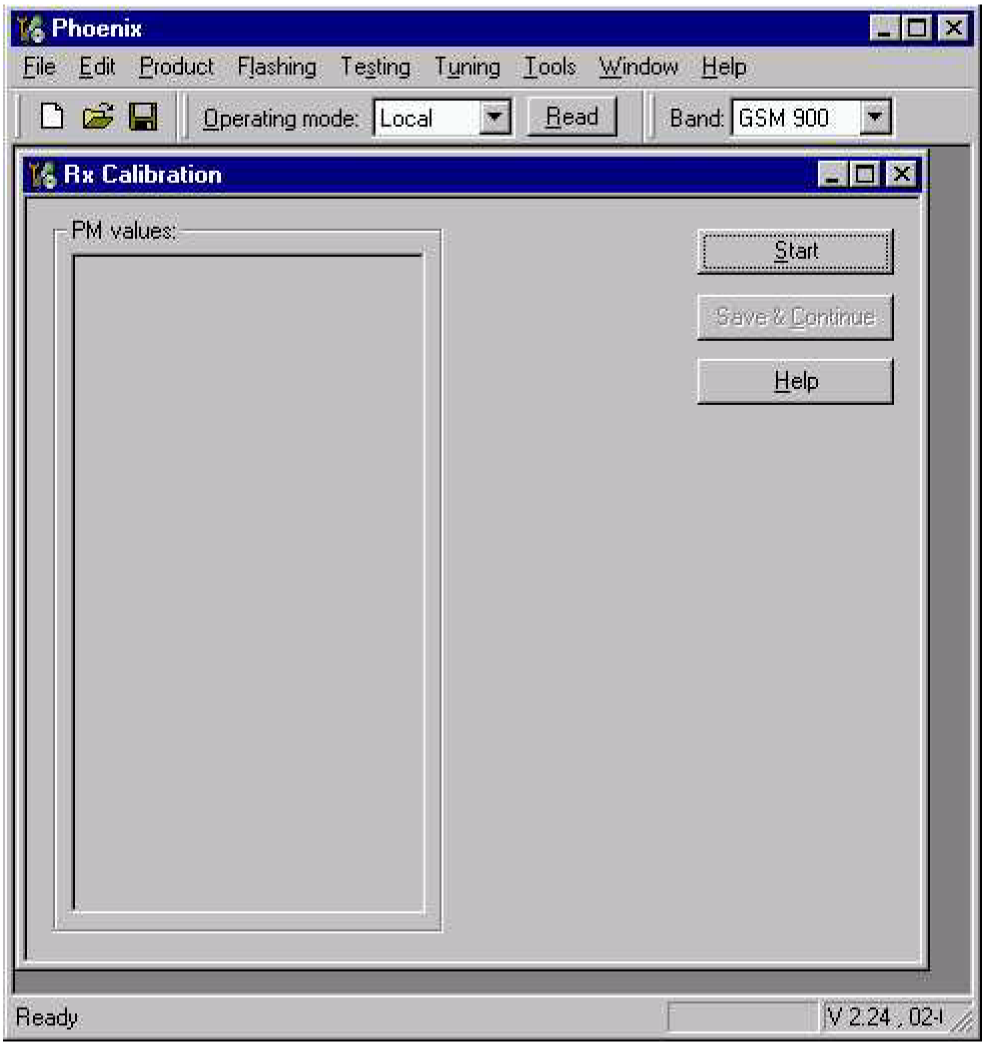
Set operating mode to local mode

Select	Tuning	Alt-u
	RX Calibration	C

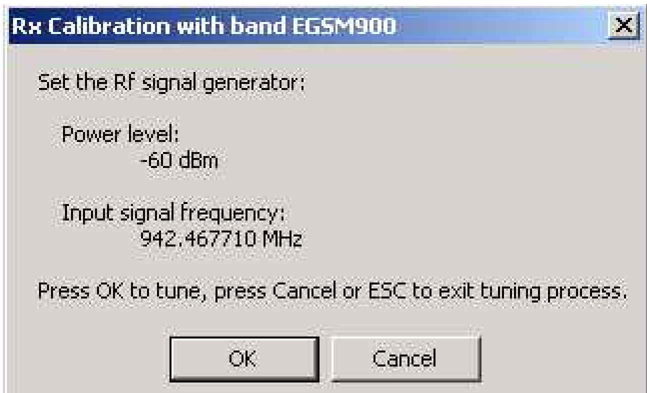
Wait until the RX Calibration window pops up.

Select	Band	GSM 900

The setup should now look like this:



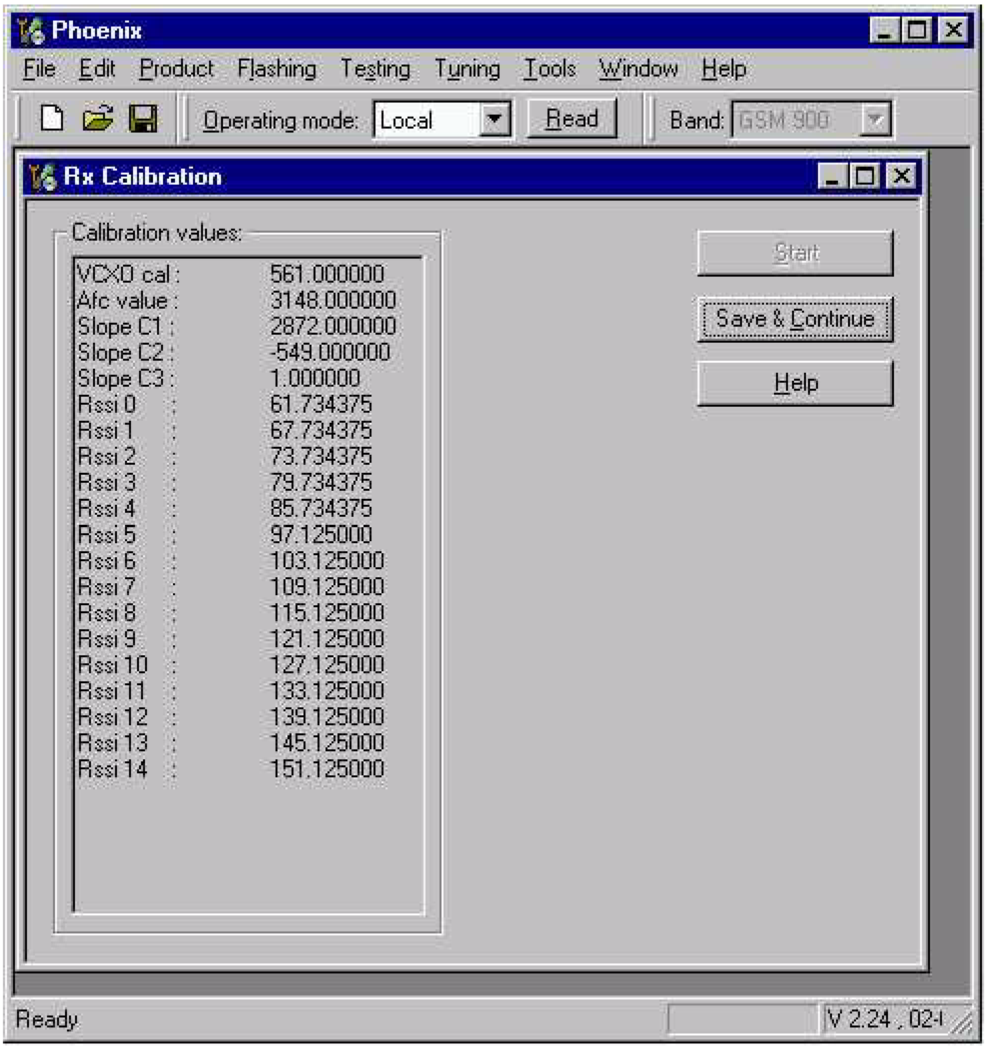
Press Start and a window pops up:



Connect an external signal generator to the RF connector of the phone and set the generator as told in the window, taking care for external cable losses.

Press ok and the window closes.

A typical result will look like this:

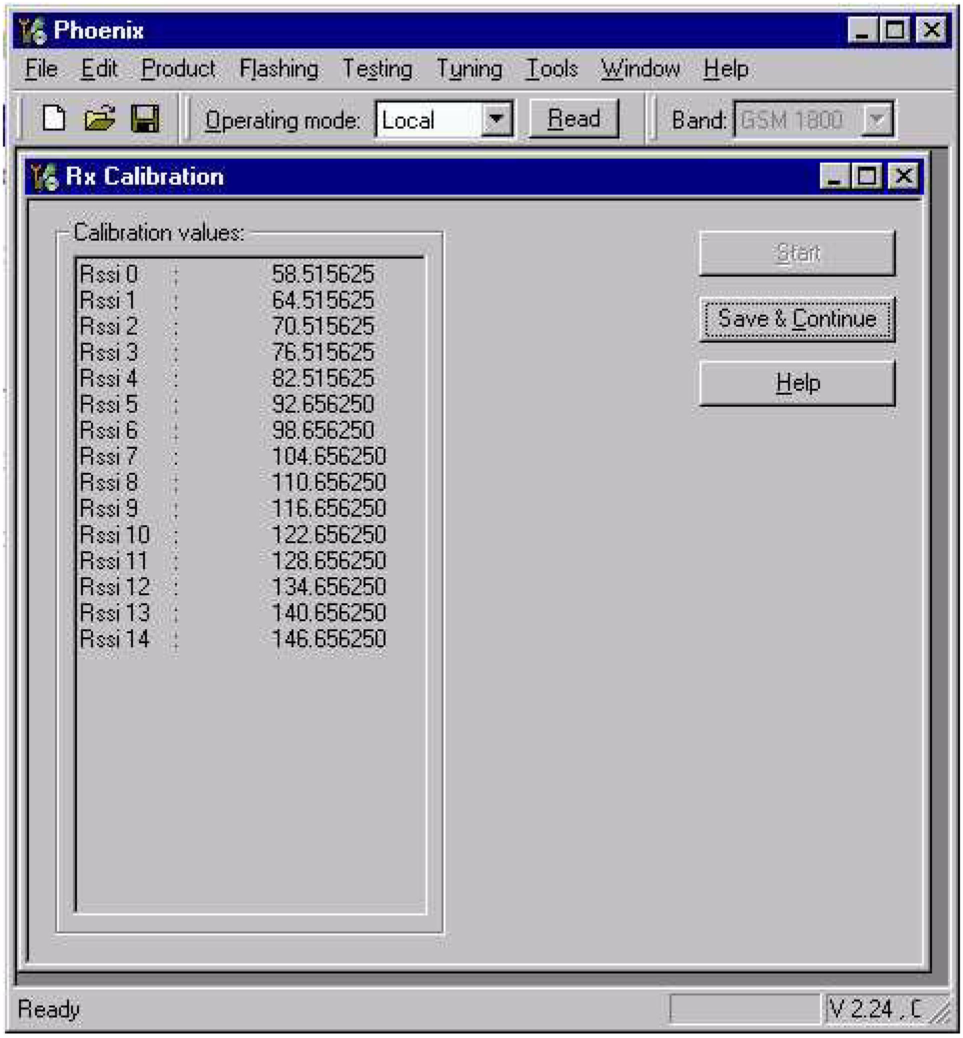


Press Save and Continue. RX Calibration for EGSM is finished and the tuning continues automatically with GSM1800.

GSM1800 (DCS/PCN)

Set the generator as instructed and press OK.

A typical result will look like this:

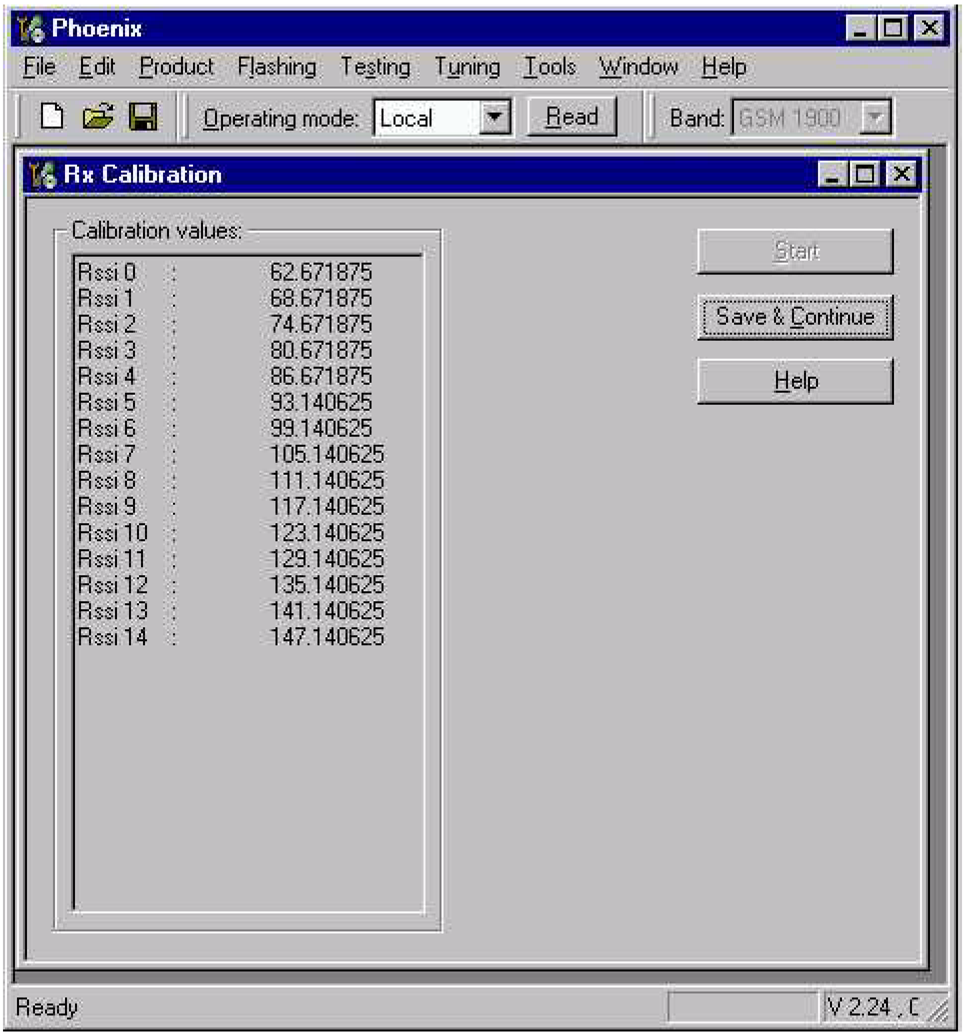


Press Save and Continue. RX Calibration for GSM1800 is finished and the tuning continues automatically with GSM 1900.

GSM1900 (PCS)

Set the generator as instructed and press OK.

A typical result will look like this:



Press Save and Continue. RX Calibration is finished and the tuning is fully completed.

RX AGC limits

The Rx calibration is only valid if it is within certain limits.

For the most recent limits see NEM-4 Production Testing Requirements,

If calibration is not within limits, there is a fault in the RX chain.

Below the values for RSSI4 and RSSI7 are given:

RSSI4:(Rx A5)

band	min	typ	max
EGSM900	81	86	91
GSM1800	79	84	89
GSM1900	79	85	89

RSSI7:(Rx A8)

band	min	typ	max
EGSM900	103	108	113
GSM1800	99	105	109
GSM1900	100	104	110

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RX Band Filter Response Compensation

RX Band Filter Response Compensation needs to be done on all three bands. The procedure begins with EGSM and continues automatically with GSM1800 and GSM1900.

Set operating mode to local mode.

Select	Testing	Alt-S
	RF Controls	V

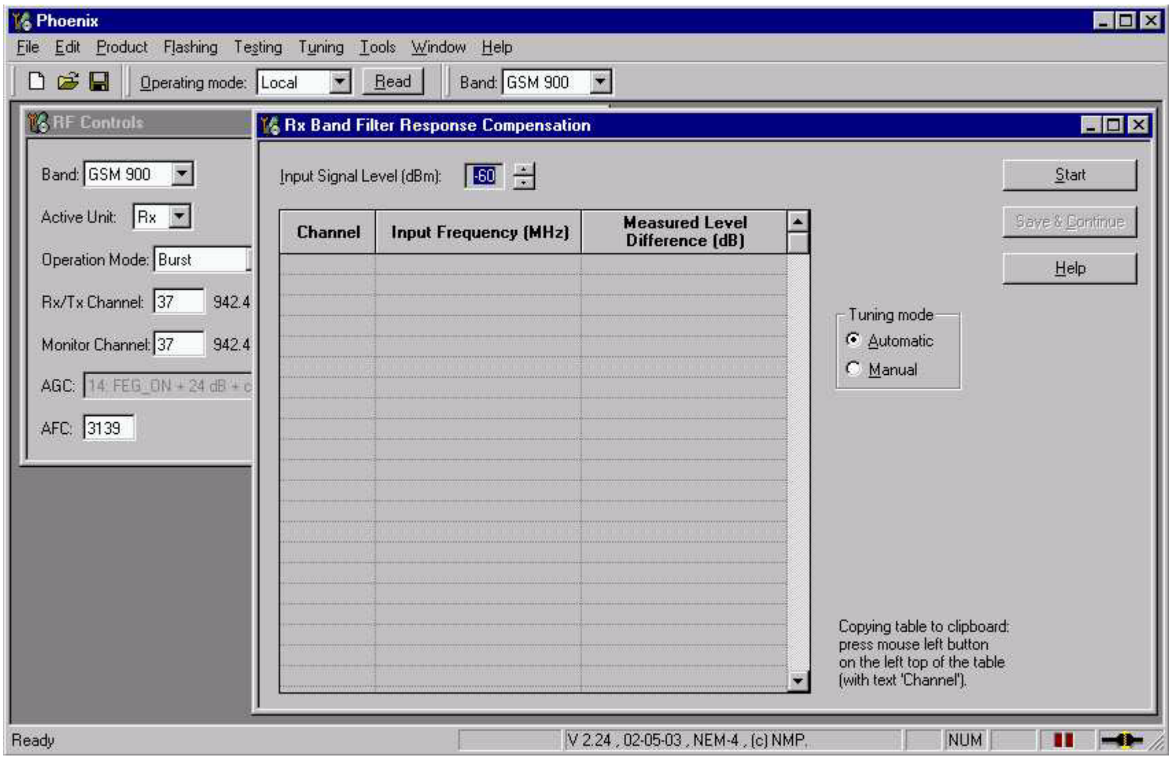
Wait until the RF Controls window pops up

Select Band GSM 900

Select	Tuning	Alt-u
	RX Band Filter Response Compensation	B

Select Input Signal Level -60dBm.

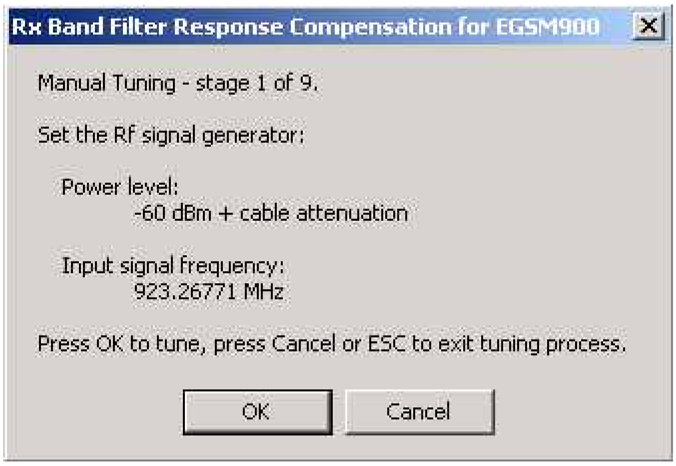
The setup should now look like this:



Manual Tuning

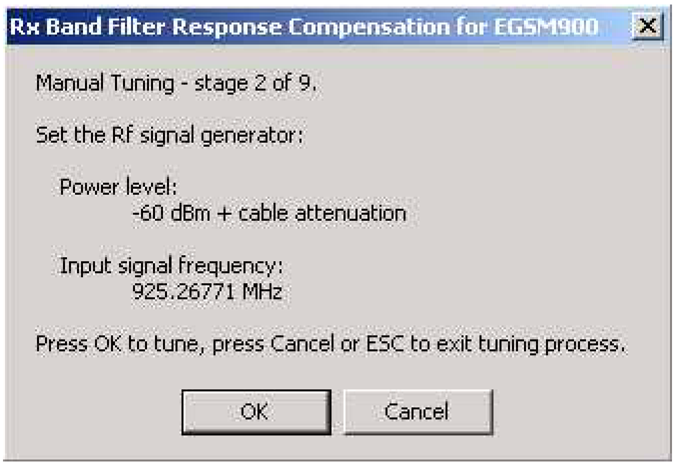
EGSM900

Select Manual Tuning mode. Press Start. A window pops up:



Connect an external signal generator to the RF connector of the phone and set the generator as told in the window.

Press OK and a new window pops up:



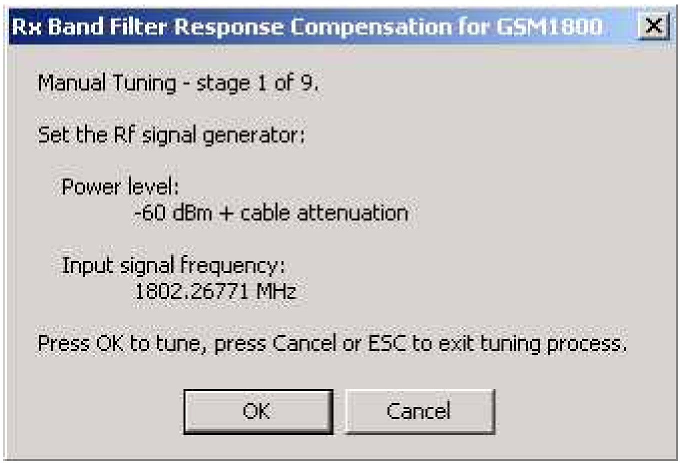
Set the generator as told in the window.

Press OK and a new window pops up. Repeat this sequence **9 times** until all channels have been tuned.

Press Save and Continue. RX Band Filter Response Compensation for EGSM is finished and the tuning continues automatically with GSM1800.

GSM1800 (DCS/PCN)

Band Filter Response Compensation has to be done first for EGSM band (see previous chapter). After tuning the EGSM, the tuning continues automatically with GSM1800 and the following window should be seen:



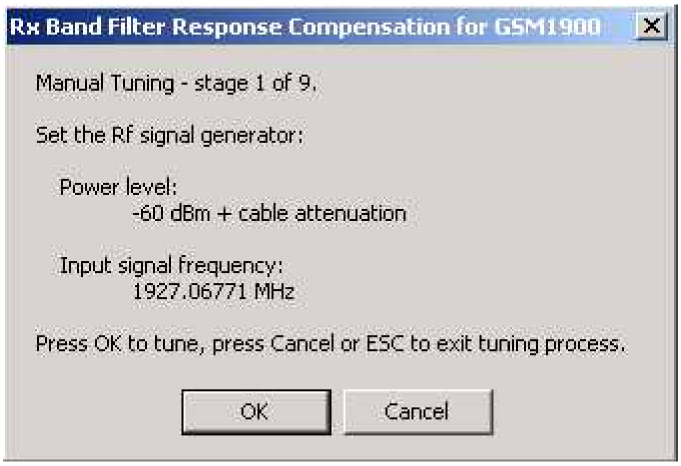
Set the generator as instructed and press OK.

Repeat this sequence **9 times** until all channels have been tuned.

Press Save and Continue. RX Band Filter Response Compensation for GSM1800 is finished and the tuning continues automatically with GSM1900.

GSM1900 (PCS)

Band Filter Response Compensation has to be done first for EGSM and GSM1800 bands (see previous chapters). After the other bands have been tuned, the tuning continues automatically with GSM1900 and the following window should be seen:



Set the generator as instructed and press OK.

Repeat this sequence **9 times** until all channels have been tuned.

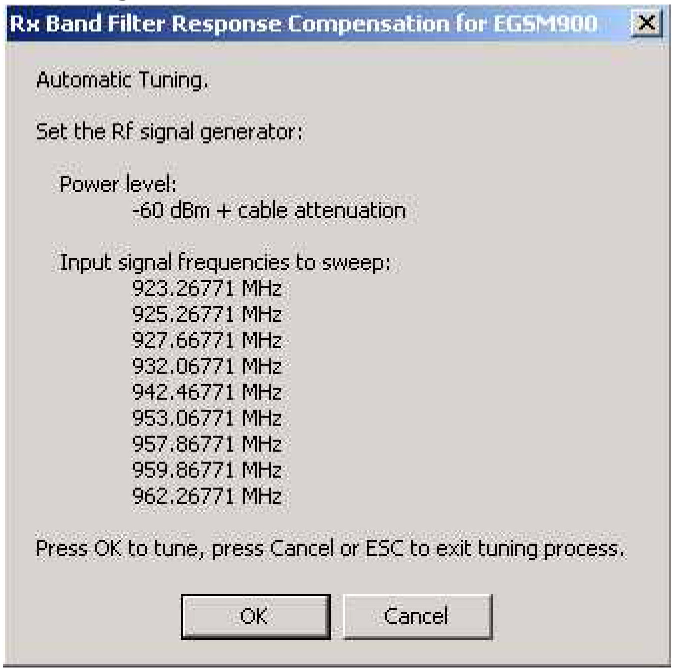
Press Save and Continue. RX Band Filter Response Compensation for all three bands is finished and the tuning is fully completed.

Auto Tuning

A faster and more convenient method for Band Filter Calibration can be performed by clicking on "Auto Tuning". This requires a signal Generator that can be programmed to sweep a user defined list of frequencies.

EGSM900

Select Automatic Tuning mode. Press start and then Tune. A window pops up:



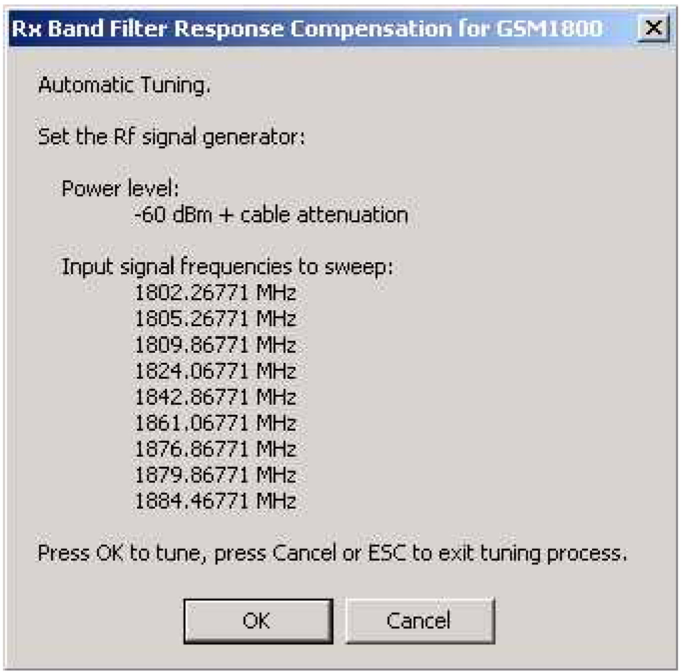
Connect an external signal generator to the RF connector of the phone and let the signal generator step sweep through the programmed frequency list.

Press OK.

Press Save and Continue. RX Band Filter Response Compensation for EGSM is finished and the tuning continues automatically with GSM1800.

GSM1800 (DCS/PCN)

Band Filter Response Compensation has to be done first for EGSM band (see previous chapter). After tuning the EGSM band, the tuning continues automatically with GSM1800 and the following window should be seen:

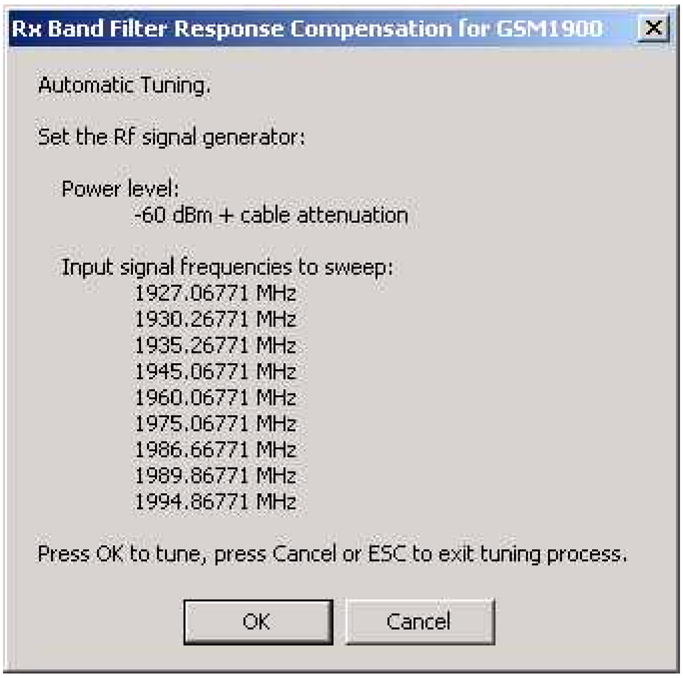


Set the generator to sweep the frequency list as instructed and press OK.

Press Save and Continue. RX Band Filter Response Compensation for GSM1800 is finished and the tuning continues automatically with GSM1900.

GSM1900 (PCS)

Band Filter Response Compensation has to be done first for EGSM and GSM1800 bands (see previous chapters). After tuning the other bands have been tuned, the tuning continues automatically with GSM1900 and the following window should be seen:



Set the generator to sweep the frequency list as instructed and press OK.

Press Save and Continue. RX Band Filter Response Compensation for all three bands is finished and the tuning is fully completed.

RX Channel Select Filter Calibration

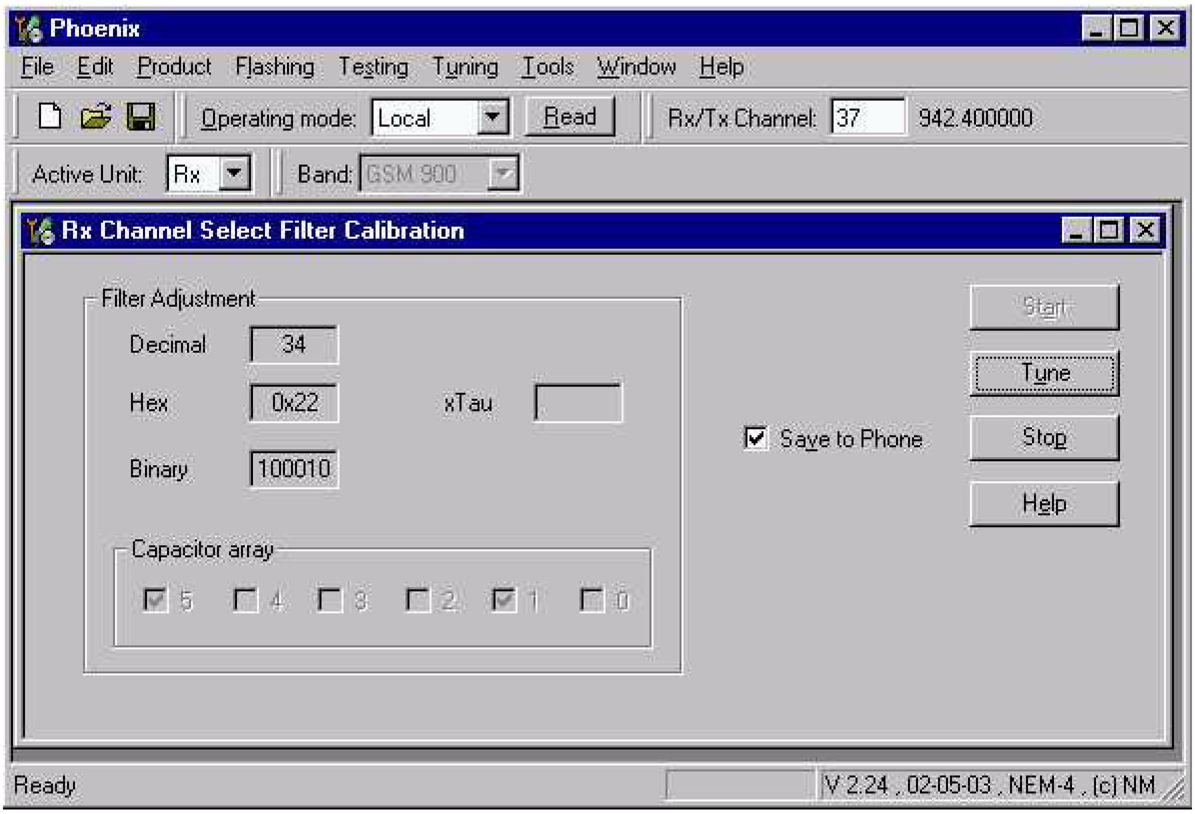
This calibration is calibrating the Base band filter inside Mjoelner. It is done by internally measuring a prototype filter, for this reason the calibration is done once, not separately in 3 bands.

Set operating mode to local mode

Select	Tuning		Alt-u
		RX Channel Select filter Calibration	H

Check Save to Phone box.

The setup should now look like this:



Press Tune.

Press Stop. Channel select filter calibration is finished and the tuning is fully completed.

TX Power tuning

This tuning must be done in all three bands.

Note: TX Power tuning must be done with a peak power meter, e.g. Anritsu model ML2408A with Anritsu Peak Power Sensor MA2442A and a suitable attenuator.

The use of a spectrum analyser or the power meter in GSM testers is likely to cause larger error than the use of a dedicated power meter and might cause the phone to be non-compliant with GSM specifications.

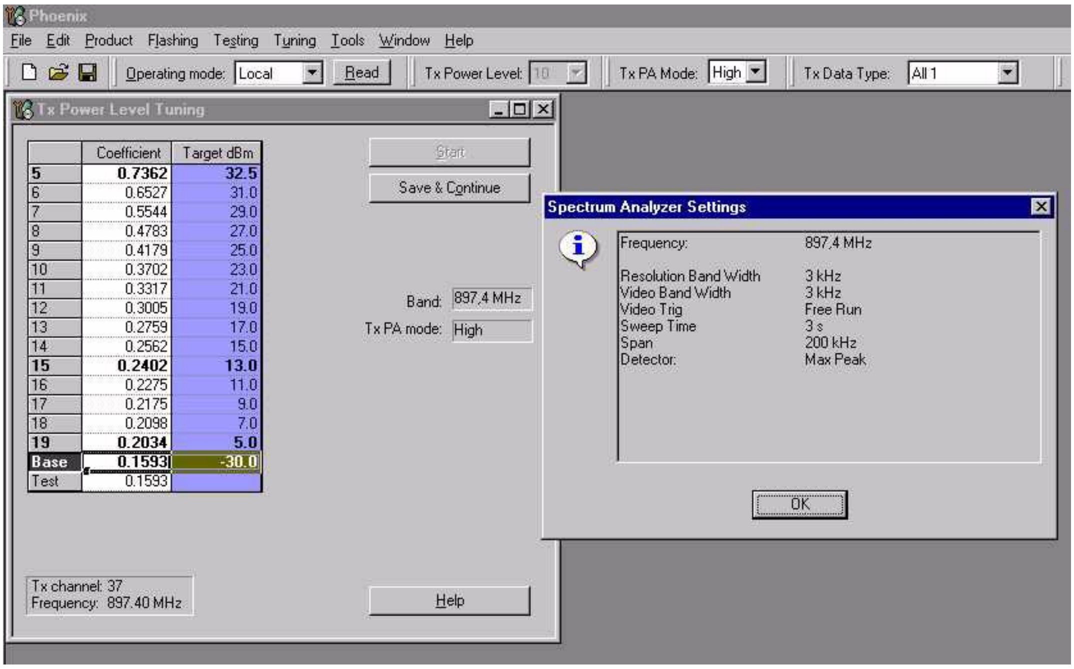
Connect a calibrated powermeter to the RF connector of the phone.

Set operating mode of the phone to Local.

Select Tuning [Alt-U] TX Power Level Tuning [L]

Wait until the TX Power Level Tuning window pops up. Press Start.

TX Power Level Tuning procedure begins from EGSM900 and continues automatically to GSM1800 (PCS/PCN) and GSM1900 (PSCS).



EGSM900 (EGSM)

If a spectrum analyser is used, follow the instruction window. Press OK to continue.

From the main toolbar, select TX Data Type Random and TX PA Mode High.

Tune the power levels according to the table below by adjusting the corresponding coefficient values. The levels mentioned in the table below differ to some extent from the target values mentioned in Phoenix, since they are product specific.

Table 1: EGSM900

PL	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Base
dBm	32.5	31	29	27	25	23	21	19	17	15	13	11	9	7	5	-28

Press Save and Continue to tune the PA Low Mode. In the Spectrum Analyzer Settings window, press OK.

From the main toolbar, select TX Data Type Random and TX PA Mode Low.

Tune the power levels (except levels 5 and 6) according to the previous table by adjusting the corresponding coefficient values.

Press Save and Continue in order to continue with the next band.

GSM1800 (DCS/PCN)

Change the center frequency of the Spectrum Analyzer in the Spectrum Analyzer Settings window as instructed and press OK.

From the main toolbar, select TX Data Type Random and TX PA Mode High.

Tune the power levels according to the table below by adjusting coefficient values. The levels below differ to some extent from the target values in Phoenix, since they are product specific.

Table 2: GSM1800

PL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Base
dBm	30	28	26	24	22	20	18	16	14	12	10	8.5	7	5.5	4.3	3	-28

Press Save and Continue in order to continue with the next band.

GSM1900(PCS)

Change the center frequency of the spectrum analyzer as instructed in the Spectrum Analyzer Settings window and press OK.

From the main toolbar, select TX Data Type Random and TX PA Mode High.

Tune the power levels according to the table below by adjusting coefficient values. The levels below differ to some extent from the target values in Phoenix, since they are product specific.

Table 3:

PL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Base
dBm	30	28	26	24	22	20	18	16	14	12	10	8.2	6.4	4.6	2.8	1	-28

Press Save and Continue to finish TX Power Level Tuning.

TX I/Q Tuning

This tuning must be done in all three bands.

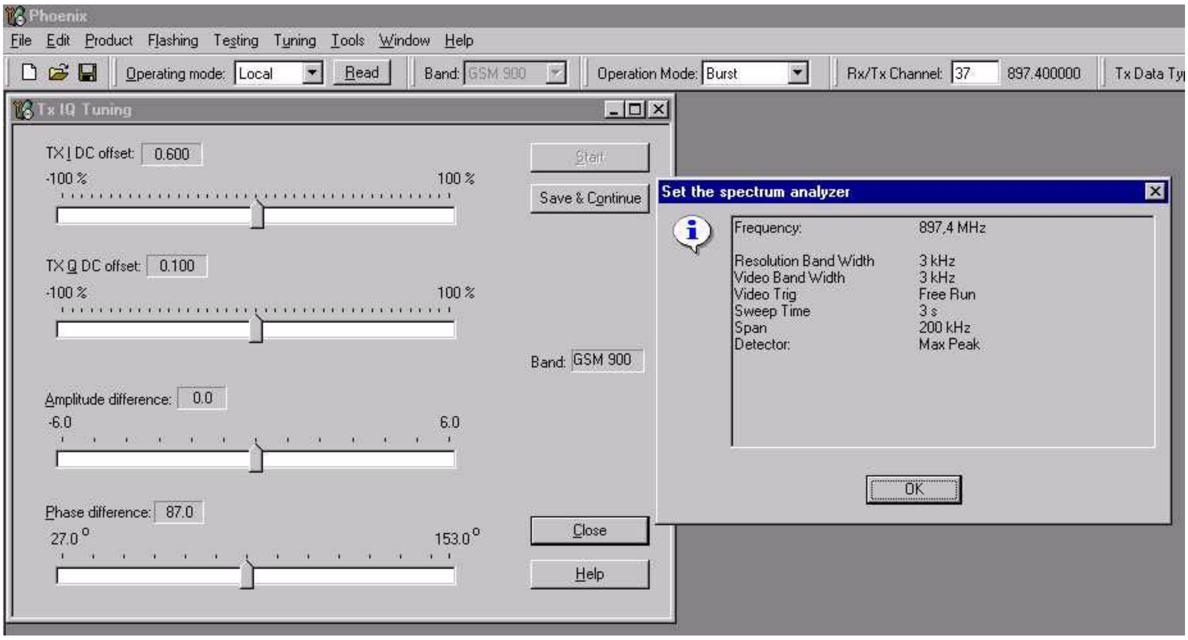
Caution: In case you use a spectrum analyser make sure that the external attenuation (20 - 30dB) between phone and spectrum analyser is high enough that the input of the analyser can't be destroyed. Adjust the reference level offset according to the insertion loss from the phone to the spectrum analyser.

Connect a Spectrum Analyzer or GSM tester with the option *Narrow Spectrum' to the RF connector of the phone.

Select Tuning [Alt-U] TX IQ Tuning [I]

Wait until the TX IQ Tuning window pops up. Press Start.

Set the spectrum analyzer according to the instruction window and press OK. TX IQ tuning procedure begins from EGSM900, and continues automatically to GSM1800 (PCS/PCN) and GSM1900 (PCS).



EGSM900 (EGSM)

If a spectrum analyzer is used then use the following settings.

Table 4:

	EGSM/EGSM900
Center Frequency	897.4 MHz
Frequency Span	200/300 kHz
Resolution Bandwidth	3kHz
Video Bandwidth	3kHz
Sweep Time	3 sec.
Sweep Type	Clear/Write
Detector Type	Max Peak
Reference level	35 dBm
	EGSM/EGSM900
Marker 1	897.33229 MHz
Marker 2	897.4 MHz
Marker 3	897.46771 MHz

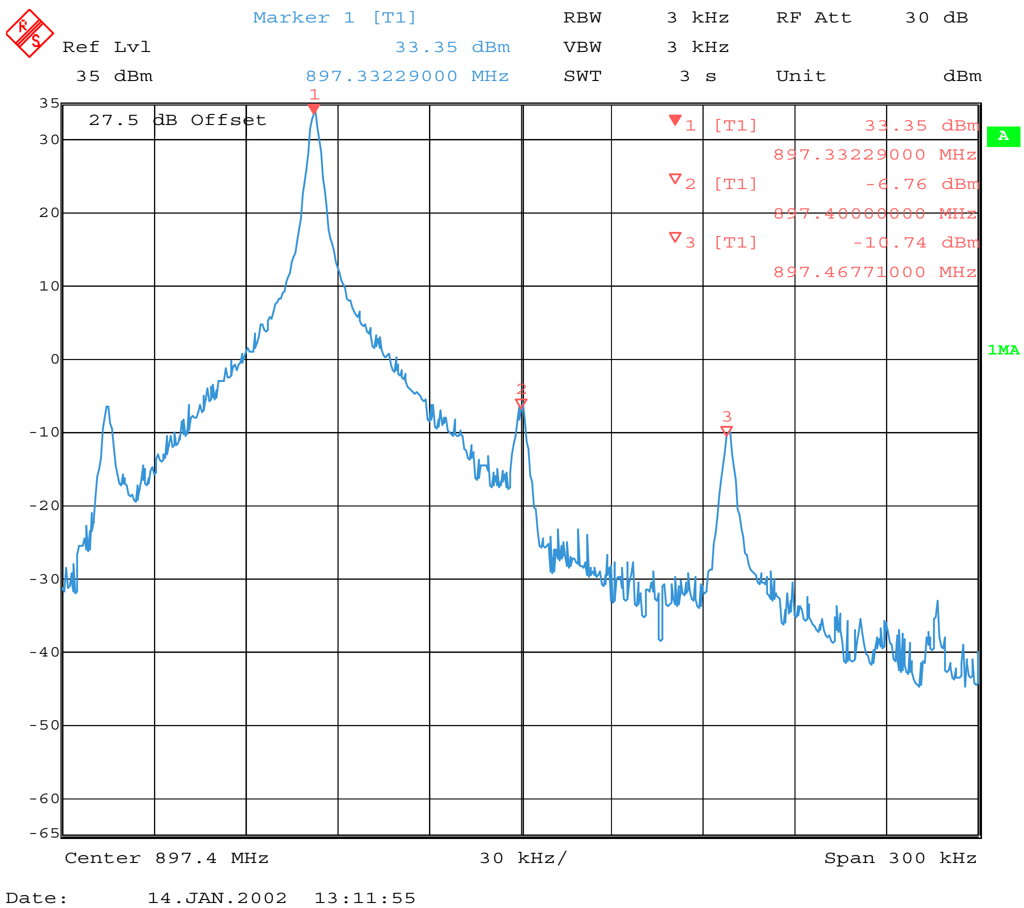
The following default values of the main toolbar should be used:

Band	GSM 900
Active Unit	TX
Operation Mode	Burst
RX/TX Channel	37
TX PA Mode	Free
TX Data Type	All1

Select Testing [Alt-S] RF Controls [R]

Wait until the RF Controls window pops up. Choose TX Power Level 5.

The spectrum analyzer shows now a plot like this:



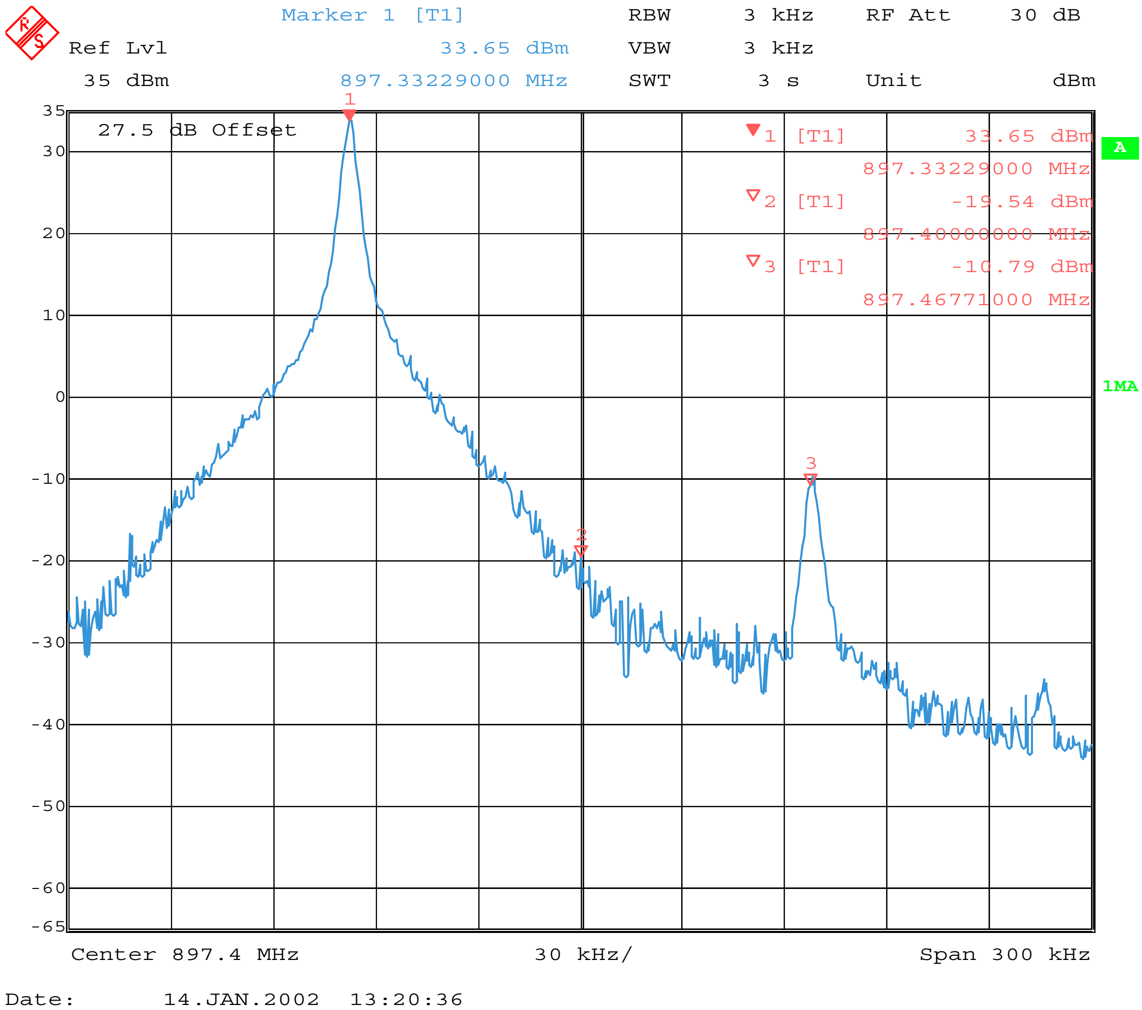
The purpose of this tuning is to tune the carrier signal and the +67kHz signal to a minimum level (Marker 2 and 3).

Use the variables 'TX I DC offset' and 'TX Q DC offset' to adjust the carrier signal to a minimum level (Marker 2).

After tuning to the minimum the level difference between the peak levels at marker 1 and 2 must exceed 40dB.

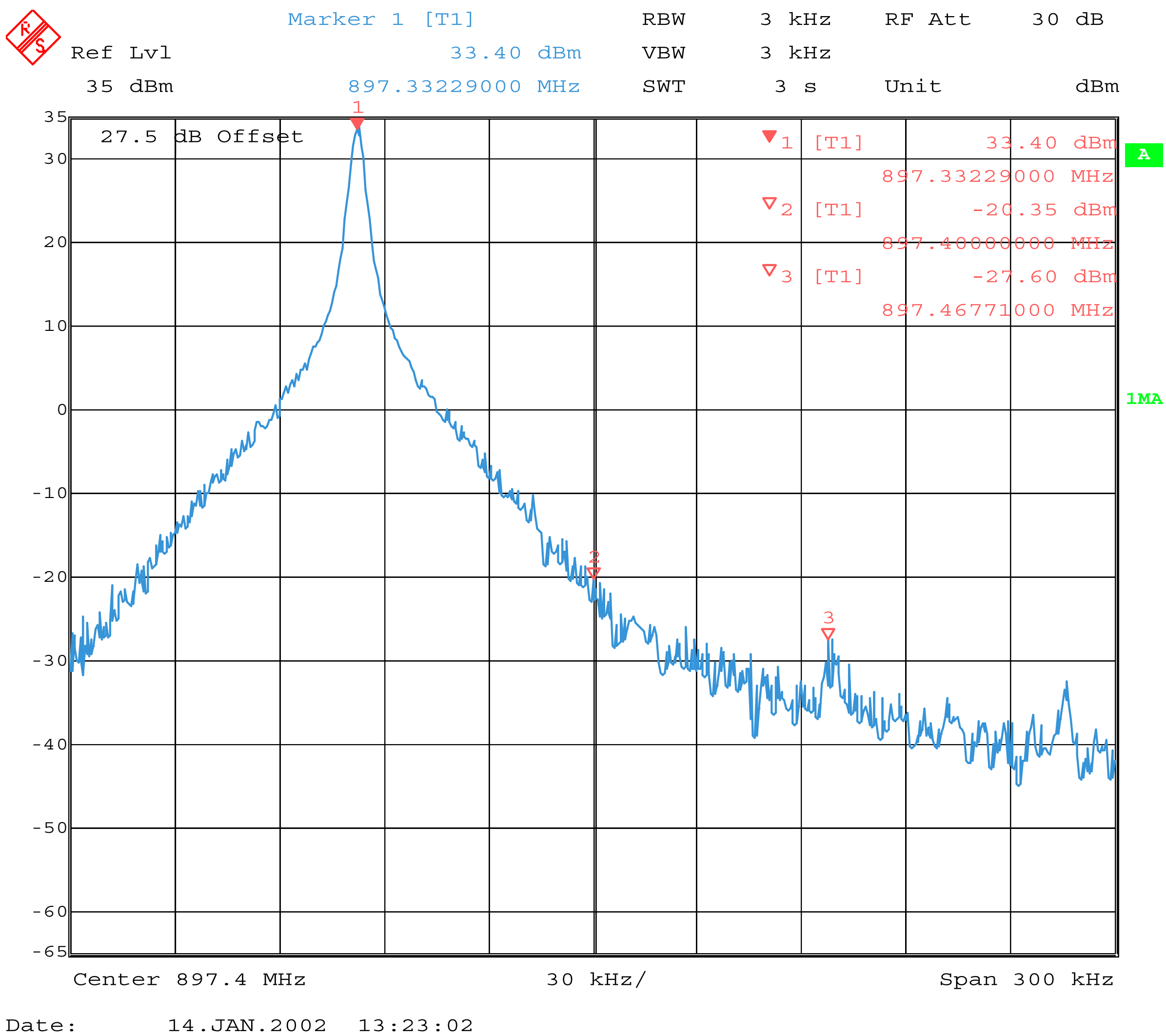
Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but even possible.

The Spectrum Analyzer now shows a plot like this:



Use the variables 'Amplitude difference' and 'Phase difference' to adjust the +67kHz signal to a minimum level (Marker 3). After tuning to the minimum the level difference between the peak levels at marker 1 and 3 must exceed 40dB. Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but even possible.

The Spectrum Analyzer now shows a plot like this:



Press Save and Continue in order to continue with the next band.

Note: The optimal values for I and Q Offset and Amplitude and Phase Difference vary from phone to phone.

GSM1800 (DCS/PCN)

If a spectrum analyzer is used then use the following settings.

Table 5:

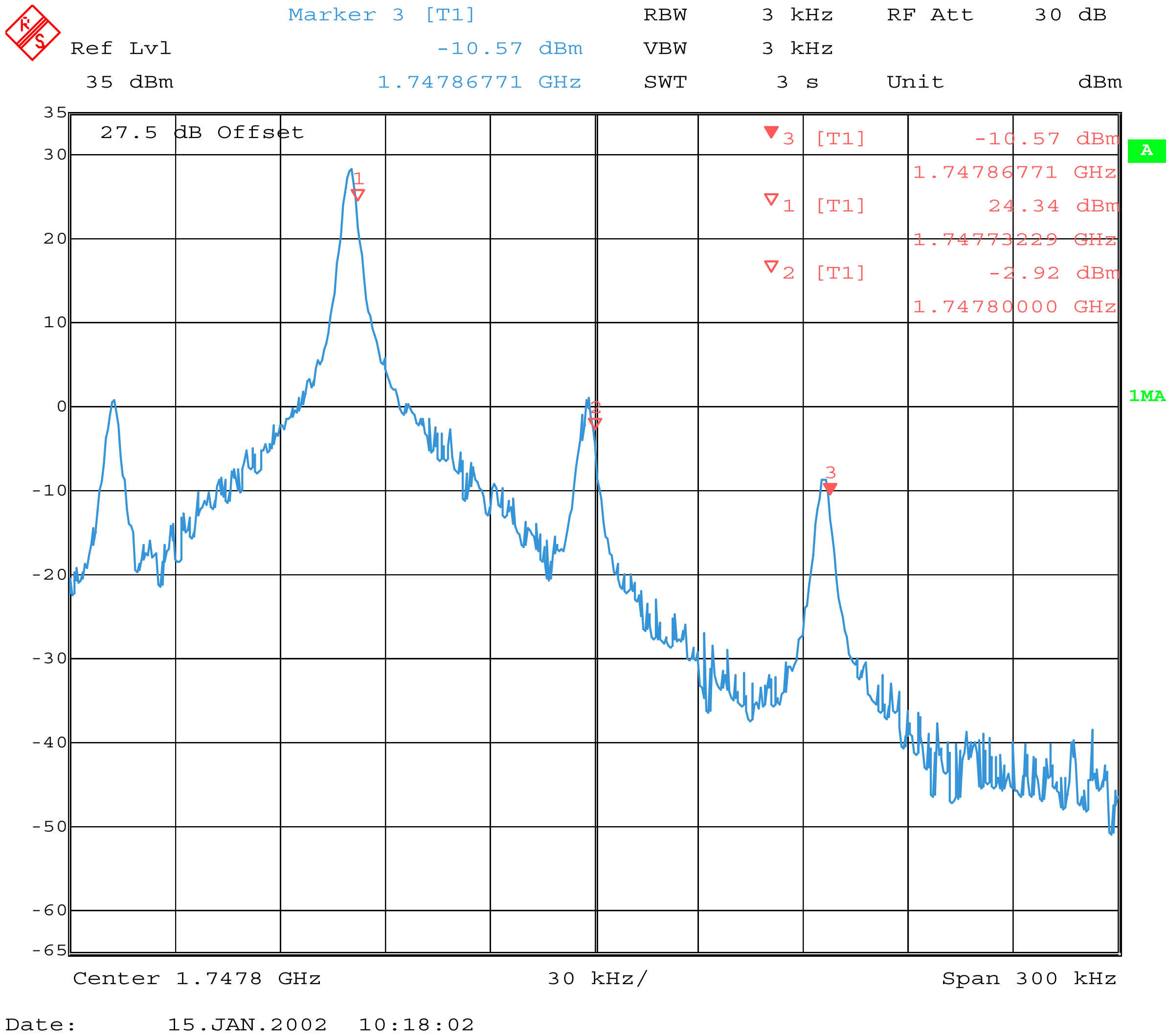
	GSM1800
Center Frequency	1747.8MHz
Frequency Span	200/300 kHz
Resolution Bandwidth	3 kHz
Video Bandwidth	3 kHz
Sweep Time	3 sec.
Sweep Type	Clear/Write
Detector Type	Max Peak
Reference level	35 dBm
Marker 1	1747.73229 MHz
Marker 2	1747.8 MHz
Marker 3	1747.86771 MHz

The following default values of the main tool bar should be used:

Band	GSM 1800
Active Unit	TX
Operation Mode	Burst
RX/TX Channel	700
TX PA Mode	Free
TX Data Type	All1

Select TX Power Level 0 from the RF Controls window.

The Spectrum Analyzer now shows a plot like this:

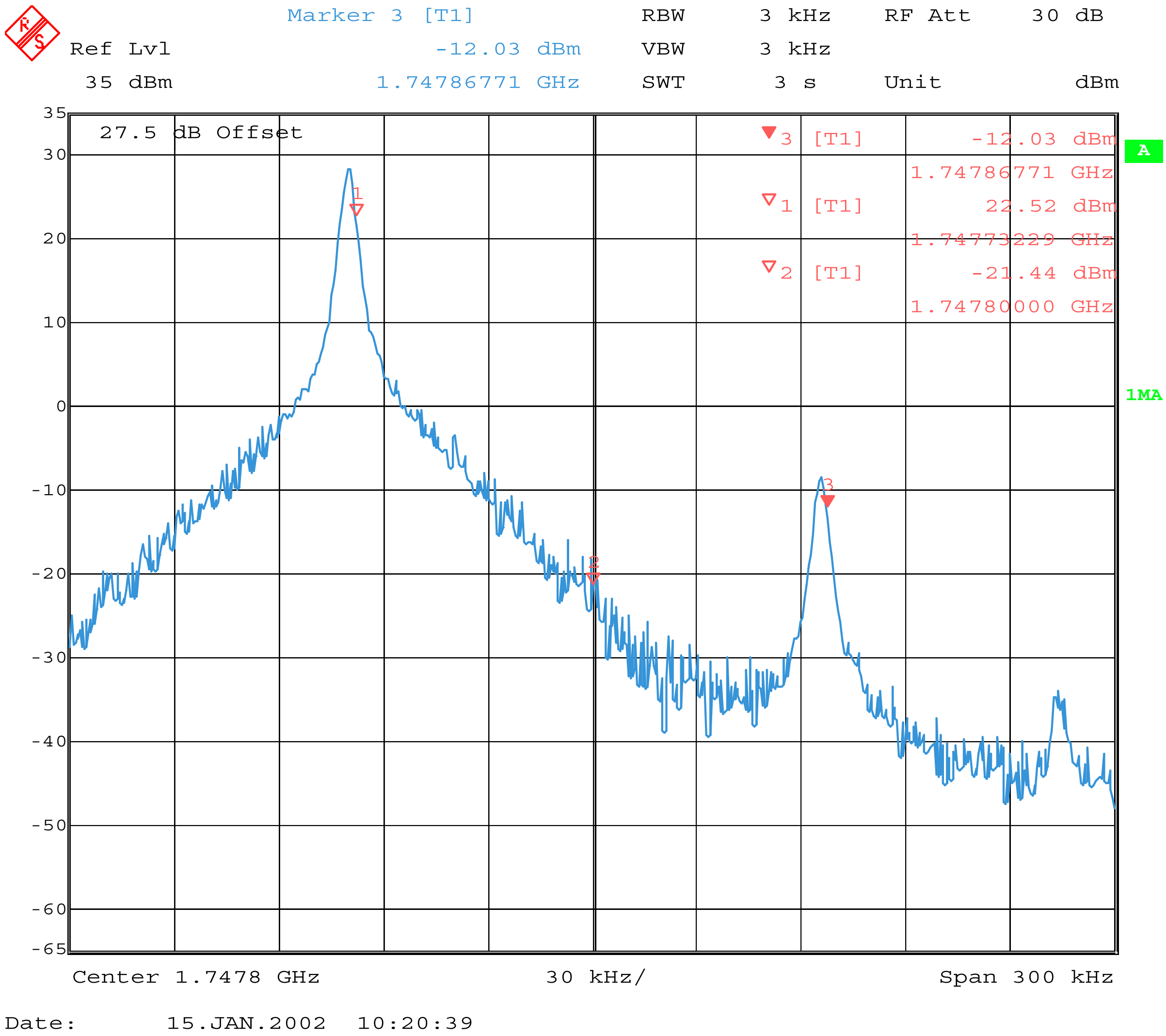


The purpose of this tuning is to tune the carrier signal and the +67kHz signal to a minimum level (Marker 2 and 3).

Use the variables 'TX I DC offset' and 'TX Q DC offset' to adjust the carrier signal to a minimum level (Marker 2). After tuning to the minimum the level difference between the peak levels at marker 1 and 2 must exceed 40dB.

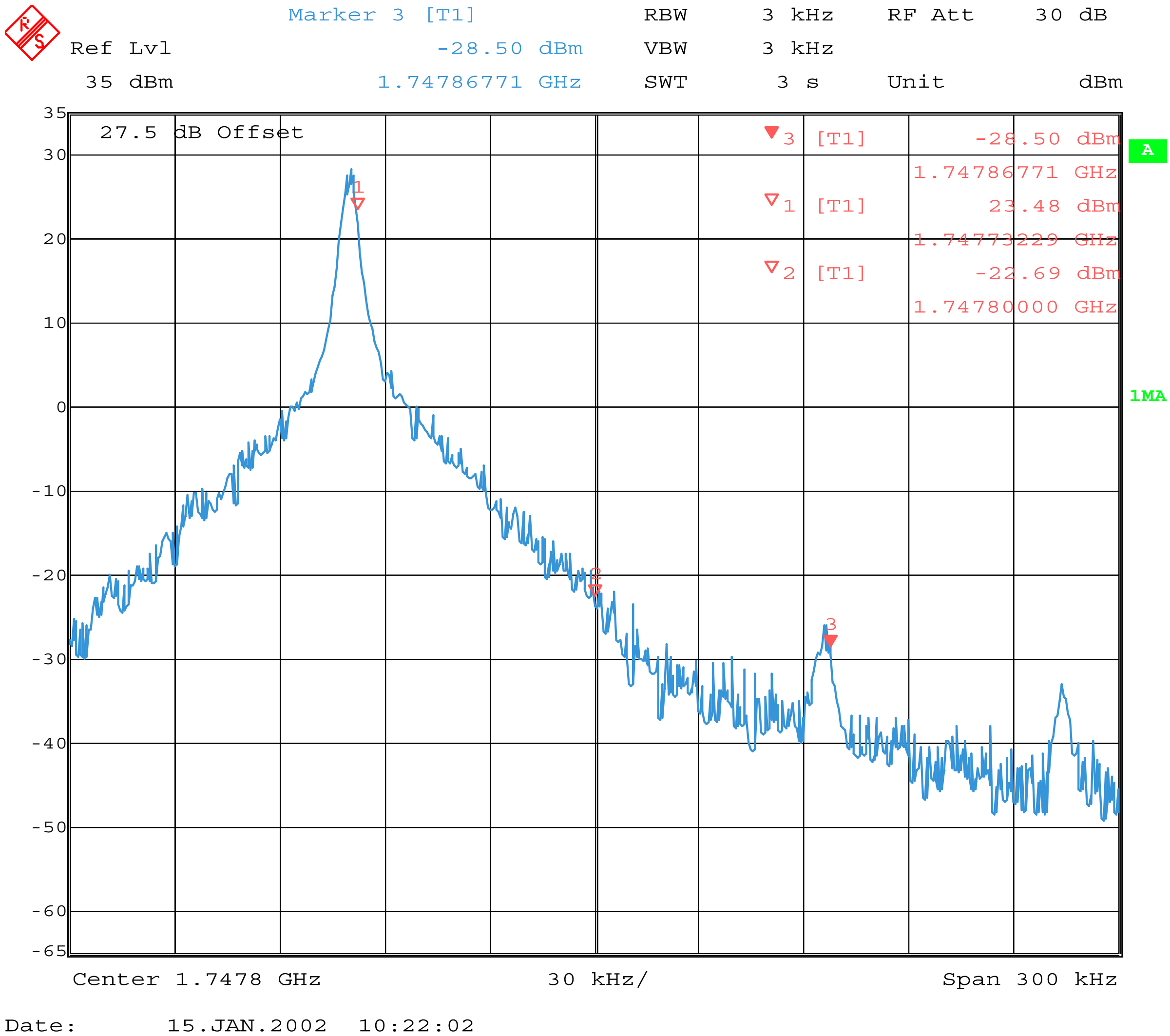
Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but possible.

The Spectrum Analyzer now shows a plot like this:



Use the variables 'Amplitude difference' and 'Phase difference' to adjust the +67kHz signal to a minimum level (Marker 3). After tuning to the minimum the level difference between the peak levels at marker 1 and 3 must exceed 40dB. Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but even possible.

The Spectrum Analyzer now shows a plot like this:



Press Save and Continue in order to continue with the next band.

Note: The optimal values for I and Q Offset and Amplitude and Phase Difference vary from phone to phone.

GSM1900 (PCS)

If a spectrum analyzer is used then use the following settings.

Table 6:

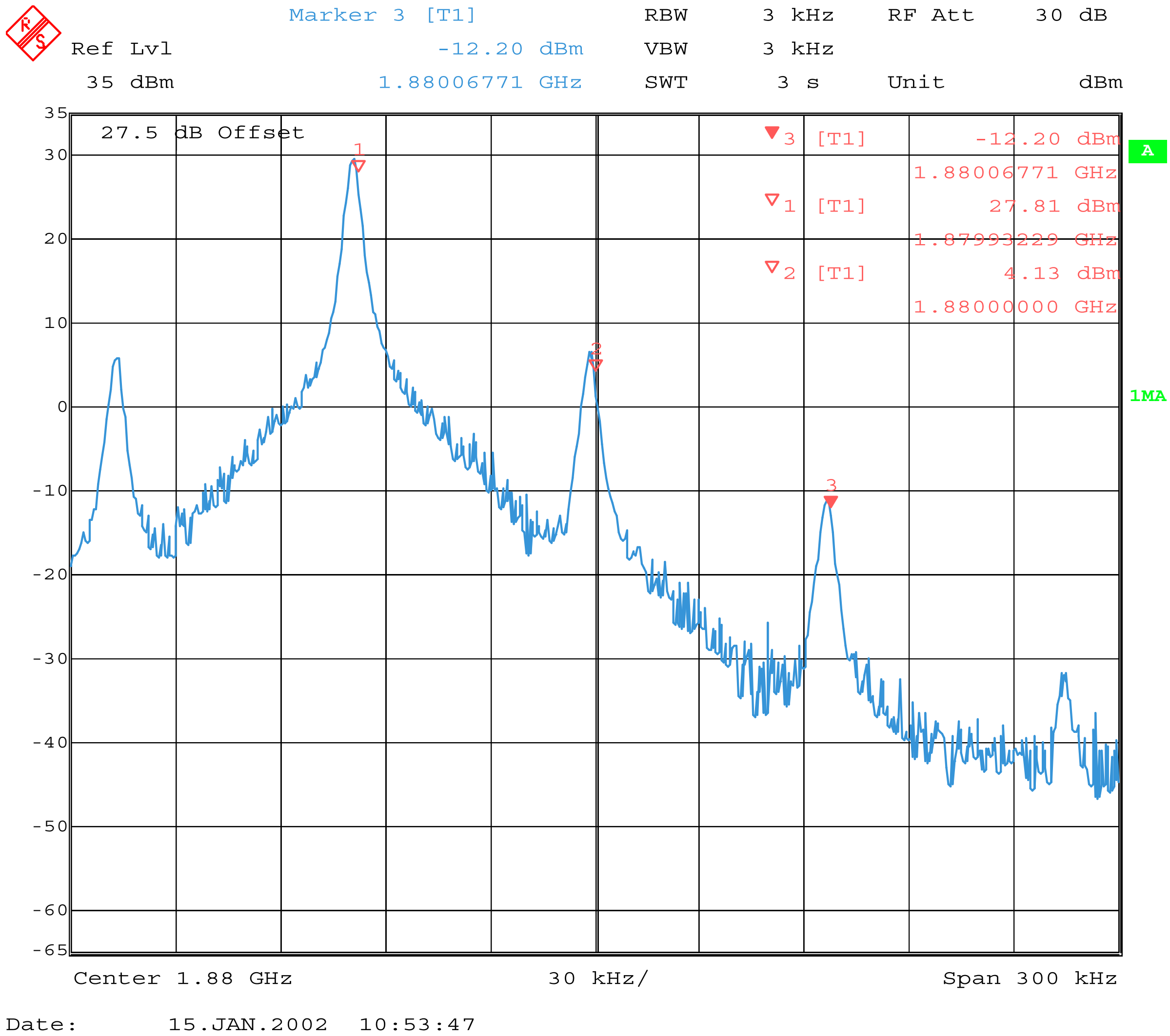
	GSM1900
Center Frequency	1880MHz
Frequency Span	200/300 kHz
Resolution Bandwidth	3 kHz
Video Bandwidth	3 kHz
Sweep Time	3 sek.
Sweep Type	Clear/Write
Detector Type	Max Peak
Reference level	35 dBm
Marker 1	1879.93229 MHz
Marker 2	1880 MHz
Marker 3	1880.06771 MHz

The following default values of the main tool bar should be used:

Band	GSM 1900
Active Unit	TX
Operation Mode	Burst
RX/TX Channel	661
TX PA Mode	Free
TX Data Type	All1

Select TX Power Level 0 from the RF Controls window.

The Spectrum Analyzer now shows a plot like this:



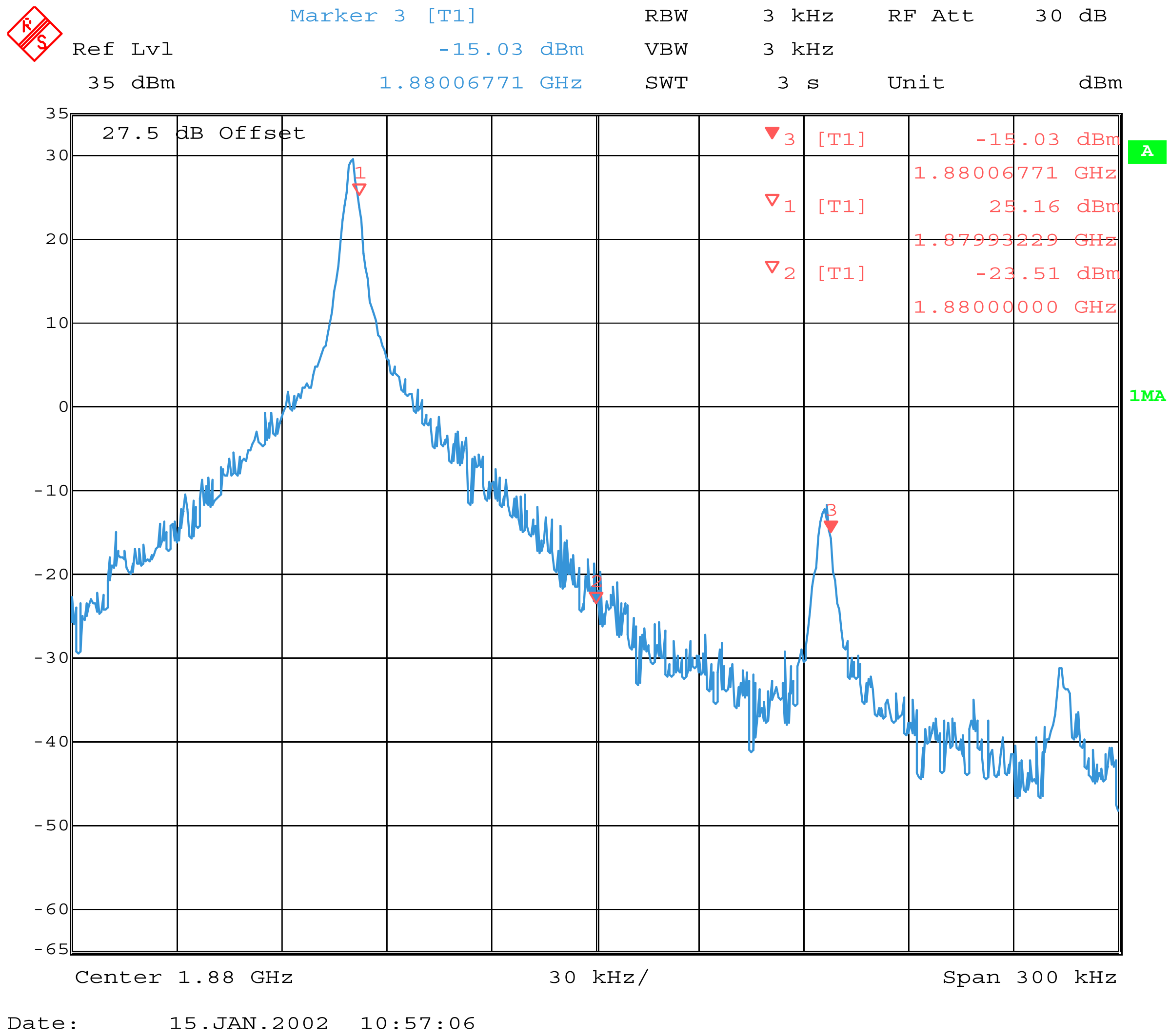
The purpose of this tuning is to tune the carrier signal and the +67kHz signal to a minimum level (Marker 2 and 3).

Use the variables 'TX I DC offset' and 'TX Q DC offset' to adjust the carrier signal to a minimum level (Marker 2).

After tuning to the minimum the level difference between the peak levels at marker 1 and 2 must exceed 40dB.

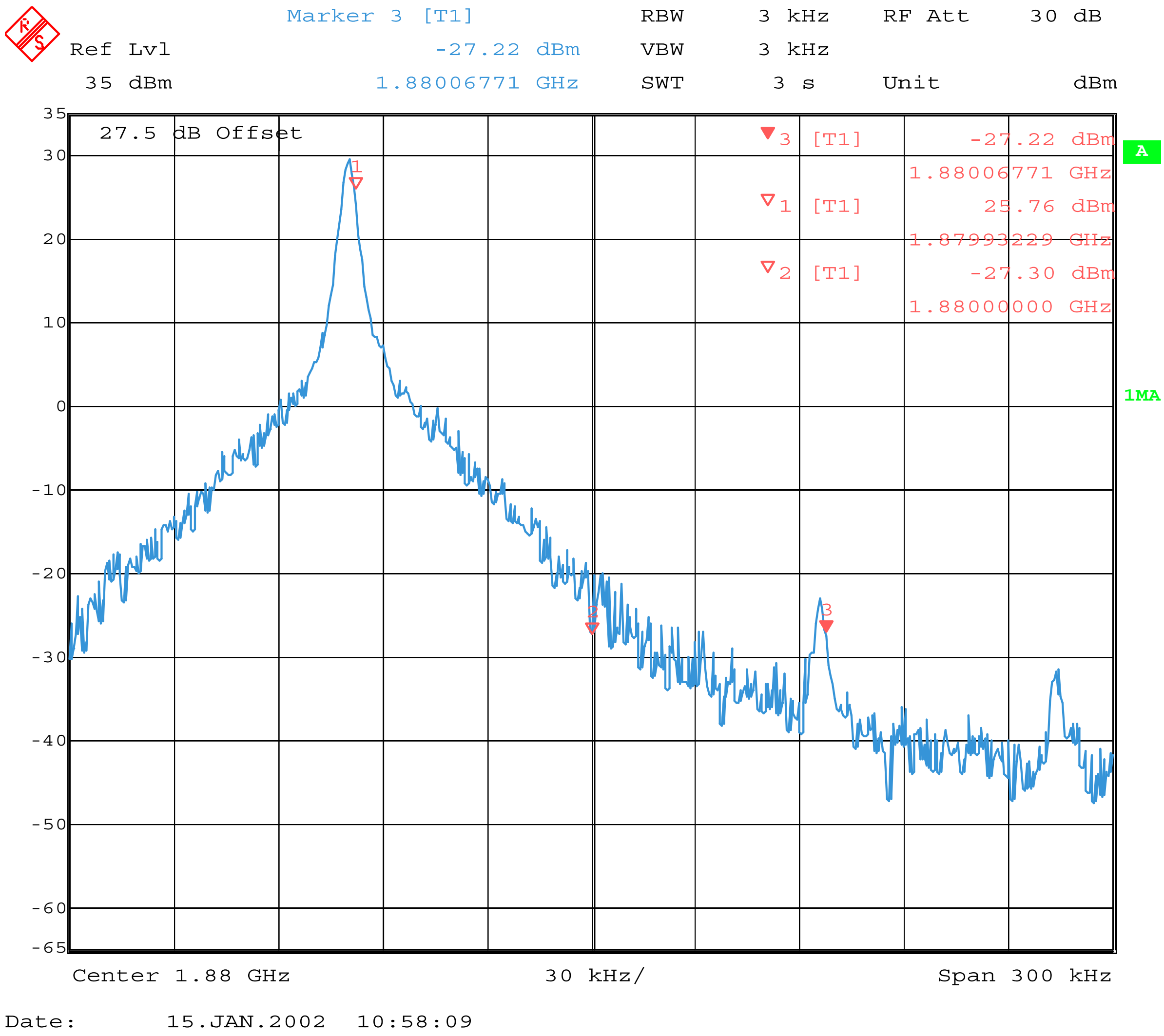
Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but even possible.

The Spectrum Analyzer now shows a plot like this:



Use the variables 'Amplitude difference' and Phase difference' to adjust the +67KHz signal to a minimum level (Marker 3). After tuning to the minimum the level difference between the peak levels at marker 1 and 3 must exceed 40dB, Tuning is possible by using arrow keys on the keyboard. Pushing the sliders by using the mouse is less sensitive but even possible.

The Spectrum Analyzer now shows a plot like this:



Press Save and Continue to finish the TX IQ tuning.

Note! The optimal values for I and Q Offset, Amplitude and Phase Difference vary from phone to phone.

Bluetooth Troubleshooting

CBUS

CBUS is a three wire serial interface between the main baseband components. The bus consists of data, clock and bus_enable signals. In NEM-4 the bus is connected from UPP WD2 to ZOCUS, UEM and LPRF. UPP_WD2 takes care of controlling the traffic on the bus.

If the interface is faulty from the UPP WD2's end the phone won't boot properly as powering configurations don't work. Traffic on the bus can be monitored from three pins on the LPRF module. Pins 34, 35 and 36.

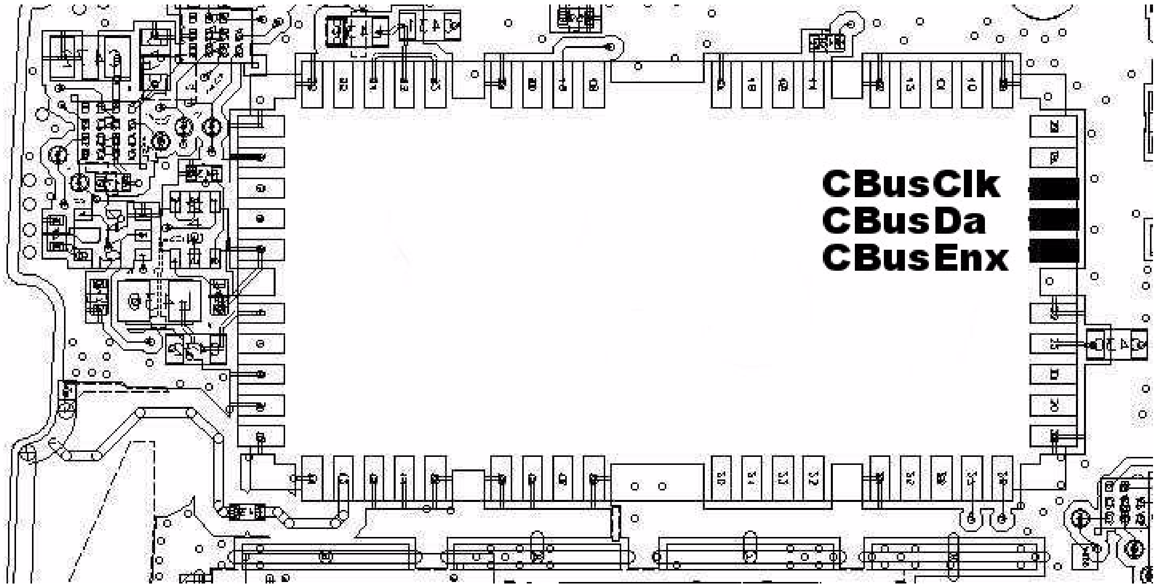
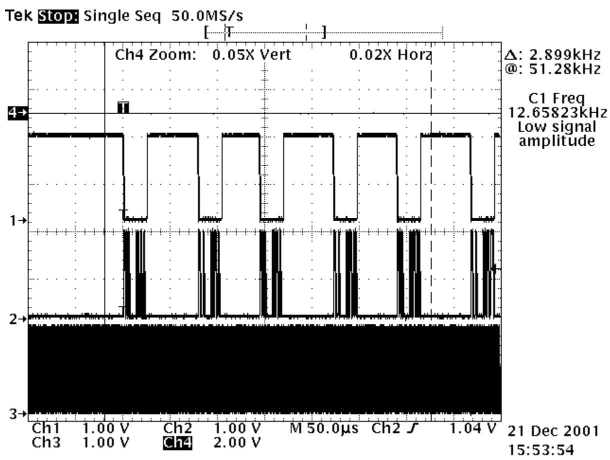


Figure 1: CBUS measuring points

In the pictures below CBUS traffic at bootup is shown. CbusEnx is connected to Ch1, Cbus Da to Ch2 and CbusClk to Ch3.



If however you are able to get the phone to boot up and can reach Phoenix BB self tests it is possible to test the functionality of each component attached to Cbus. Use

ST_UEM_CBUS_IF_TEST to test UEM Cbus interface

ST_LPRF_IF_TEST to test Bluetooth Cbus interface

If an error is found testing any of the above components you should replace the failing component.

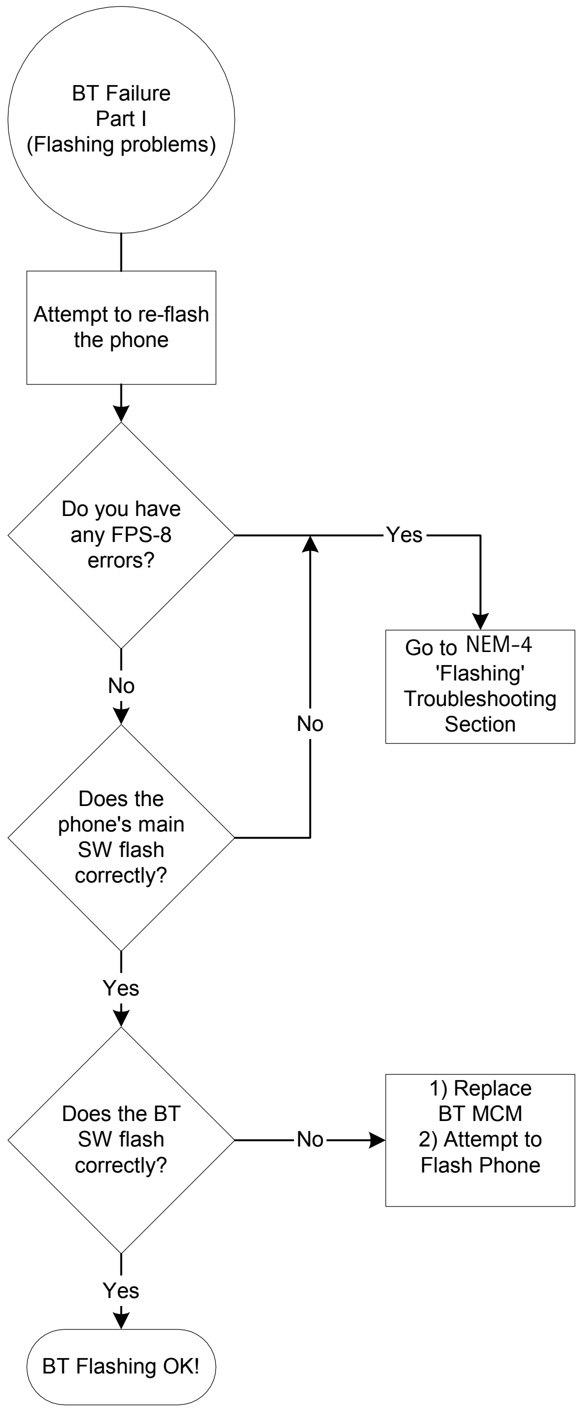
FBUS

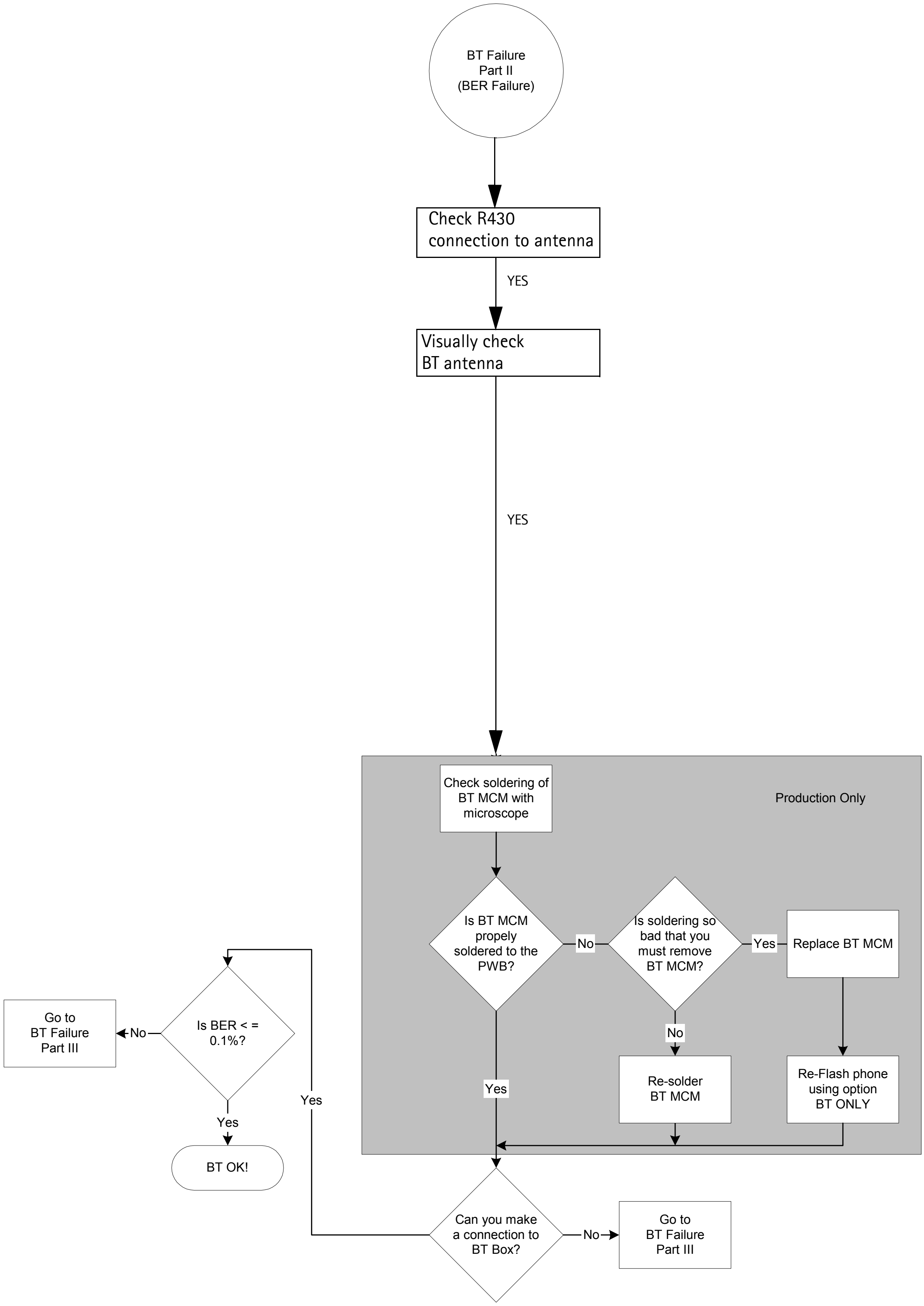
FBUS is a two wire RX and TX interface between UPP and flash/test interface. The bus goes through UEM which adjusts the voltage levels to suit UPP_WD2. The interface voltage level on the phone flash/test pad pattern is 2.78V and on the UPP WD2 end it is 1.8V. The functionality of this interface should not affect the device boot into NORMAL, LOCAL nor TEST modes. Phoenix tests can be performed through MBUS interface in the case of a failure in FBUS interface. Flashing is not possible if there is a problem in FBUS.

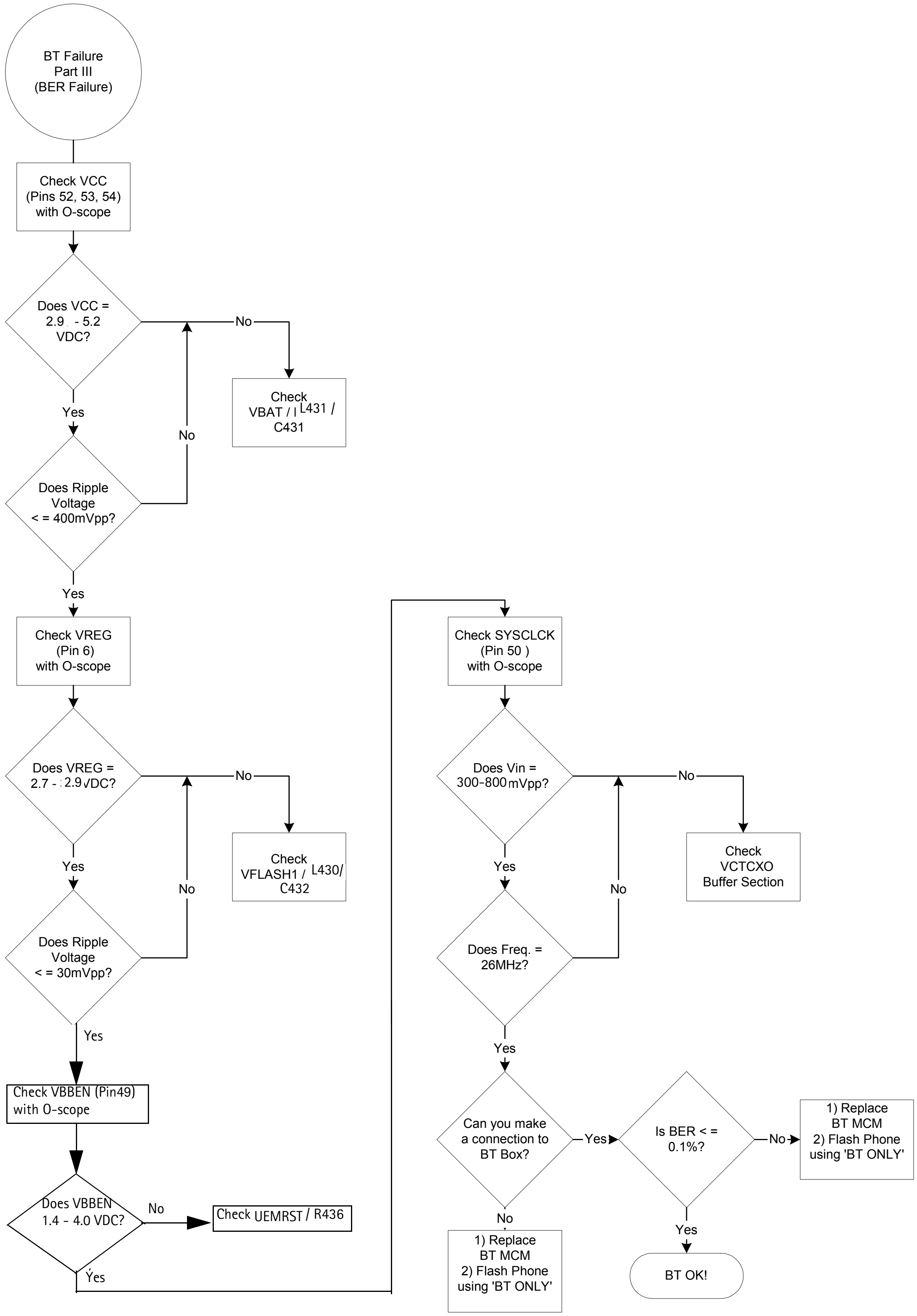
MBUS

MBUS is a two wire RX and TX interface between UPP and UEM. From UEM the interface continues to flash/test interface as a one wire interface. UEM also adjusts the voltage levels. The interface voltage level on the phone flash/test pad pattern is 2.78V and on the UPP WD2 end it is 1.8V. MBUS traffic between UPP WD2 and UEM can be tested with PHOENIX (ST_MBUS_RX_TX_LOOP_TEST). Flashing is not possible if there is a problem in MBUS.

Bluetooth Troubleshooting diagrams




BT Failure
Part II
(BER Failure)
Check R430
connection to antenna
YES
Visually check
BT antenna
YES
Production Only
Check soldering of
BT MCM with
microscope
Is BT MCM
propely
soldered to the
PWB?
No
Is soldering so
bad that you
must remove
BT MCM?
Yes
Replace BT MCM
No
Re-solder
BT MCM
Re-Flash phone
using option
BT ONLY
Yes
Can you make
a connection to
BT Box?
No
Go to
BT Failure
Part III
Yes
Is BER < =
0.1%?
No
Go to
BT Failure
Part III
Yes
BT OK!


BT Failure
Part III
(BER Failure)
Check VCC
(Pins 52, 53, 54)
with O-scope
Does VCC =
2.9 - 5.2
VDC?
No
Check
VBAT / L431 /
C431
Yes
No
Does Ripple
Voltage
< = 400mVpp?
Yes
Check VREG
(Pin 6)
with O-scope
Does VREG =
2.7 - 2.9 VDC?
No
Check
VFLASH1 / L430/
C432
Yes
No
Does Ripple
Voltage
< = 30mVpp?
Yes
Check VBBEN (Pin49)
with O-scope
Does VBBEN
1.4 - 4.0 VDC?
No
Check UEMRST / R436
Yes
Check SYSCLCK
(Pin 50)
with O-scope
Does Vin =
300-800mVpp?
No
Check
VCTCXO
Buffer Section
Yes
No
Does Freq. =
26MHz?
Yes
Can you make
a connection to
BT Box?
Yes
Is BER < =
0.1%?
No
1) Replace
BT MCM
2) Flash Phone
using 'BT ONLY'
No
1) Replace
BT MCM
2) Flash Phone
using 'BT ONLY'
Yes
BT OK!

