6 - Troubleshooting

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Introduction

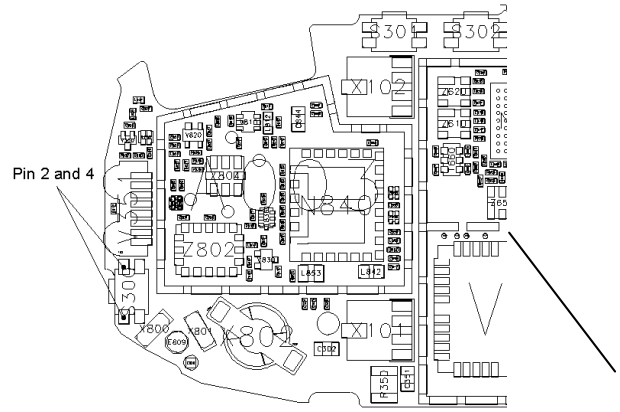
This section is a summary of experiences the NPE-4 R&D team made during the development. It covers some errors or wrong configurations and their symptoms as well as advice for problem solving. The section is seperated into two main parts the Baseband troubleshooting and the RF troubleshooting, however, it is advisable to read both parts.

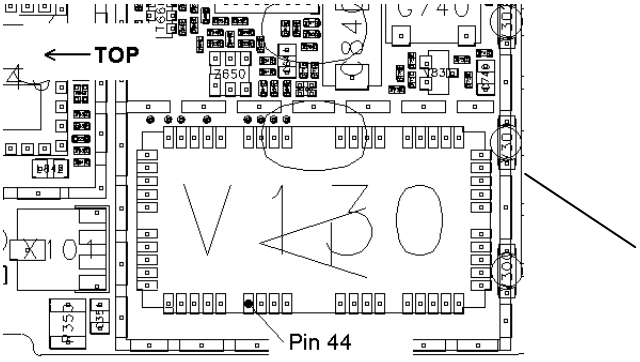
Baseband Troubleshooting

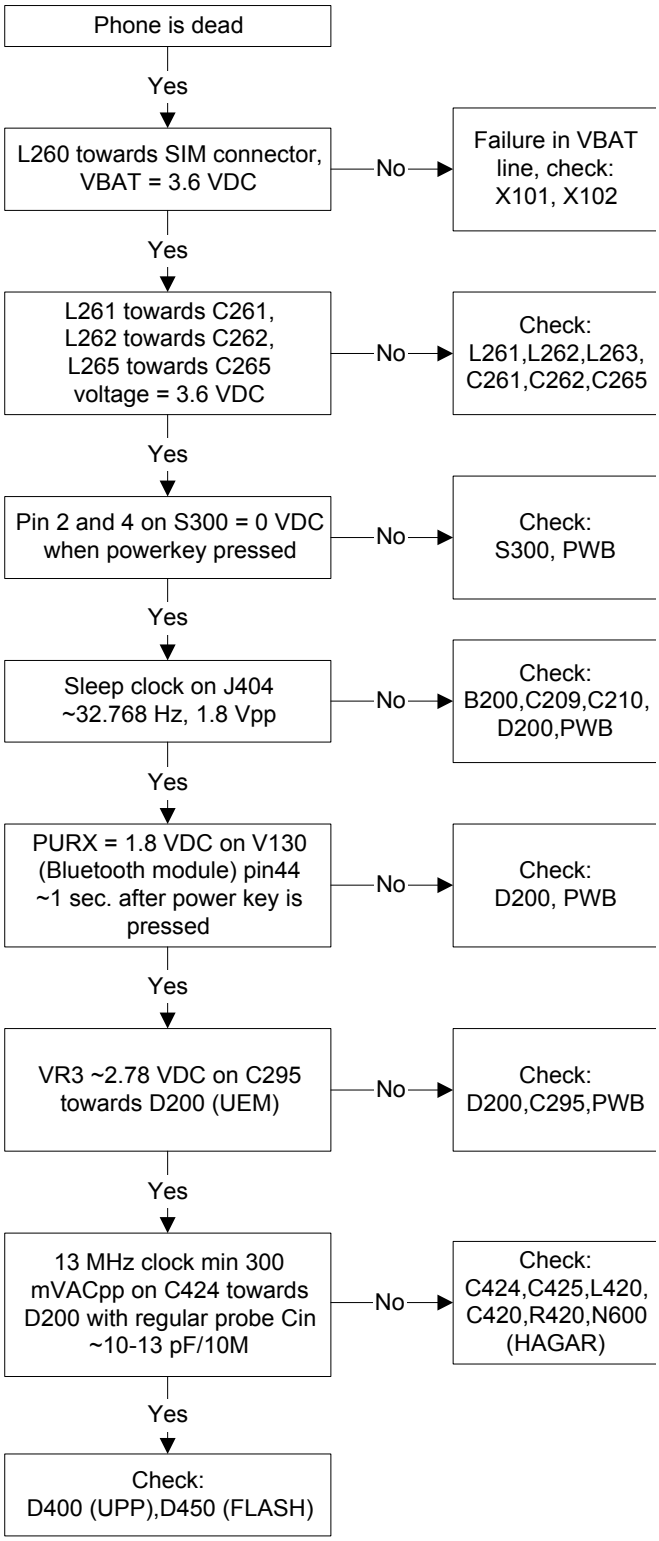
Phone is dead

This means that the phone does not use any current at all when supply is connected and/or powerkey is pressed.

It is assumed that the voltage supplied is 3.6 VDC. The UEM will prevent any functionality what so ever at battery/supply levels below 2.9 VDC.







Flash programming doesn't work

The flash programming can be done via the pads on the PWB or via system connector X100.
In production, the first programming is done via the pads on the PWB.

The main differences between these are:

a) Flash programming voltage is produced different way.

b) Signal routings are different.

In case of Flash failure in FLALI station, problem is most likely related to SMD problems. Possible failures could be Short circuiting of balls under µBGAs (UEM, UPP, FLASH). Missing or misaligned components.

In flash programming error cases the flash prommer can give some information about a fault.

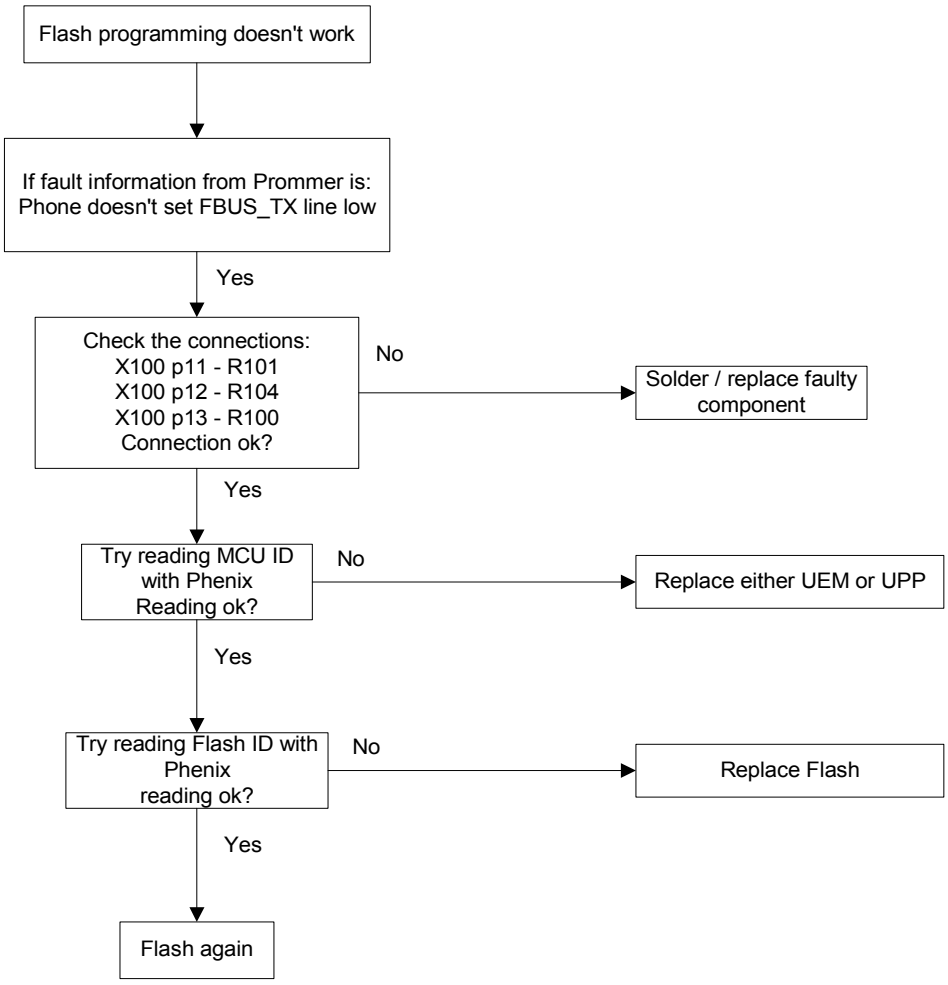
The fault information messages could be:

- Phone doesn't set FBUS_TX line low

The preliminary fault-finding diagrams for flash programming are shown in the next page.

Because of the use of uBGA components it is not possible to verify if there is a short circuit in control- and address lines of MCU (UPP) and memory (flash).

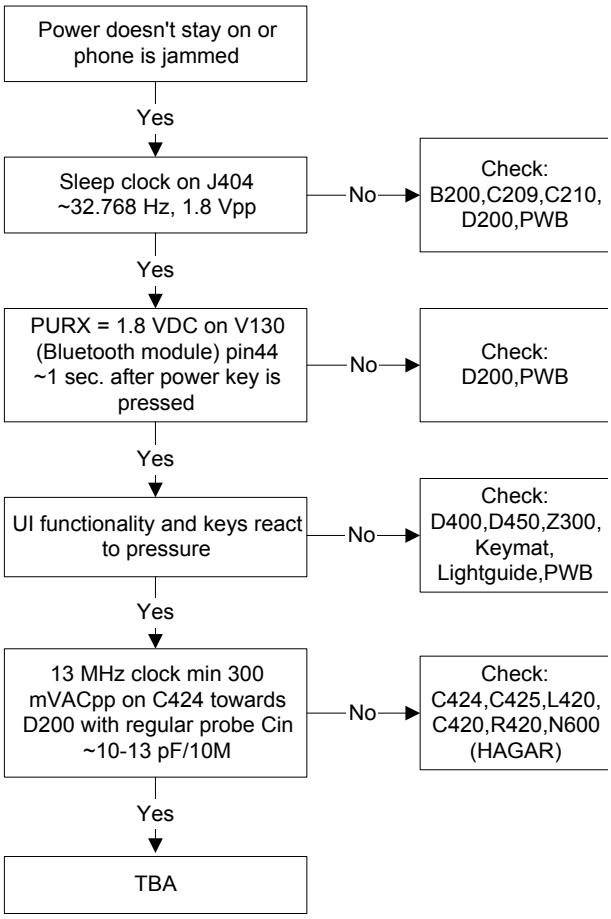
Flash programming



Power doesn't stay on, or phone is jammed

If this kind of failure is presenting itself immediately after FLALI, it is most likely caused by ASICs missing contact with PWB.

If for some reason the MCU does not service the watchdog register within the UEM, the operations watchdog will run out after approximately 32 seconds. Unfortunately, the service routine can not be measured.



Display Information: "Contact Service"

When this error appears in the display, it means that one or more of the internally Base-band tests has failed. The Baseband tests (selftests) are performed each time the phone is powered on. The selftests are devided into those performed while powering up (Start up tests), and the ones that can be executed with a PC using Phoenix (Runtime tests). The following Start-up tests are performed during power up:

UPP Register verfication test.

UEM CBUS Interface test.

SleepX loop test.

Aux. Data loop test.

Ear Data loop test.

Tx IDP loop test.

Tx IQ DP loop test.

SIM Clock loop test.

SIM I/O Control loop test.

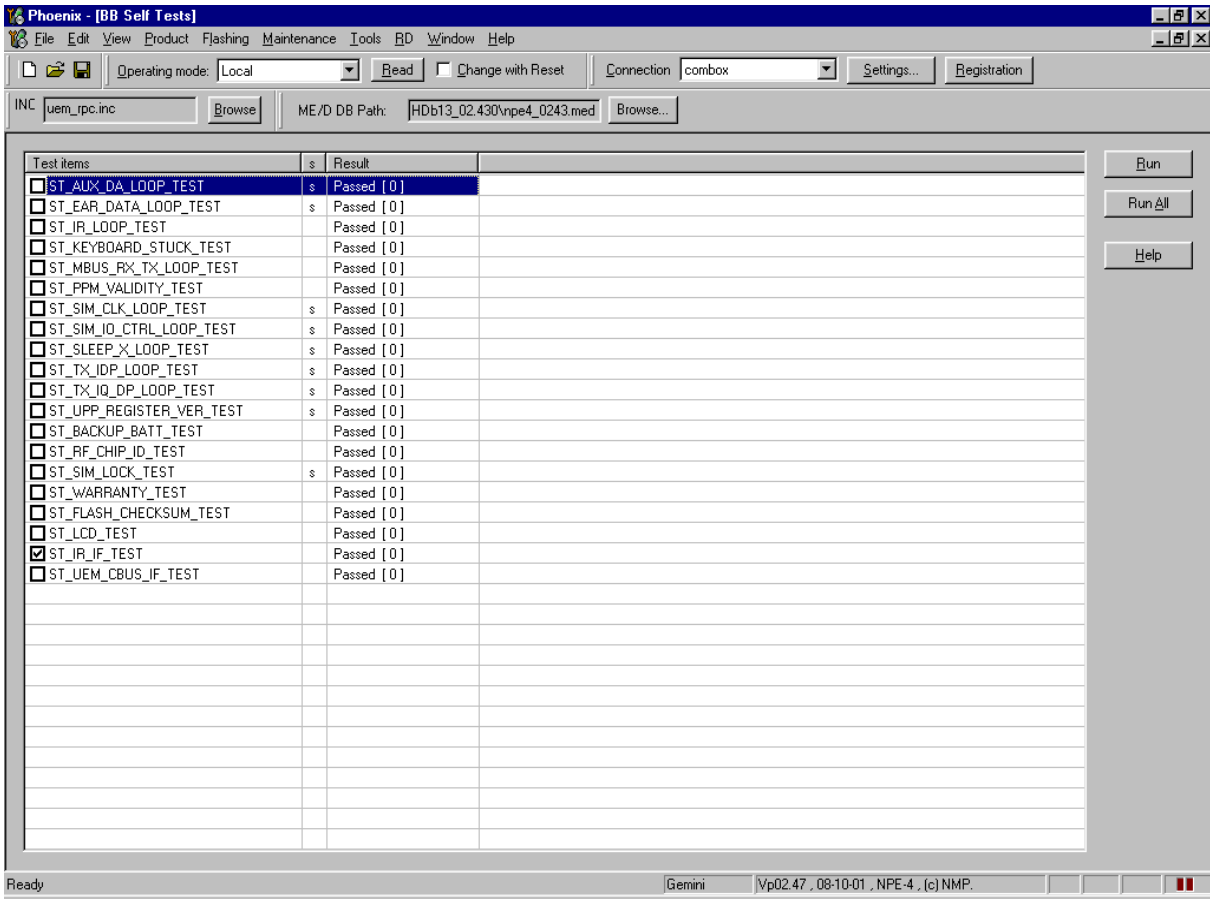
SIM Lock test.

PMM (Flash) Validity test.

PMM (Flash) Checksum test.

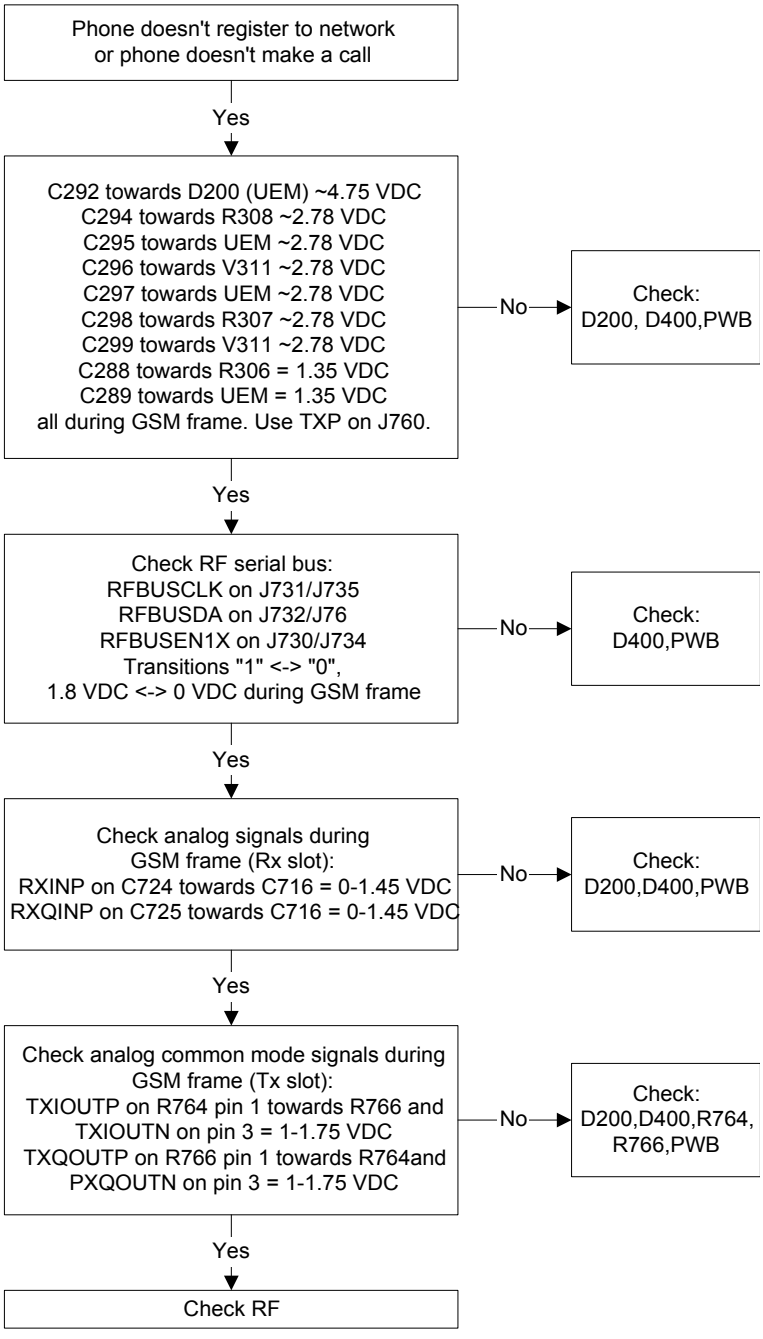
If all these selftests are passed, the phone will start-up.

From Phoenix it is possible to run all the selftest and the additional "Runtime test". The test cases can be seen below.



The phone doesn't register to the network or phone doesn't make a call

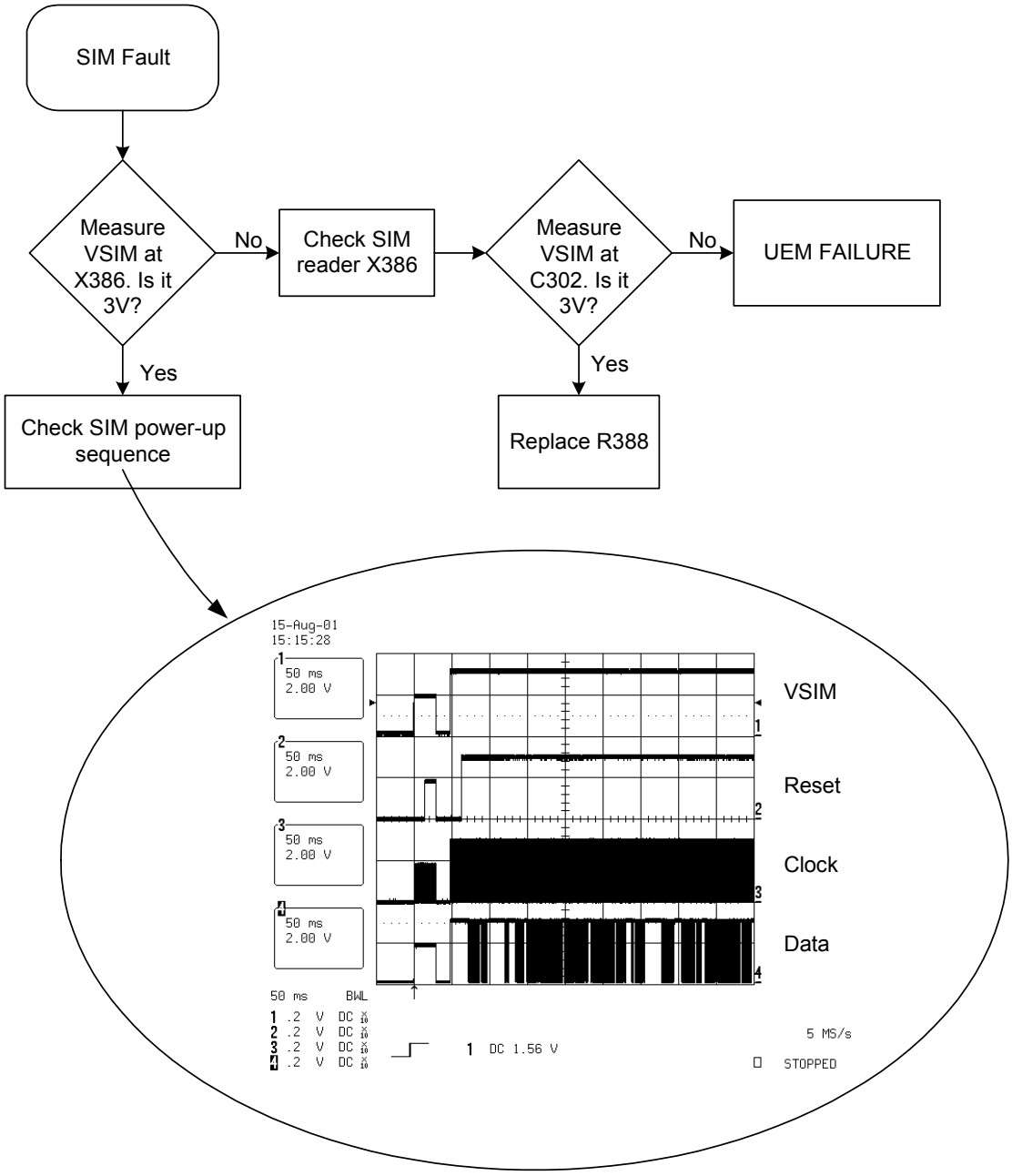
If the phone doesn't register to the network, the fault can be in either BB or RF. Due to the highly module design of the BB area, very few signals can be measured.



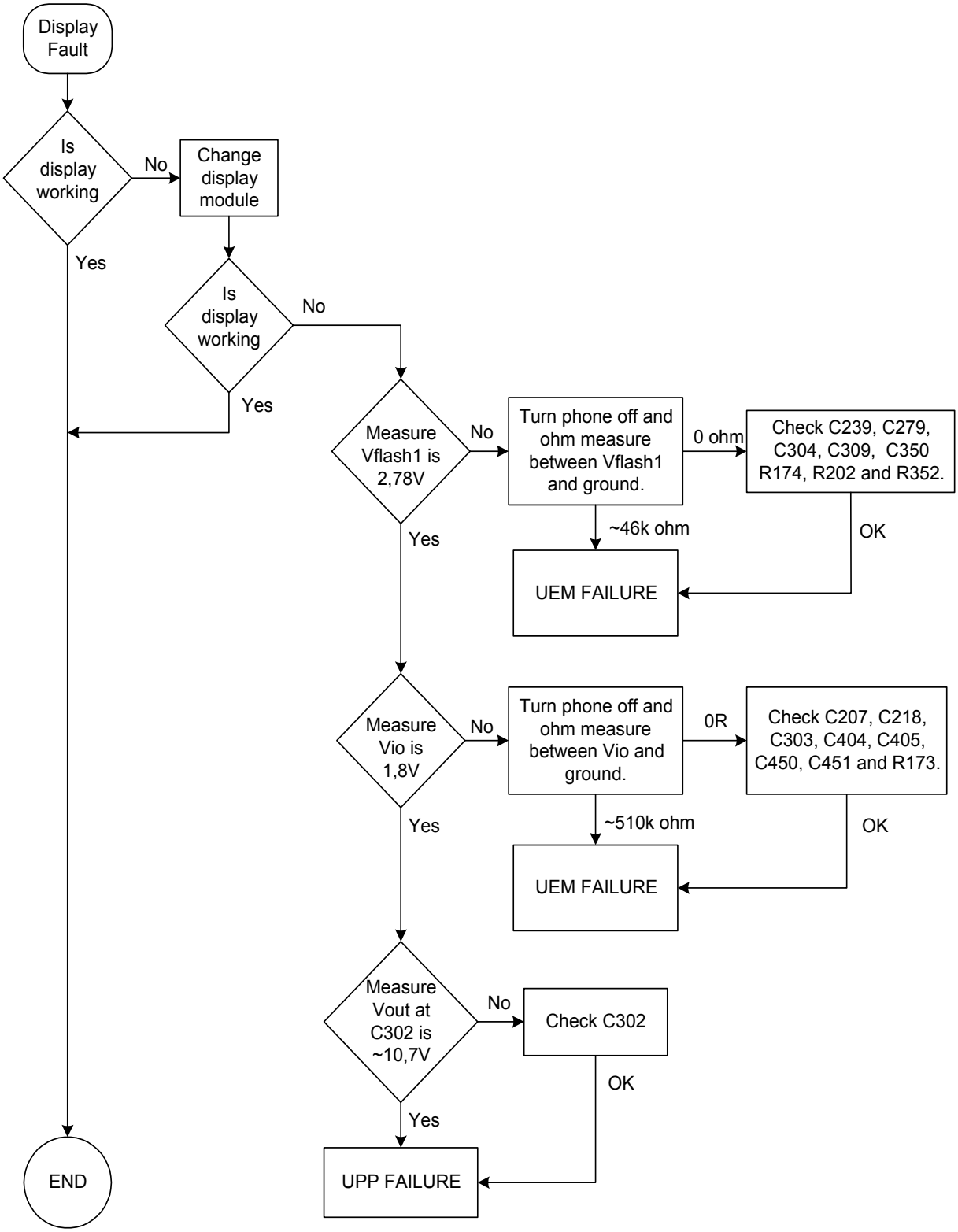
SIM Failure

The hardware of the SIM interface from UEM (D200) to the SIM connector (X386) can be tested without a SIM card. When the power is switched on the phone first check for a 1,8V SIM card and then a 3V SIM card. The phone will try this four times, whereafter it will display "Insert SIM card".

The error "SIM card rejected" means that the ATR message received from SIM card is corrupted, e.g. data signal levels are wrong. The first data is always ATR and it is sent from card to phone.

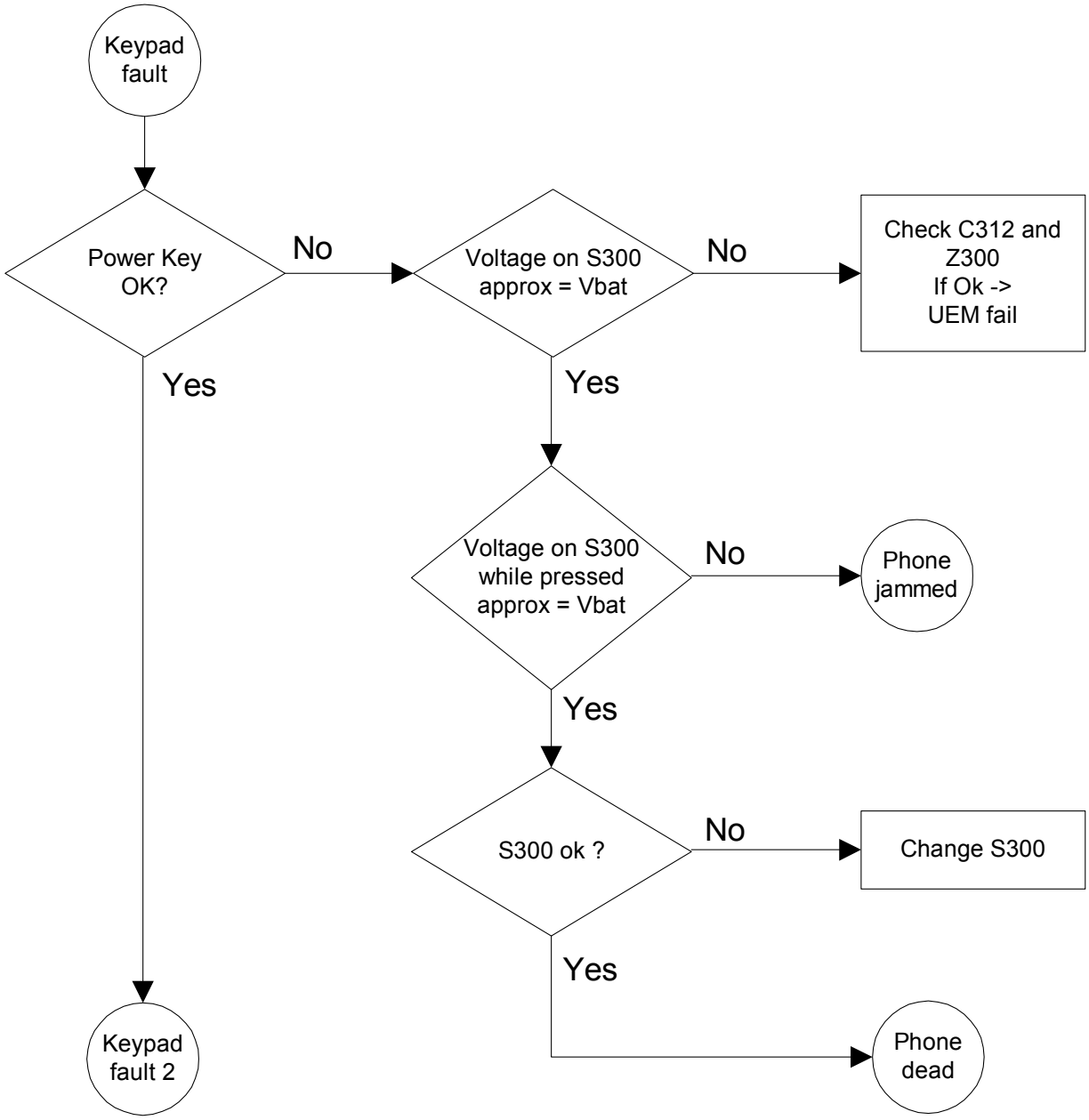


Display Failure

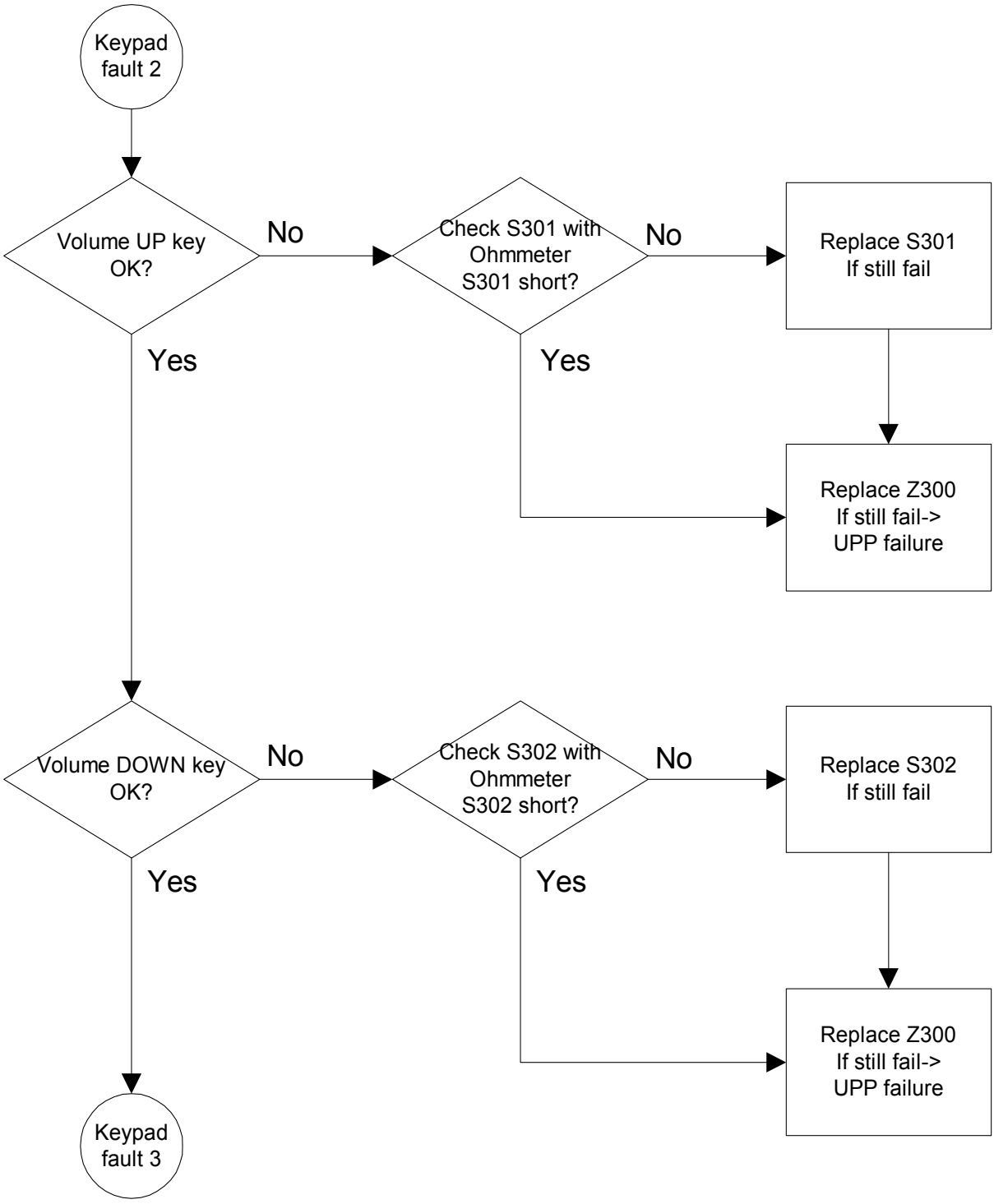


Keypad Failure

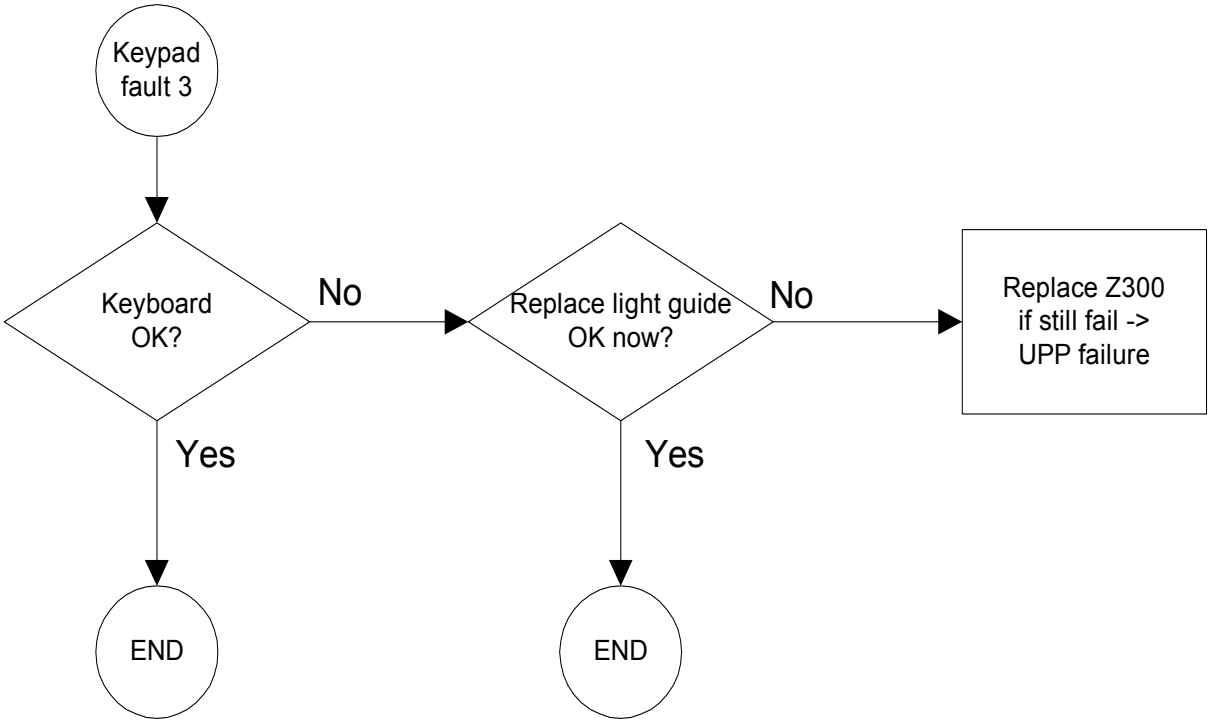
Power key failure



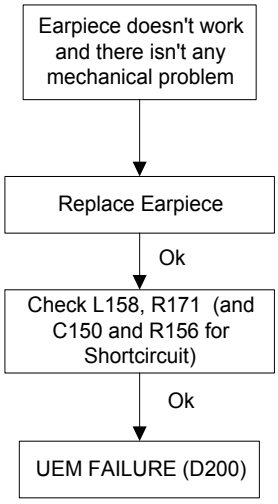
Volume key failure

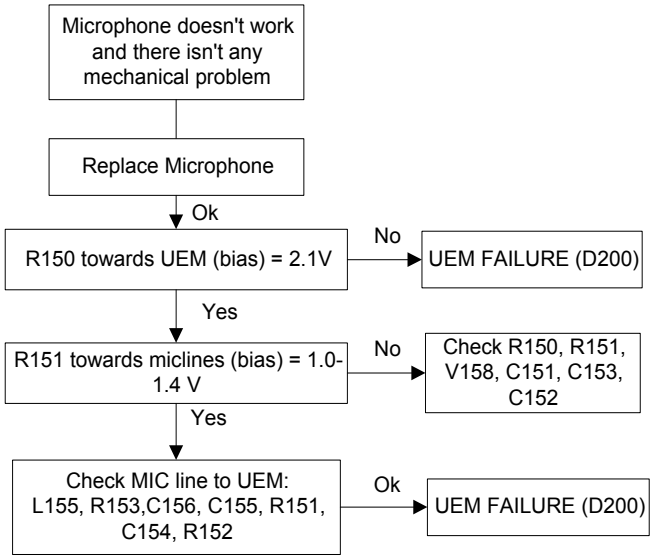


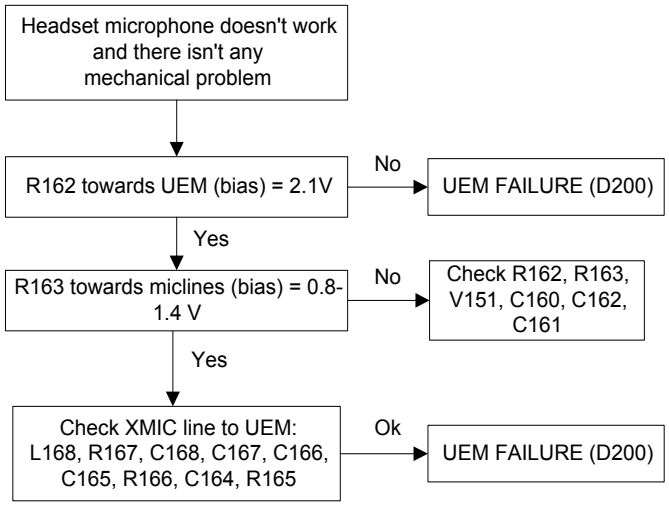
Keyboard failure

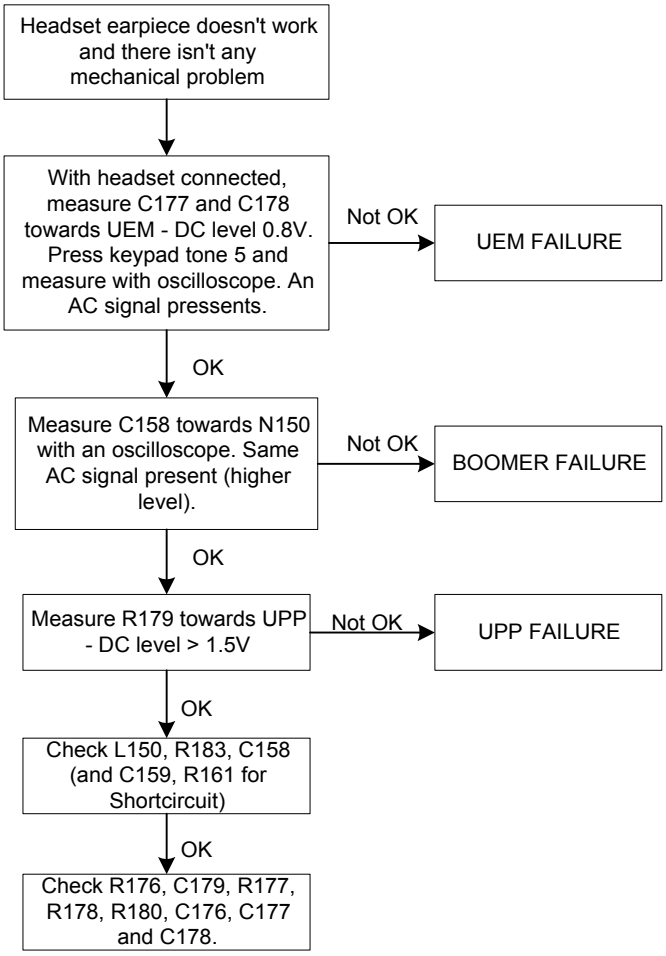


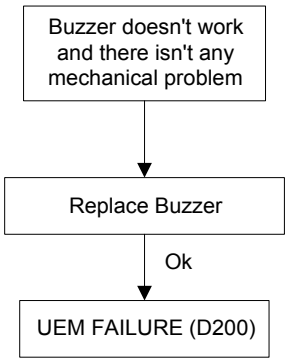
Audio faults

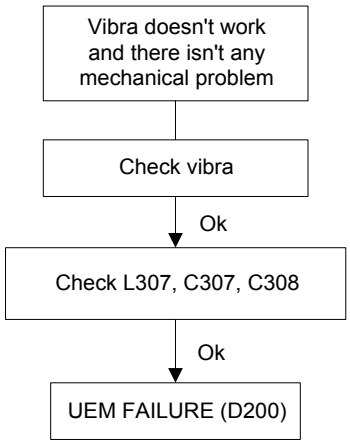




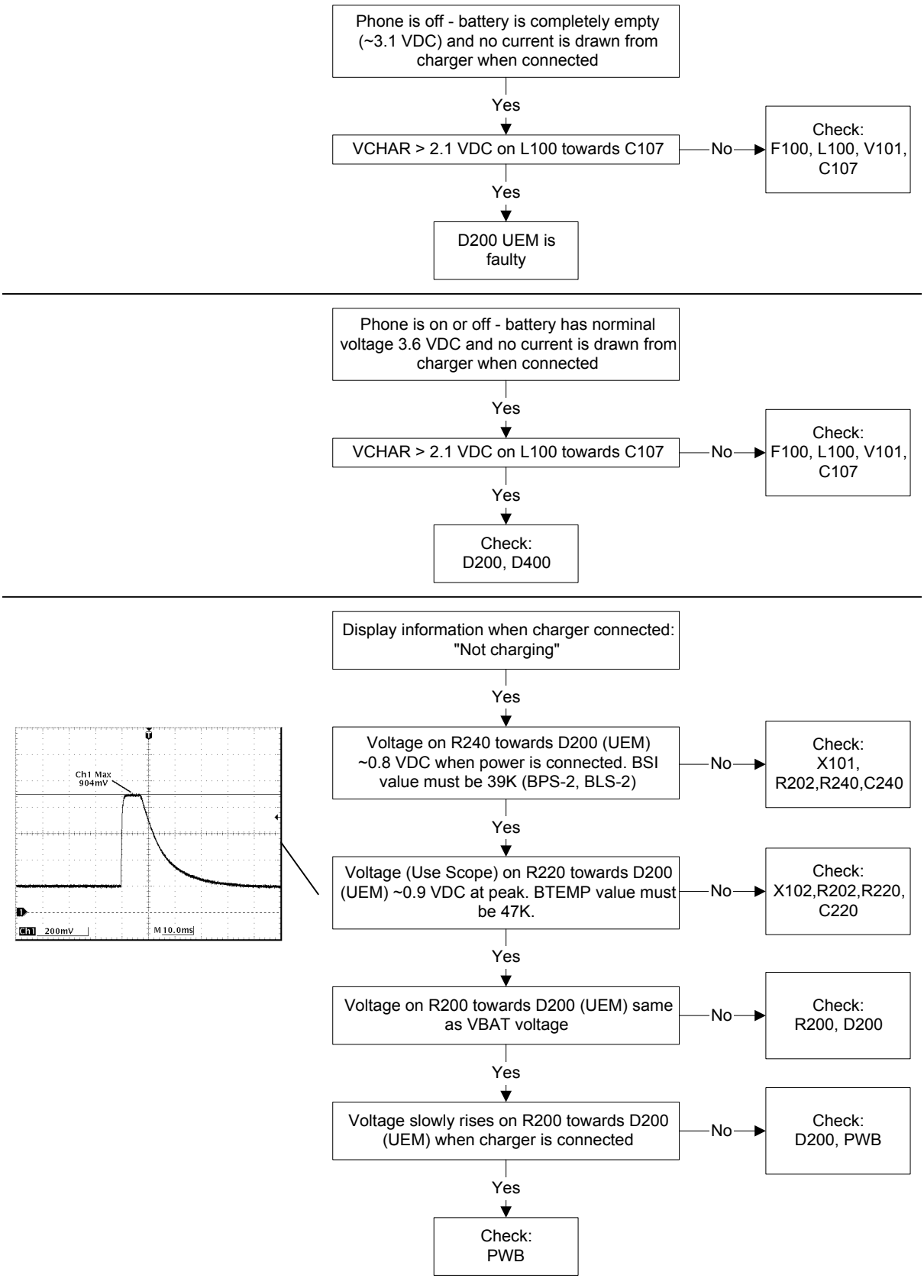




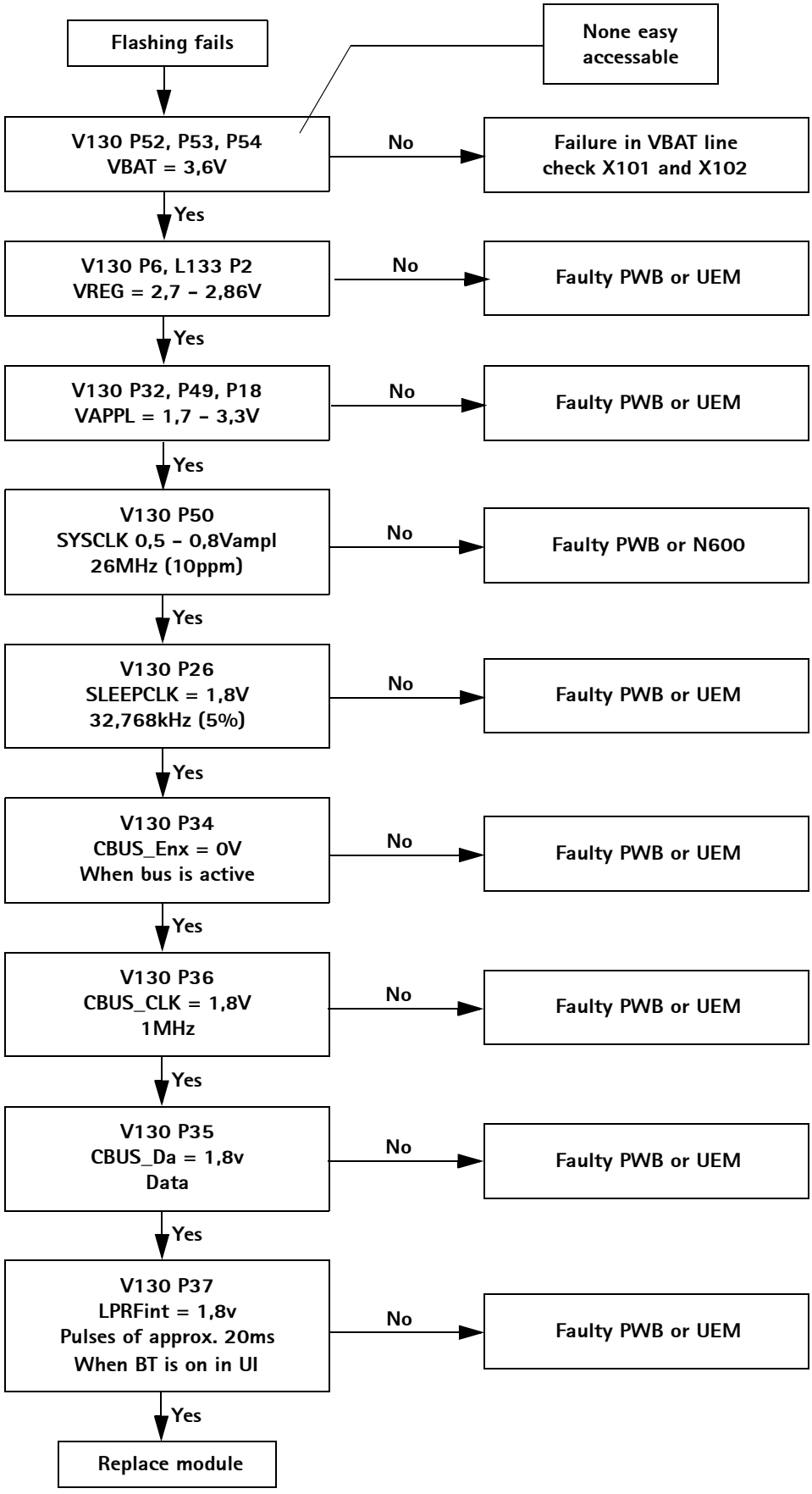




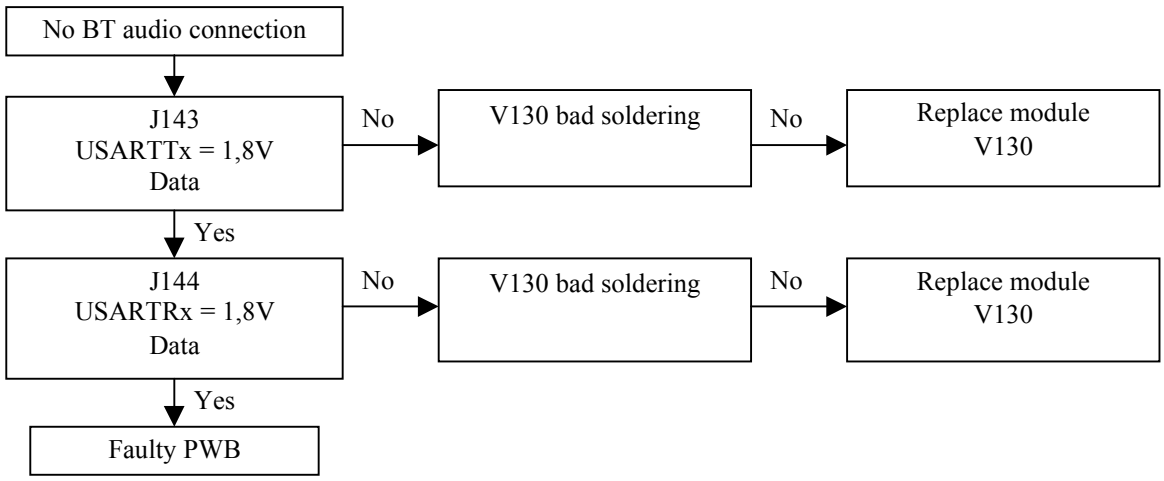
Charger failure

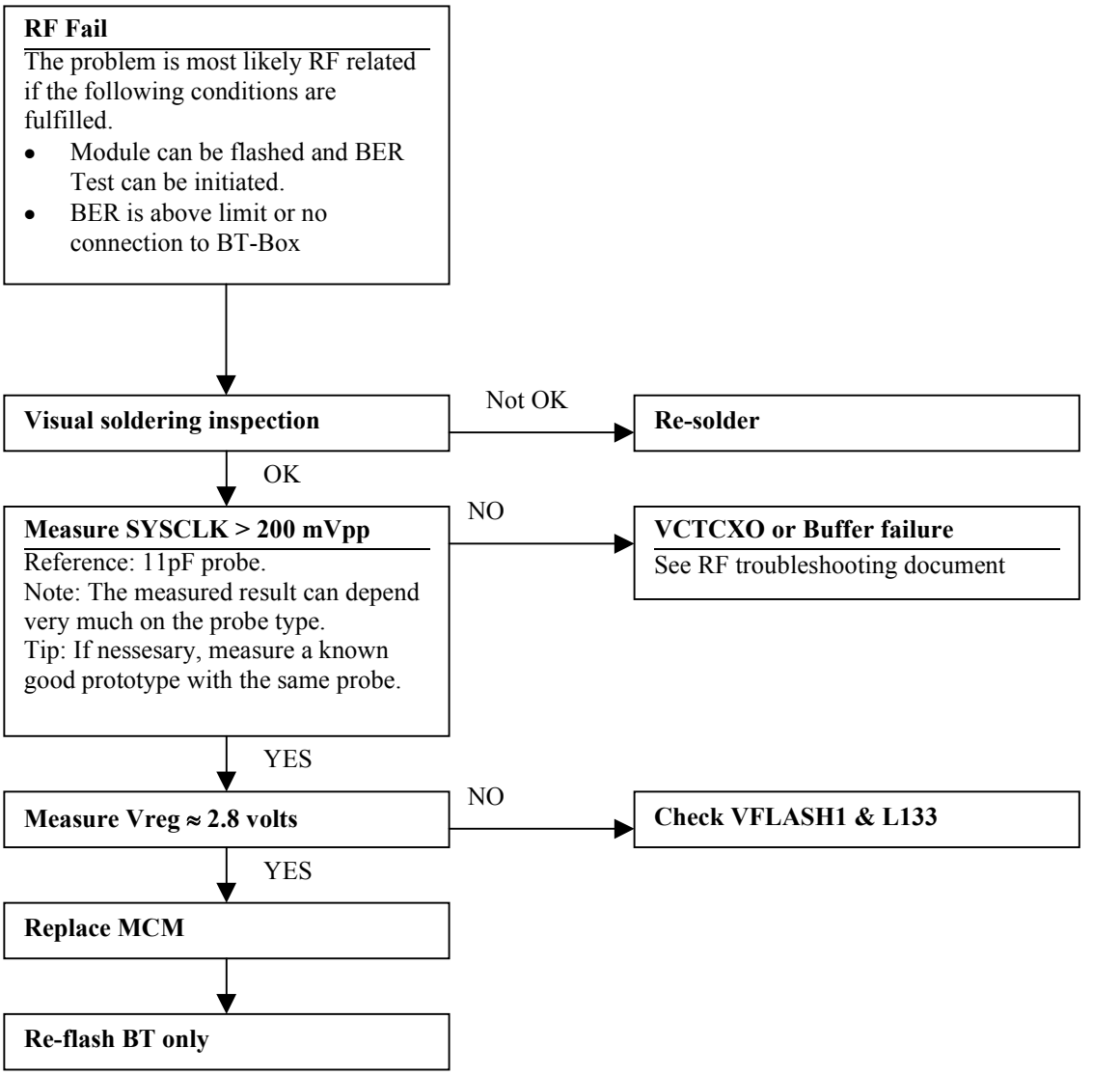


Blue Tooth module faults




No BT air connection
Antenna open circuit
No
V130 bad soldering
No
Replace module
V130
Yes
Faulty PWB


No BT audio connection
J143
USARTTx = 1,8V
Data
No
V130 bad soldering
No
Replace module
V130
Yes
J144
USARTRx = 1,8V
Data
No
V130 bad soldering
No
Replace module
V130
Yes
Faulty PWB



Test points can be seen in the document “Baseband testpoints”.

RF Troubleshooting

Introduction

Measurements should be done using Spectrum Analyzer with high-frequency high-impedance passive probe (LO-/reference frequencies and RF-power levels) and Oscilloscope with a 10:1 probe (DC-voltages and low frequency signals).

The RF-section is build around one ASICS Hagar (N600). For easier troubleshooting, this RF troubleshooting document is divided into sections.

Before changing Hagar, please check the following things: Supply voltages are OK and serial communication are coming to Hagar (See Baseband troubleshooting document).

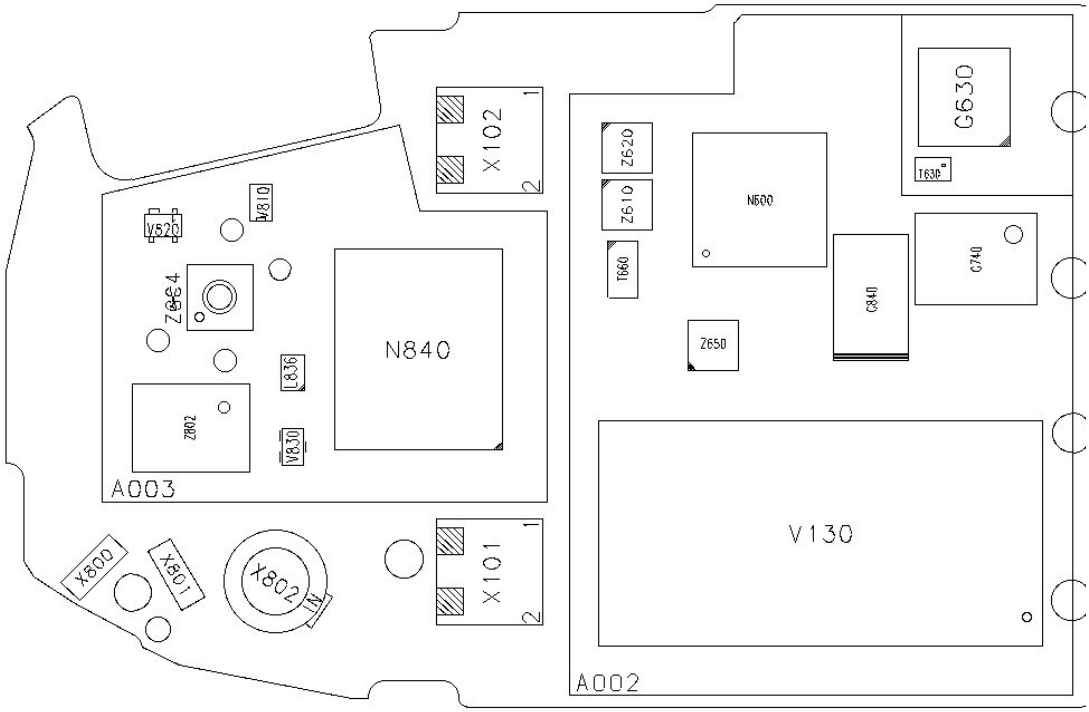
Please note that the grounding of the PA-module is directly below PA-module so it is difficult to check or change. **Most RF semiconductors are static discharge sensitive!** So ESD protection must be taken during repair (ground straps and ESD soldering irons). The Hagar IC is moisture sensitive so parts must be pre-baked prior to soldering.

Apart from key-components described in this document here are a lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done by checking if soldering of the component is done properly, for factory repairs (checking if it is missing from PCB). Capacitors can be checked for shortening and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Please be aware that all measured voltages or **RF levels in this document are rough figures**. Especially RF levels varies due to different measuring equipment or different grounding of the used probe.

All tuning must be done with Phoenix Service Software, version 02.90.001, or later.

RF Key component placement

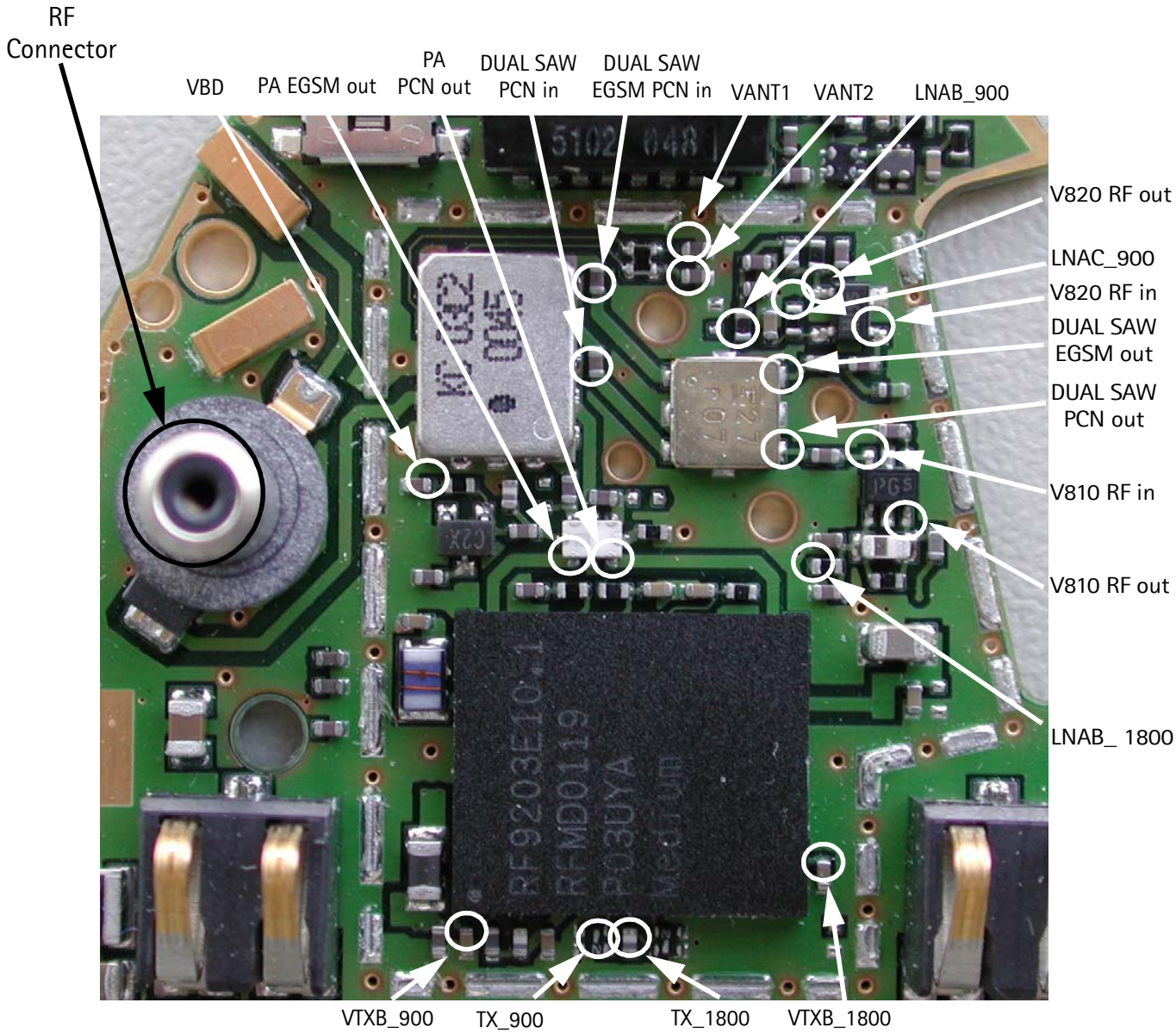


Reference number	Name	Reference number	Name
N600	HAGAR RF IC	X802	RF Connector
N840	PA	L836	Directional Coupler
Z610	PCN RX SAW filter	V830	Detector Diode
Z620	EGSM RX SAW filter	X101	Battery Terminal V+
Z650	EGSM TX SAW filter	X102	Battery Terminal V-
Z804	RX DUAL SAW filter	G630	VCO
Z802	RXTX Switch Module	G740	VCTCXO
T660	PCN TX Balun	T630	VCO Balun
V810	PCN RX LNA	C840	Supply Capacitor
V820	EGSM RX LNA	V130	Bluetooth Module
X800	Antenna signal clip	A002	HAGAR RF Can
X801	Antenna ground clip	A003	PA Can

RF Measurement points

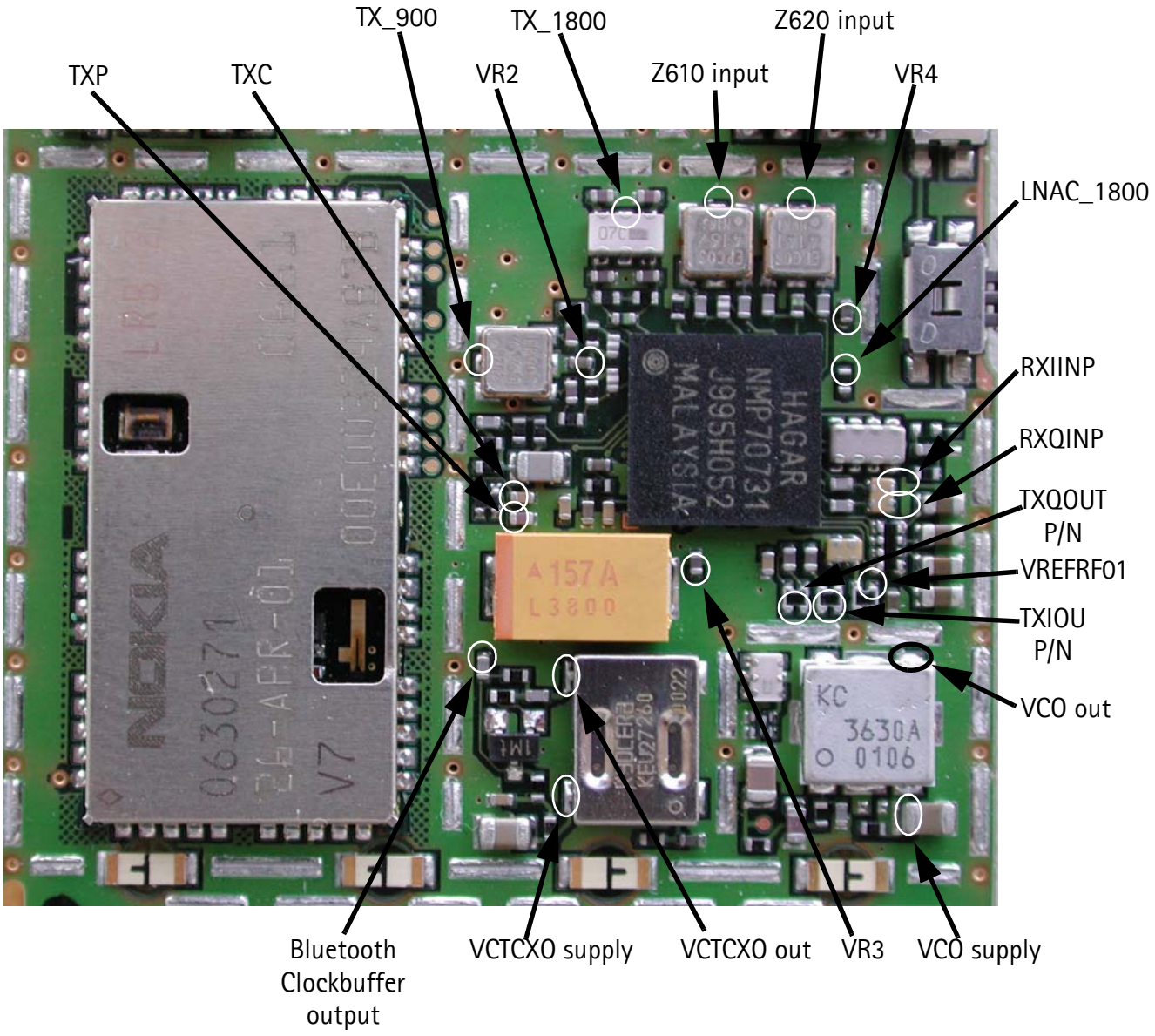
PA Can

Measurement points are shown on the picture below inside the circles.



Hagar RF can

Measurement points are shown circled on the picture below.

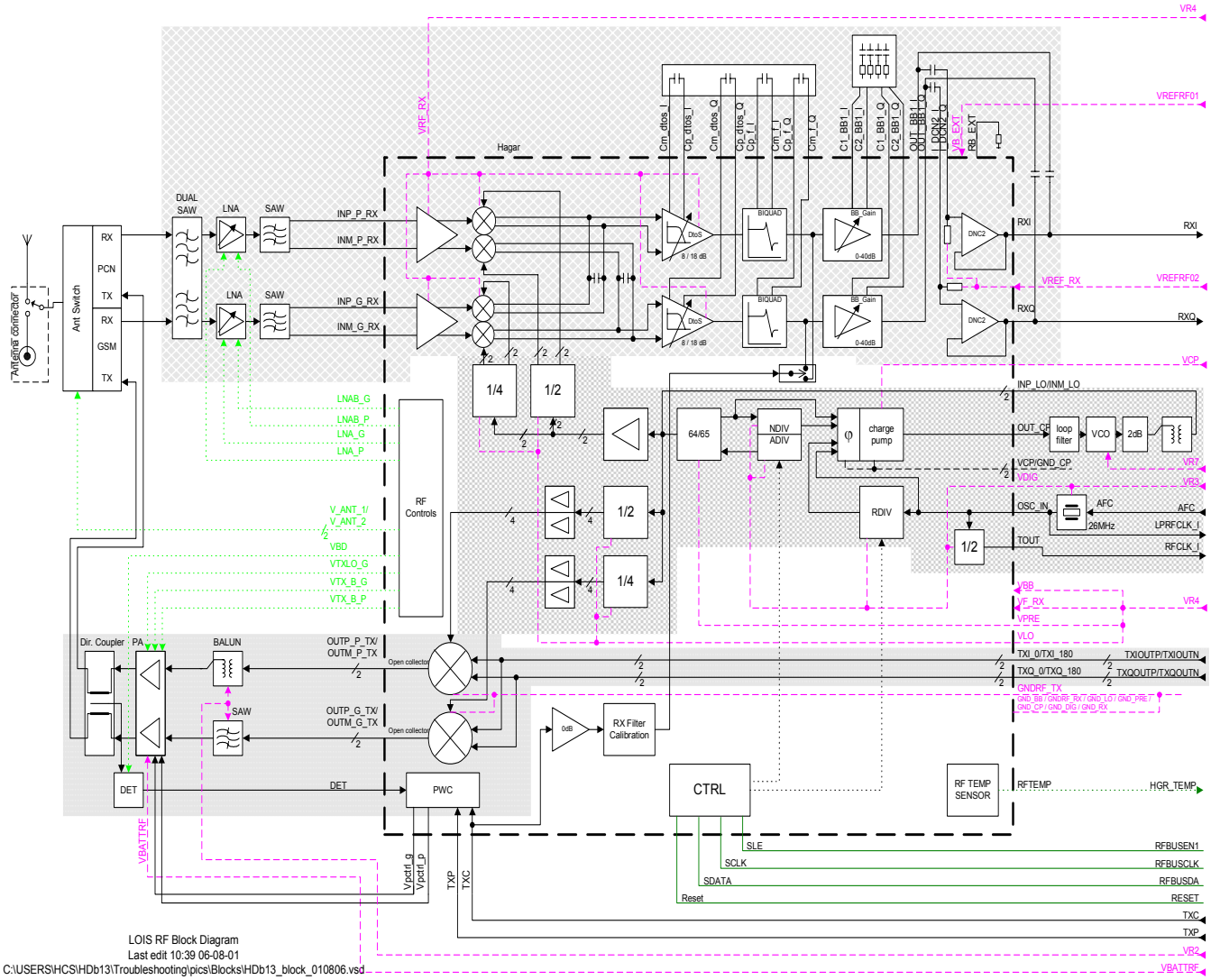


Abbreviations in fault finding charts

BB	Baseband
DC	Direct Current
EGSM	Extended GSM (See section 9.6.1 for frequency range)
ESD	Electro Static Dicharge
f:	Frequency of signal (measured with Spectrum Analyzer)
GPRS	General Packed Radio Service
HSCSD	High Speed Circuit Switched Data
LO	Local Oscillator
P:	Power of signal in decibels (dB) (measured with Spectrum Analyzer)
PA	Power Amplifier
PCB	Printed Circuit Board
PCN	GSM1800 (See section 9.6.2 for frequency range)
PLL	Phase Locked Loop
RF	Radio Frequency
RX	Receiver
T:	Time between pulses
TX	Transmitter
UHF	Ultra High Frequency
V:	Voltage of signal (measured with oscilloscope)
VCO	Voltage controlled oscillator
VHF	Very High Frequency

RF in general

The RF part of this product is a Dualband Direct Conversion transceiver (Also used in 6210, 8210, 8850, 8310, and other). In Direct Conversion no intermediate frequencies are used for up- or downconversion. 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 IC named Hagar (N600). Hagar also contains PLL and a DC control section used to power and/or control LNAs, TX buffers, Detector and RX/TX Switch. Hagar is controlled via a serial bus (CTRL).



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

EGSM Receiver

General instructions for EGSM RX troubleshooting

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

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

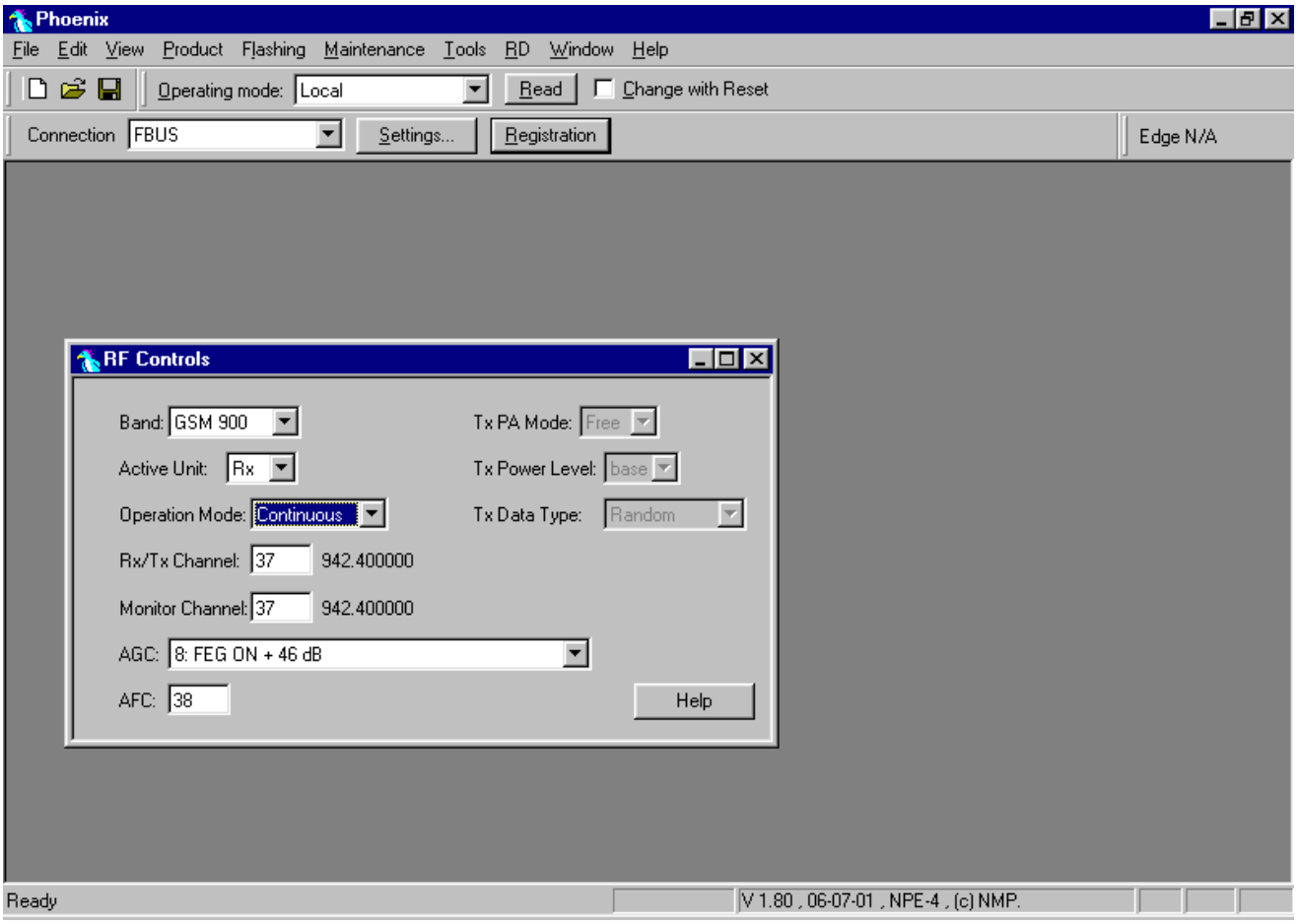
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

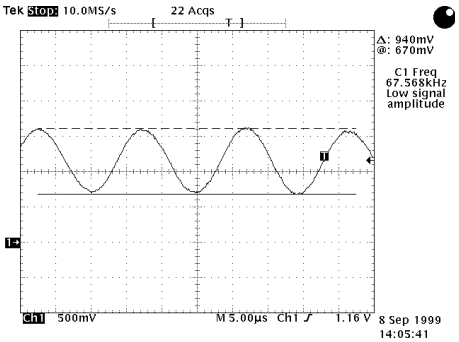
Select	Band	GSM 900
	Active unit	RX
	Operation mode	Continuous
	RX/TX Channel	37
	AGC	8

The setup should now look like this:



Apply a 942.467 MHz (channel 37 + 67.710kHz offset) -80 dBm signal to the RF-connector (remember to compensate for cable attenuation).

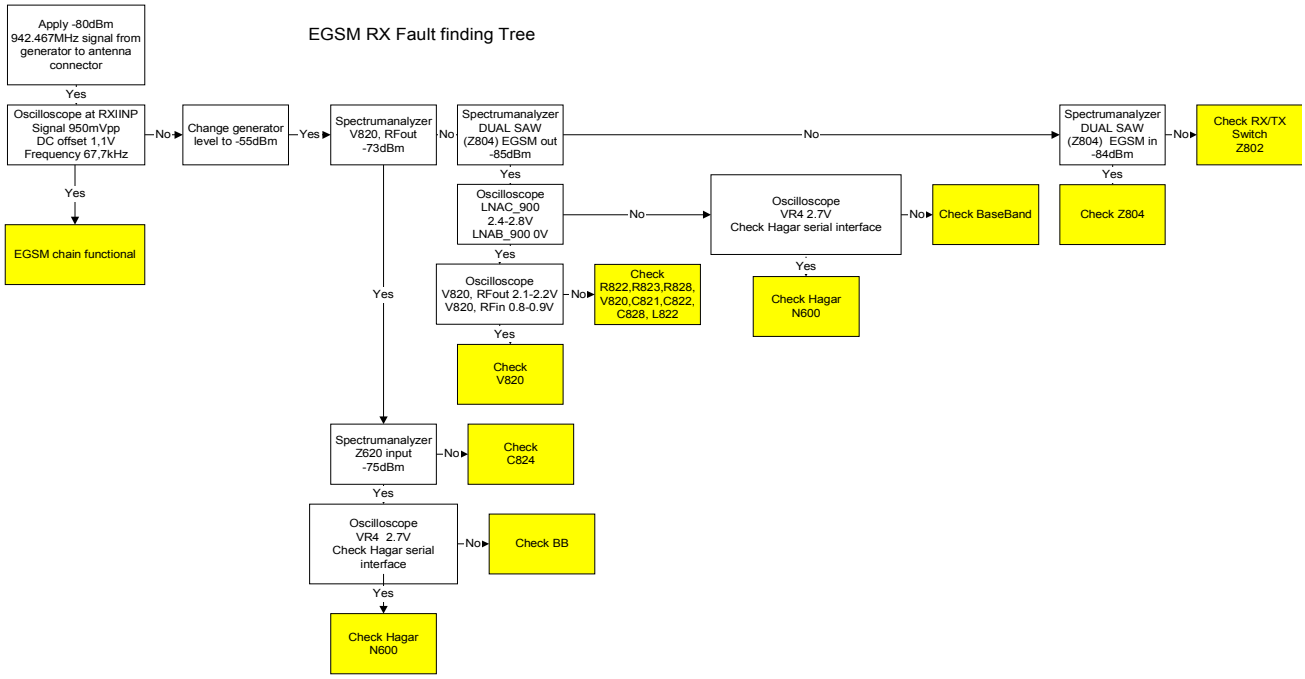
Measuring with an oscilloscope on "RXIINP" or "RXQINP" this picture should be seen on a working EGSM receiver:



Signal amplitude	950mV
DC offset	1,1V
Frequency	67kHz

If this picture is not seen, then go to troubleshooting.

Fault finding chart for EGSM receiver



EGSM Signal path

For easy error tracing it is important to know the signal path of the EGSM receiver. The compnents can be grouped into blocks and drawn as shown below. Note that the picture shows bothe the EGSM receiver (bottom) and PCN (top).

Tba

RX/TX Switch

From the antenna-pad (X800) the RF signal is lead to the RX/TX switch (Z802) via a mechanical switch, the antenna connector (X802).

If no control voltage is present at VC1 or VC2 the RX/TX switch is open to the two RX outlets GSM_Rx and DCS_Rx. The RX/TX switch will work as a diplexer and EGSM signals pass to GSM_Rx and PCN signals to DCS_Rx.

From GSM_Rx the EGSM signal is feed to the Dual RX SAW filter (Z804) via C804.

Front-end

The EGSM front-end consists mainly of two SAW filters (Z804 and Z620) and one LNA (V820) in-between. The SAW filters provides out-of-band blocking immunity, the LNA provides front-end gain. The first SAW filter (Z804) is a DUAL package including SAW filter for both EGSM and PCN. The last SAW filter (Z620) is single ended input and balanced output providing a balanced signal input for Hagar (N600).

The signal-path is through Z804 (In-band insertion-loss 3,5dB), through the matching circuit (L821, L820 and C821) and to the EGSM LNA (V820, RFin).

From the LNA (V820, RF out) the signal is lead through C824, through the 2nd EGSM SAW Z620 (In-band insertion-loss 3,5dB), through the balanced matching circuit (C626, C627, L626) to Hagar (N600).

Hagar

The balanced RX signal is mixed with a signal from the local oscillator at the same frequency as the wanted RX signal. After mixing the signal is converted to a single ended signal in the DtoS (Differential to Single ended) amplifier. The signal is now filtered in a BIQUAD filter to provide channel separation, amplified in the BB_Gain amplifier and DC compensated in DCN2.

PCN Receiver

General instructions for PCN RX troubleshooting

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

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

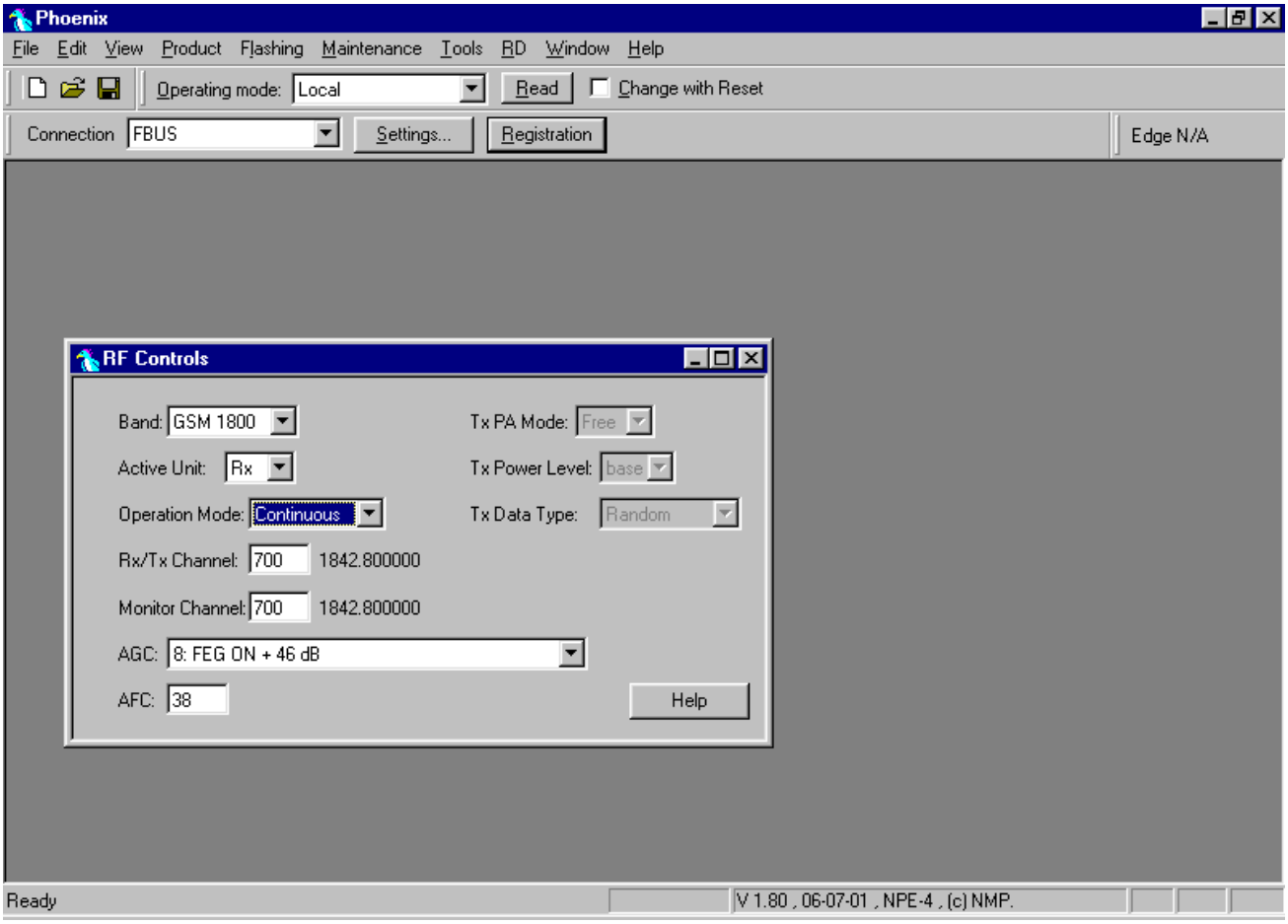
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

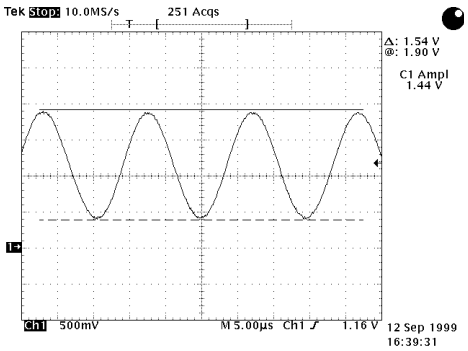
Select	Band	GSM 1800
	Active unit	RX
	Operation mode	Continuous
	RX/TX Channel	700
	AGC	8

The setup should now look like this:



Apply a 1842.867 MHz (channel 700 + 67.710kHz offset) -80 dBm signal to the RF-connector (remember to compensate for cable attenuation).

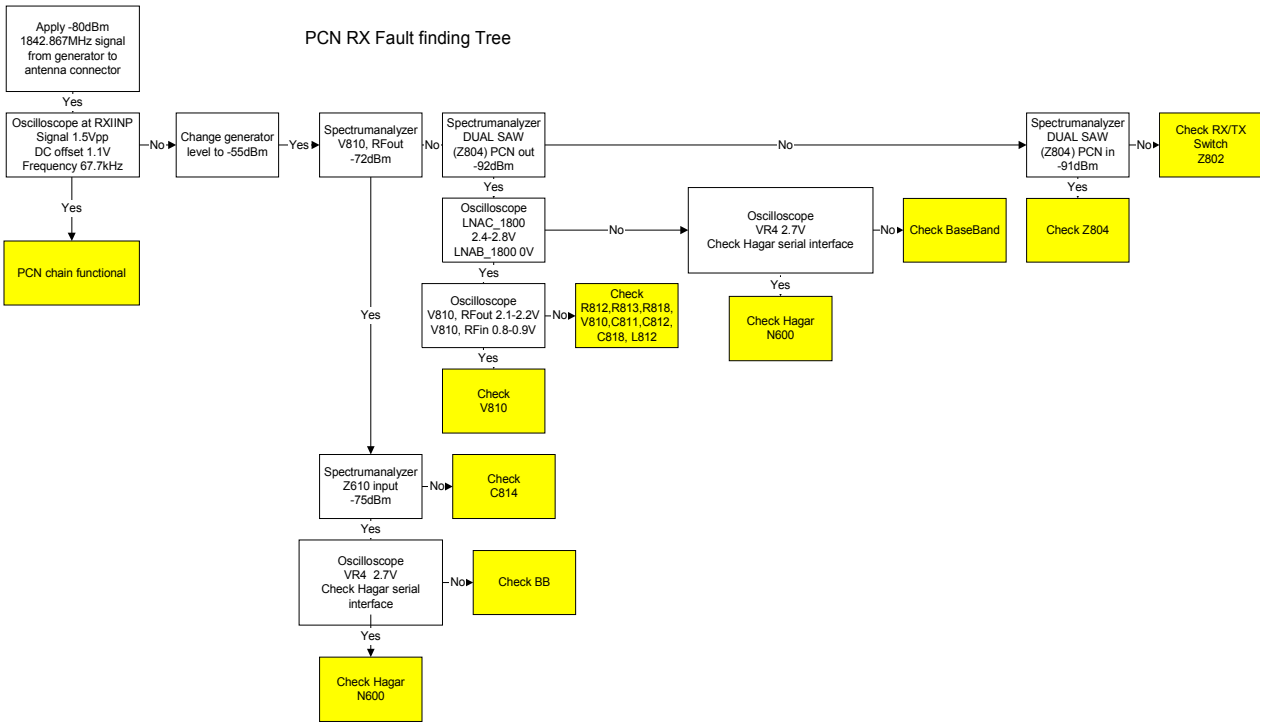
Measuring with an oscilloscope on "Hagar RXI" or "Hagar RXQ" this picture should be seen on a working PCN receiver:



Signal amplitude	1.5V
DC offset	1,1V
Frequency	67kHz

If this picture is not seen, then go to section 6.2 of this document for troubleshooting.

Fault finding chart for PCN receiver



PCN Signal path

For easy error tracing it is important to know the signal path of the PCN receiver. The components can be grouped into blocks and drawn as shown below. Note that the picture shows both EGSM recieiver (bottom) and PCN receiver (top).

Tba

RX/TX Switch

From the antenna-pad (X800) the RF signal is lead to the RX/TX switch (Z802) via a mechanical switch, the antenna connector (X802).

If no control voltage is present at VC1 or VC2 the RX/TX switch is open to the two RX outlets GSM_Rx and DCS_Rx. The RX/TX switch will work as a diplexer and EGSM signals pass to GSM_Rx and PCN signals to DCS_Rx.

From DCS_Rx the PCN signal is feed to the Dual RX SAW filter (Z804) via C806.

Front-end

The PCN front-end consists mainly of two SAW filters (Z804 and Z610) and one LNA (V810) in-between. The SAW filters provides out-of-band blocking immunity, the LNA provides front-end gain. The first SAW filter (Z804) is a DUAL package including SAW filter for both EGSM and PCN. The last SAW filter (Z610) is single ended input and balanced output providing a balanced signal input for Hagar (N600).

The signal-path is through Z804 (In-band insertion-loss max 4dB), through C811 to the PCN LNA (V810, RFin).

From the LNA (V810, RF out) the signal is lead through C814, through the 2nd EGSM SAW Z610 (In-band insertion-loss max 4dB), through the balanced matching circuit (C616, C617, L616) to Hagar (N600).

Hagar

The balanced RX signal is mixed with a signal from the local oscillator at the same frequency as the wanted RX signal. After mixing the signal is converted to a single ended signal in the DtoS (Differential to Single ended) amplifier. The signal is now filtered in a BIQUAD filter to provide channel separation, amplified in the BB_Gain amplifier and DC compensated in DCN2.

EGSM 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, Powermeter, Spectrum Analyzer, or similar) or to at least a 10-dB attenuator, otherwise the PA may be damaged.

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

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

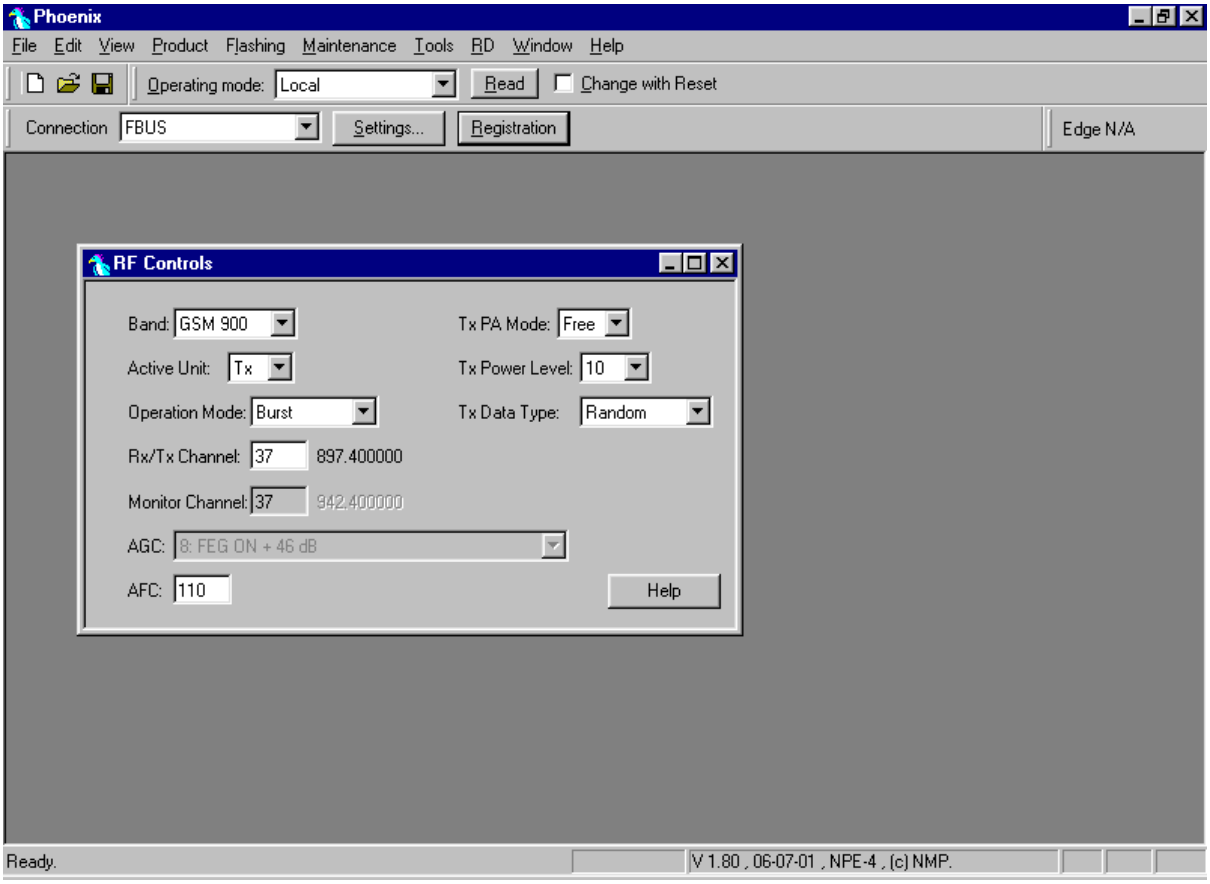
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

Select	Band	GSM 900
	Active unit	TX
	Operation mode	Burst
	RX/TX Channel	37
	TX PA Mode	Free
	TX Power Level	10
	TX Data Type	Random

The setup should now look like this:



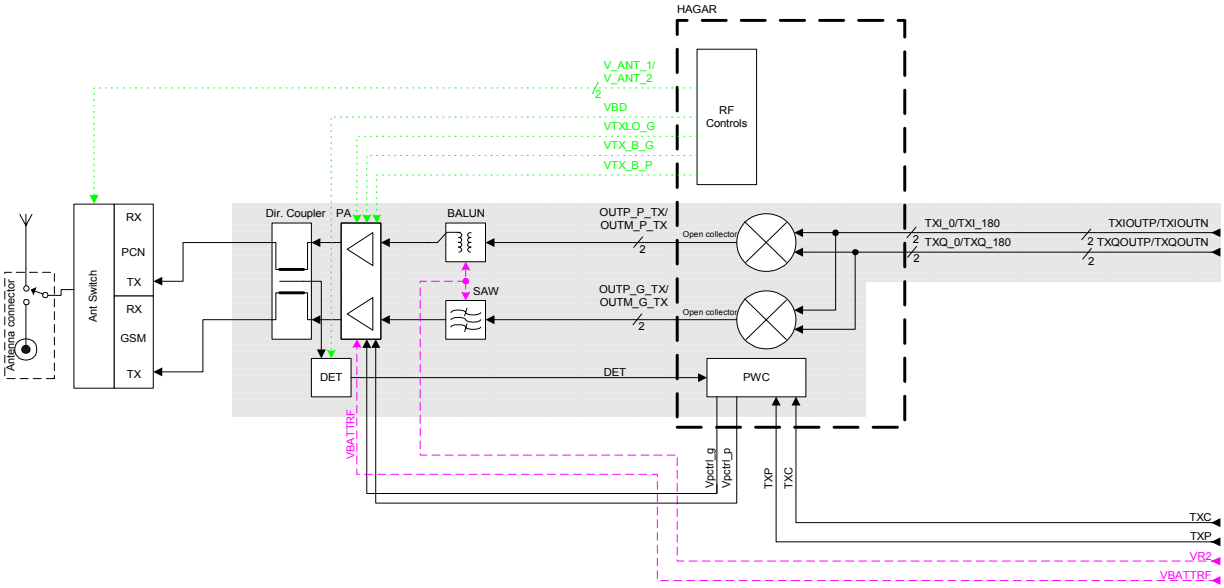
Now the measurement equipment should measure the following output signal from the phone.

- P_{out} +23dBm @ 897.4MHz

If this is not the case, then go to the fault finding chart for EGSM transmitter in this document for troubleshooting.

Path of the transmitted EGSM signal

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



Hagar

The Balanced TX signal from baseband is coming to the RF IC Hagar. It includes RF modulators, one for EGSM and one for PCN. The Baseband signal is mixed with the LO signal corresponding to the wanted TX channel. The PCN TX output of Hagar is a balanced signal.

From the output of Hagar the signal goes through the EGSM TX SAW filter (Balanced to single ended) to the PA EGSM input.

PA

The PA EGSM part has a maximum output at app. 35dBm. The supply is coming directly from the Battery terminals.

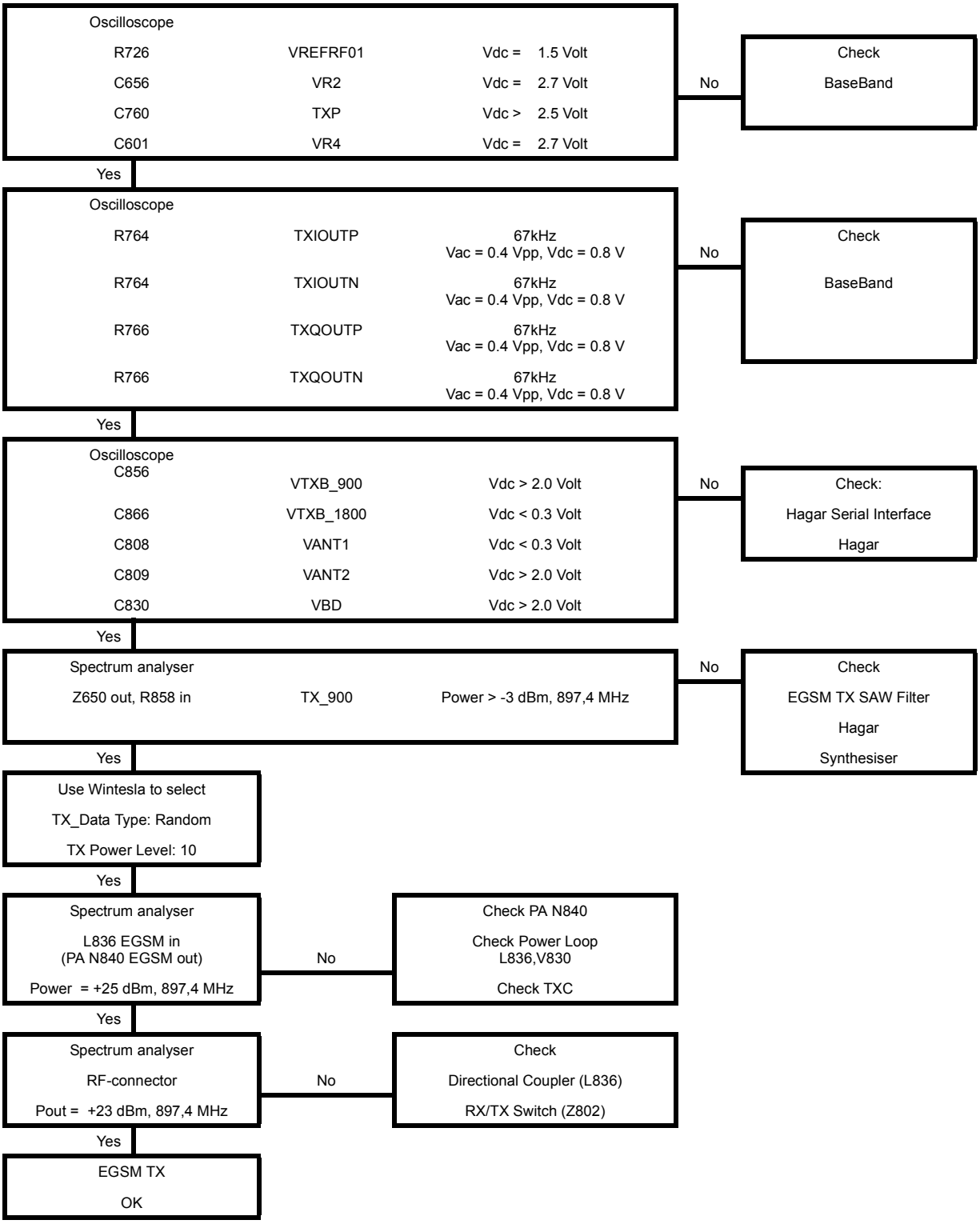
The output is controlled by Hagar by the power control loop. From the ouput of the PA the signal goes through the directional coupler (one of the power control loop components) to the RXTX Switch.

RXTX Switch

The RXTX Switch is making the filtering between RX and TX Bands and between EGSM and PCN bands. It is controlled by Hagar by the two voltages VANT1 and VANT2. The following table shows the different states.

VANT1 [Volt]	VANT2 [Volt]	EGSM Rx	PCN Rx	EGSM Tx	PCN Tx
0	0	X	X		
0	2.7			X	
2.7	0				X

Fault finding chart for EGSM transmitter



PCN Transmitter

General instructions for PCN 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) or to at least a 10-dB attenuator, otherwise the PA may be damaged.

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

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

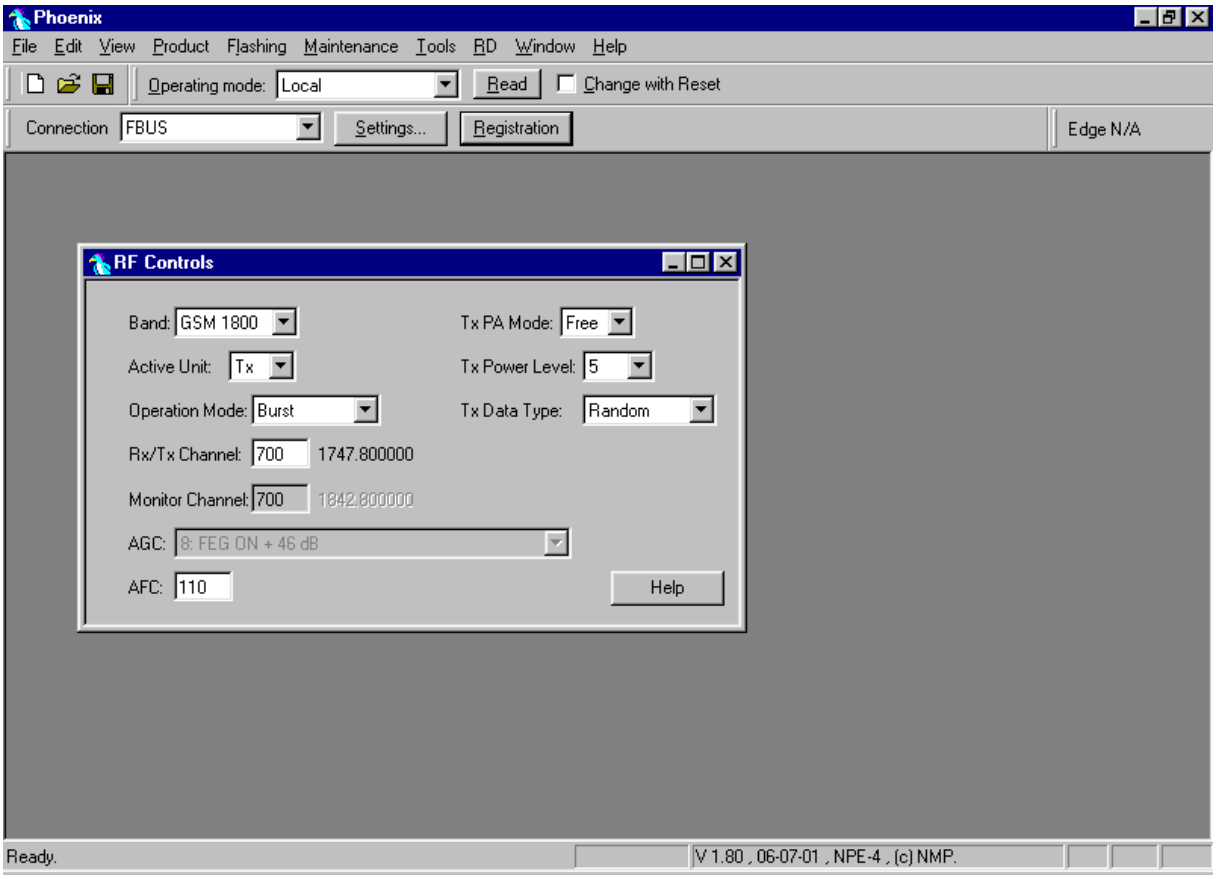
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

Select	Band	GSM 1800
	Active unit	TX
	Operation mode	Burst
	RX/TX Channel	700
	TX PA Mode	Free
	TX Power Level	5
	TX Data Type	Random

The setup should now look like this:



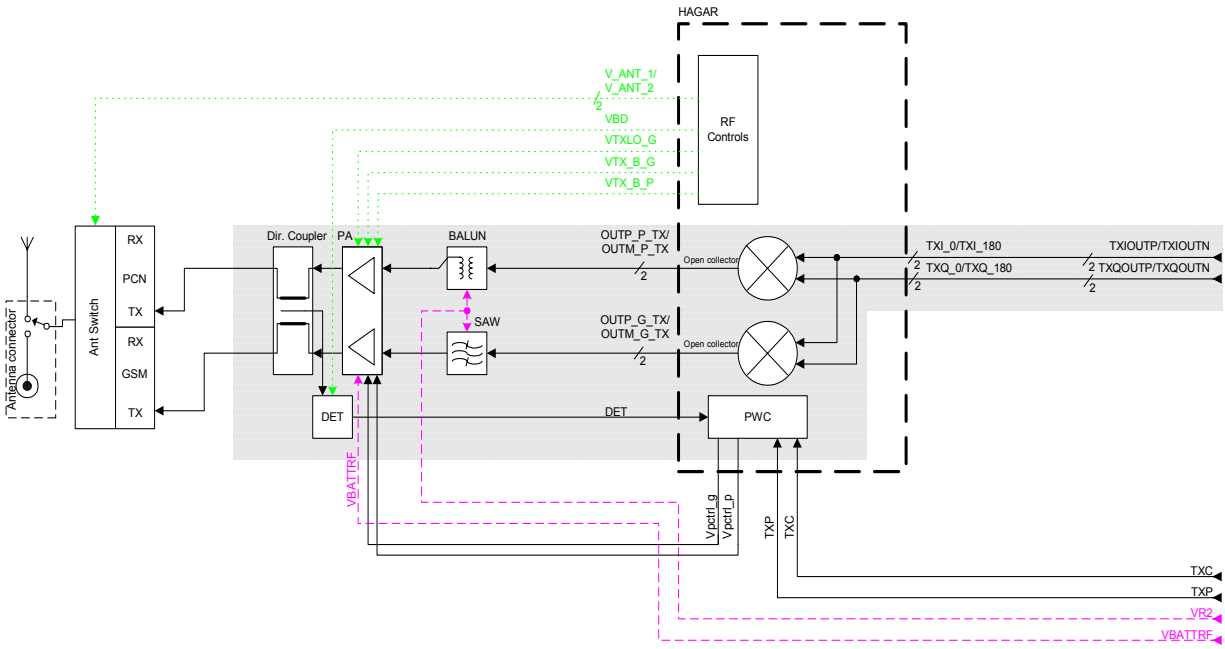
Now the measurement equipment should measure the following output signal from the phone.

- P_{out} +20dBm @ 1747.8MHz

If this is not the case, then go to the fault finding chart for PCN transmitter in this document for troubleshooting.

Path of the transmitted PCN signal

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



Hagar

The Balanced TX signal from baseband is coming to the RF IC Hagar. It includes RF modulators, one for EGSM and one for PCN. The Baseband signal is mixed with the LO signal corresponding to the wanted TX channel. The output of Hagar is a balanced signal.

From the PCN TX output of Hagar the signal goes through the PCN TX Balun (Balanced to single ended) to the PA PCN TX input.

PA

The PA PCN part has a maximum output at app. 32dBm. The supply is coming directly from the Battery terminals.

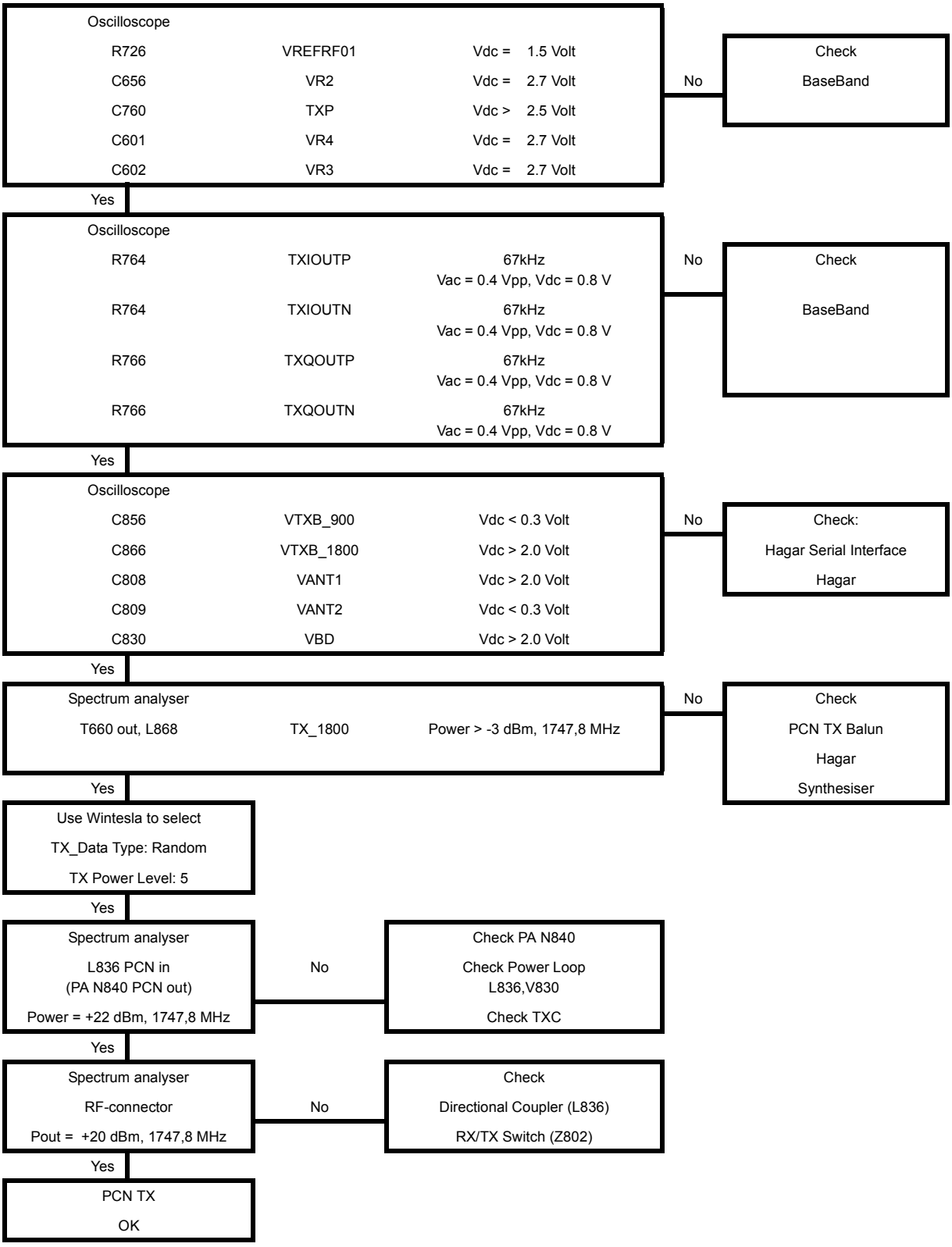
The output is controlled by Hagar by the power control loop. From the ouput of the PA the signal goes through the directional coupler (one of the power control loop components) to the RXTX Switch.

RXTX Switch

The RXTX Switch is making the filtering between RX and TX Bands and between EGSM and PCN bands. It is controlled by Hagar by the two voltages VANT1 and VANT2. The following table shows the different states.

VANT1 [Volt]	VANT2 [Volt]	EGSM Rx	PCN Rx	EGSM Tx	PCN Tx
0	0	X	X		
0	2.7			X	
2.7	0				X

Fault finding chart for PCN transmitter



Synthesiser

There is only one PLL synthesiser generating frequencies for both Rx and Tx in both bands

(EGSM and PCN). VCO frequency is divided by 2 or by 4 in HAGAR depending on which band is active.

General instructions for Synthesiser troubleshooting

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

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

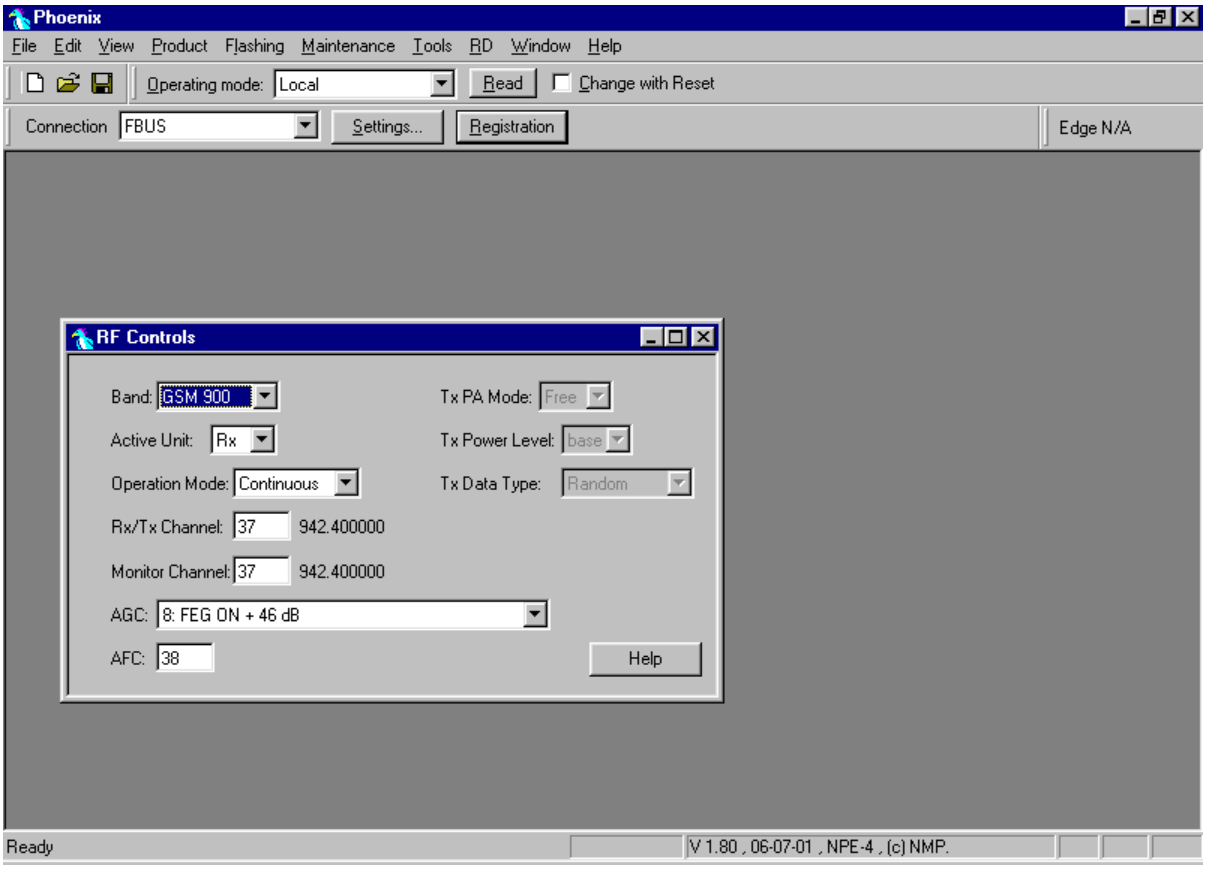
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

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

The setup should now look like this:



Now it is possible to measure frequency of 3769.6MHz at the output of the VCO (G630) using a resistive probe and a spectrum analyzer.

If this is not the case, then go to fault finding chart for PLL synthesiser in this document for troubleshooting.

26 MHz reference oscillator (VCTCXO)

The 26 MHz oscillator (G740) has three functions.

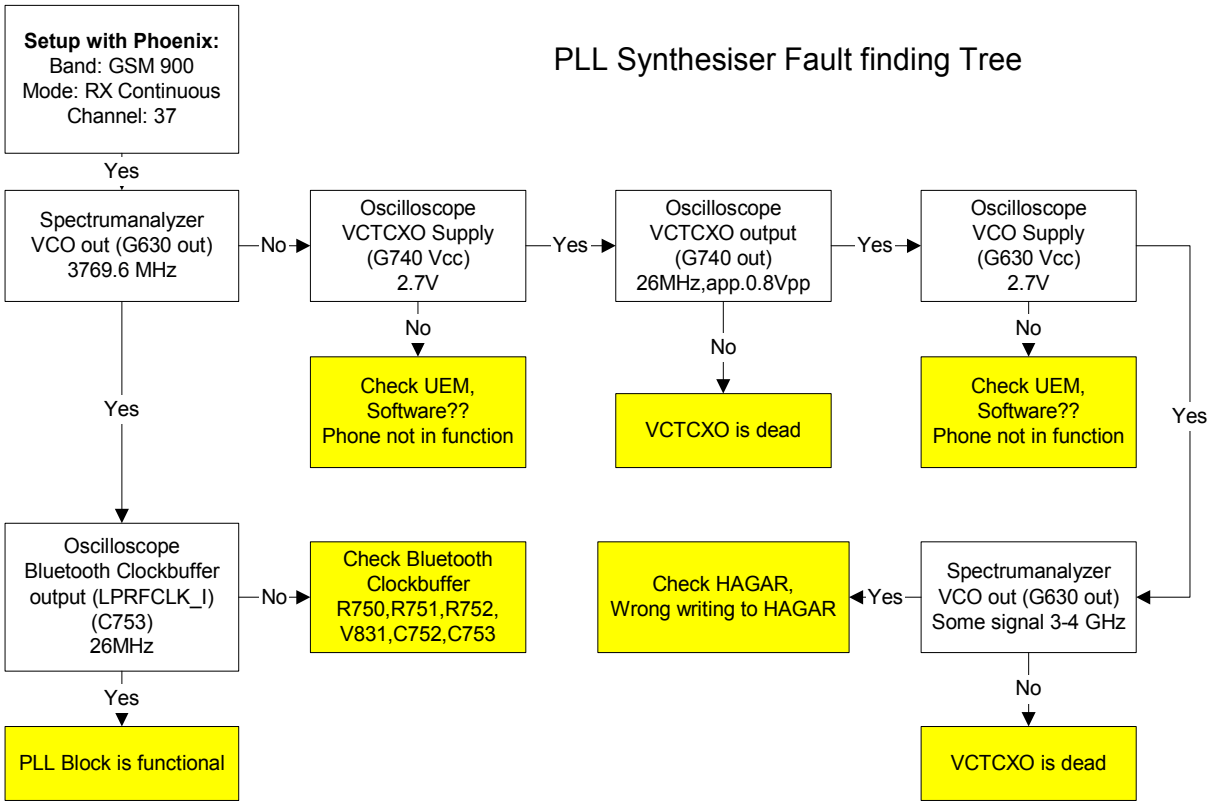
- Reference frequency for the PLL synthesiser.
- System clock for BB (13 MHz) after it is divided by 2 in HAGAR.
- 26 MHz Reference clock for Bluetooth Module (V130).

26 MHz signal from the VCTCXO is approx. 0,8 Vpp. Frequency of this oscillator is adjusted by dc voltage (Vcon) coming from the DAC in UEM (D200). Range of Vcon is 0.3 – 2.3 V.

VCO

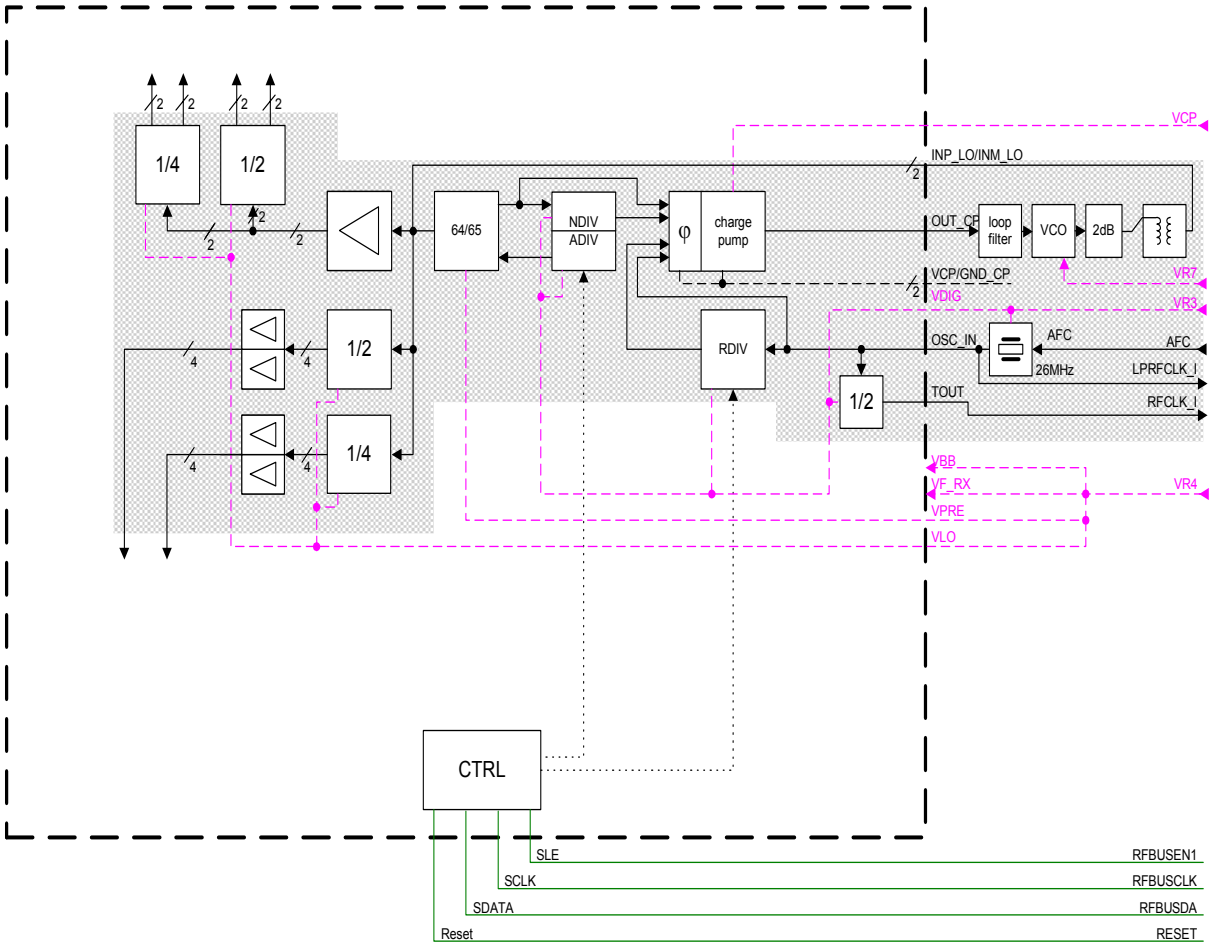
The VCO is able to generate frequencies in the range of 3420 – 3840 MHz when PLL is in function. The frequency of the VCO signal is divided by 2 or by 4 in HAGAR so it is possible to generate the frequency of all channels in EGSM and PCN (both RX and TX). Frequency of the VCO is controlled by DC voltage (Vc) coming from the loop filter. Range of the Vc when PLL is in function is 0.7 – 3.8 V. Even if PLL is not working (Vc out of range) there is some 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 Synthesiser



It is important to say that power supply for VCTCXO (VXO) is OFF only in 'Deep Sleep Mode' and power supply for VCO (G630 Vcc) is OFF in 'Sleep Mode'.

PLL Blockdiagram



Frequency lists

EGSM

Frequency list NPE-3 EGSM														
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	948	3612	3792
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	926	3524	3704	5	891	936	3564	3744	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	949	3616	3796
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	927	3528	3708	10	892	937	3568	3748	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	950	3620	3800
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	928	3532	3712	15	893	938	3572	3752	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	951	3624	3804
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	929	3536	3716	20	894	939	3576	3756	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	952	3628	3808
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	930	3540	3720	25	895	940	3580	3760	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	953	3632	3812
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	931	3544	3724	30	896	941	3584	3764	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	954	3636	3816
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	932	3548	3728	35	897	942	3588	3768	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	955	3640	3820
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	933	3552	3732	40	898	943	3592	3772	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	956	3644	3824
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	934	3556	3736	45	899	944	3596	3776	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	957	3648	3828
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	935	3560	3740	50	900	945	3600	3780	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	958	3652	3832
					54	900.8	945.8	3603.2	3783.2	116	913.2	958.2	3652.8	3832.8
					55	901	946	3604	3784	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	959	3656	3836
					59	901.8	946.8	3607.2	3787.2	121	914.2	959.2	3656.8	3836.8
					60	902	947	3608	3788	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

PCN

Frequency list NPE-3 PCN

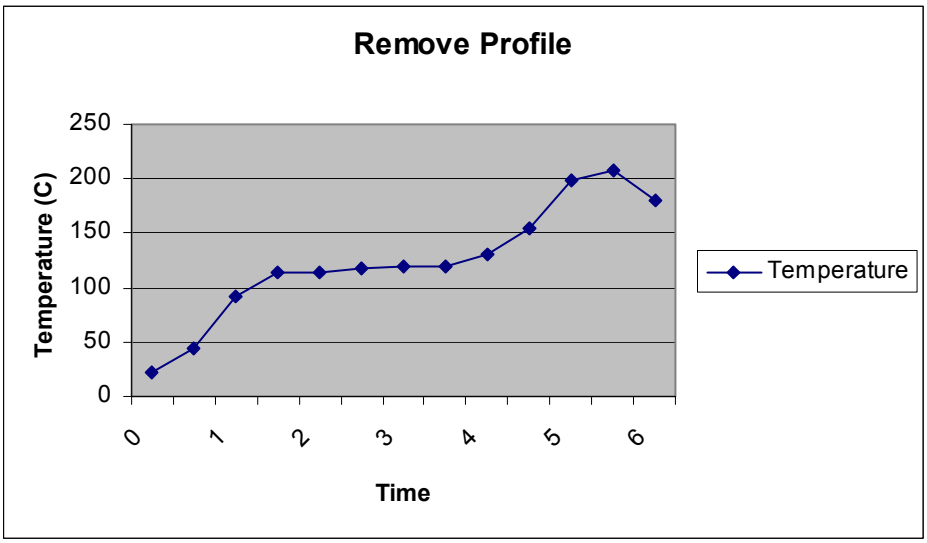
CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1710.2	1805.2	3420.4	3610.4	606	1729	1824	3458	3648	700	1747.8	1842.8	3495.6	3685.6	794	1766.6	1861.6	3533.2	3723.2
513	1710.4	1805.4	6841.6	7221.6	607	1729.2	1824.2	3458.4	3648.4	701	1748	1843	3496	3686	795	1766.8	1861.8	3533.6	3723.6
514	1710.6	1805.6	6842.4	7222.4	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	796	1767	1862	3534	3724
515	1710.8	1805.8	6843.2	7223.2	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	1806	6844	7224	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	6844.8	7224.8	611	1730	1825	3460	3650	705	1748.8	1843.8	3497.6	3687.6	799	1767.6	1862.6	3535.2	3725.2
518	1711.4	1806.4	6845.6	7225.6	612	1730.2	1825.2	3460.4	3650.4	706	1749	1844	3498	3688	800	1767.8	1862.8	3535.6	3725.6
519	1711.6	1806.6	6846.4	7226.4	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	801	1768	1863	3536	3726
520	1711.8	1806.8	6847.2	7227.2	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	1807	6848	7228	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	6848.8	7228.8	616	1731	1826	3462	3652	710	1749.8	1844.8	3499.6	3689.6	804	1768.6	1863.6	3537.2	3727.2
523	1712.4	1807.4	6849.6	7229.6	617	1731.2	1826.2	3462.4	3652.4	711	1750	1845	3500	3690	805	1768.8	1863.8	3537.6	3727.6
524	1712.6	1807.6	6850.4	7230.4	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	806	1769	1864	3538	3728
525	1712.8	1807.8	6851.2	7231.2	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	1808	6852	7232	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	6852.8	7232.8	621	1732	1827	3464	3654	715	1750.8	1845.8	3501.6	3691.6	809	1769.6	1864.6	3539.2	3729.2
528	1713.4	1808.4	6853.6	7233.6	622	1732.2	1827.2	3464.4	3654.4	716	1751	1846	3502	3692	810	1769.8	1864.8	3539.6	3729.6
529	1713.6	1808.6	6854.4	7234.4	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	811	1770	1865	3540	3730
530	1713.8	1808.8	6855.2	7235.2	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	1809	6856	7236	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	6856.8	7236.8	626	1733	1828	3466	3656	720	1751.8	1846.8	3503.6	3693.6	814	1770.6	1865.6	3541.2	3731.2
533	1714.4	1809.4	6857.6	7237.6	627	1733.2	1828.2	3466.4	3656.4	721	1752	1847	3504	3694	815	1770.8	1865.8	3541.6	3731.6
534	1714.6	1809.6	6858.4	7238.4	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	816	1771	1866	3542	3732
535	1714.8	1809.8	6859.2	7239.2	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	1810	6860	7240	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	6860.8	7240.8	631	1734	1829	3468	3658	725	1752.8	1847.8	3505.6	3695.6	819	1771.6	1866.6	3543.2	3733.2
538	1715.4	1810.4	6861.6	7241.6	632	1734.2	1829.2	3468.4	3658.4	726	1753	1848	3506	3696	820	1771.8	1866.8	3543.6	3733.6
539	1715.6	1810.6	6862.4	7242.4	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	821	1772	1867	3544	3734
540	1715.8	1810.8	6863.2	7243.2	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	1811	6864	7244	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	6864.8	7244.8	636	1735	1830	3470	3660	730	1753.8	1848.8	3507.6	3697.6	824	1772.6	1867.6	3545.2	3735.2
543	1716.4	1811.4	6865.6	7245.6	637	1735.2	1830.2	3470.4	3660.4	731	1754	1849	3508	3698	825	1772.8	1867.8	3545.6	3735.6
544	1716.6	1811.6	6866.4	7246.4	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	826	1773	1868	3546	3736
545	1716.8	1811.8	6867.2	7247.2	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	1812	6868	7248	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	6868.8	7248.8	641	1736	1831	3472	3662	735	1754.8	1849.8	3509.6	3699.6	829	1773.6	1868.6	3547.2	3737.2
548	1717.4	1812.4	6869.6	7249.6	642	1736.2	1831.2	3472.4	3662.4	736	1755	1850	3510	3700	830	1773.8	1868.8	3547.6	3737.6
549	1717.6	1812.6	6870.4	7250.4	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	831	1774	1869	3548	3738
550	1717.8	1812.8	6871.2	7251.2	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	1813	6872	7252	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	6872.8	7252.8	646	1737	1832	3474	3664	740	1755.8	1850.8	3511.6	3701.6	834	1774.6	1869.6	3549.2	3739.2
553	1718.4	1813.4	6873.6	7253.6	647	1737.2	1832.2	3474.4	3664.4	741	1756	1851	3512	3702	835	1774.8	1869.8	3549.6	3739.6
554	1718.6	1813.6	6874.4	7254.4	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	836	1775	1870	3550	3740
555	1718.8	1813.8	6875.2	7255.2	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	1814	6876	7256	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	838	1775.4	1870.4	3550.8	3740.8
557	1719.2	1814.2	6876.8	7256.8	651	1738	1833	3476	3666	745	1756.8	1851.8	3513.6	3703.6	839	1775.6	1870.6	3551.2	3741.2
558	1719.4	1814.4	6877.6	7257.6	652	1738.2	1833.2	3476.4	3666.4	746	1757	1852	3514	3704	840	1775.8	1870.8	3551.6	3741.6
559	1719.6	1814.6	6878.4	7258.4	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	841	1776	1871	3552	3742
560	1719.8	1814.8	6879.2	7259.2	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	1815	6880	7260	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	6880.8	7260.8	656	1739	1834	3478	3668	750	1757.8	1852.8	3515.6	3705.6	844	1776.6	1871.6	3553.2	3743.2
563	1720.4	1815.4	6881.6	7261.6	657	1739.2	1834.2	3478.4	3668.4	751	1758	1853	3516	3706	845	1776.8	1871.8	3553.6	3743.6
564	1720.6	1815.6	6882.4	7262.4	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	846	1777	1872	3554	3744
565	1720.8	1815.8	6883.2	7263.2	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	1816	6884	7264	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	6884.8	7264.8	661	1740	1835	3480	3670	755	1758.8	1853.8	3517.6	3707.6	849	1777.6	1872.6	3555.2	3745.2
568	1721.4	1816.4	6885.6	7265.6	662	1740.2	1835.2	3480.4	3670.4	756	1759	1854	3518	3708	850	1777.8	1872.8	3555.6	3745.6
569	1721.6	1816.6	6886.4	7266.4	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	851	1778	1873	3556	3746
570	1721.8	1816.8	6887.2	7267.2	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	1817	6888	7268	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	6888.8	7268.8	666	1741	1836	3482	3672	760	1759.8	1854.8	3519.6	3709.6	854	1778.6	1873.6	3557.2	3747.2
573	1722.4	1817.4	6889.6	7269.6	667	1741.2	1836.2	3482.4	3672.4	761	1760	1855	3520	3710	855	1778.8	1873.8	3557.6	3747.6
574	1722.6	1817.6	6890.4	7270.4	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	856	1779	1874	3558	3748
575	1722.8	1817.8	6891.2	7271.2	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	1818	6892	7272	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	6892.8	7272.8	671	1742	1837	3484	3674	765	1760.8	1855.8	3521.6	3711.6	859	1779.6	1874.6	3559.2	3749.2
578	1723.4	1818.4	6893.6	7273.6	672	1742.2	1837.2	3484.4	3674.4	766	1761	1856	3522	3712	860	1779.8	1874.8	3559.6	3749.6
579	1723.6	1818.6	6894.4	7274.4	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	861	1780	1875	3560	3750
580	1723.8	1818.8	6895.2	7275.2	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	1819	6896	7276	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	6896.8	7276.8	676	1743	1838	3486	3676	770	1761.8	1856.8	3523.6	3713.6	864	1780.6	1875.6	3561.2	3751.2
583	1724.4	1819.4	6897.6	7277.6	677	1743.2	1838.2	3486.4	3676.4	771	1762	1857	3524	3714	865	1780.8	1875.8	3561.6	3751.6
584	1724.6	1819.6	6898.4	7278.4	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	866	1781	1876	3562	3752
585	1724.8	1819.8	6899.2	7279.2	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	1820	6900	7280	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	6900.8	7280.8	681	1744	1839	3488	3678	775	1762.8	1857.8	3525.6	3715.6	869	1781.6	1876.6	3563.2	3753.2
588	1725.4	1820.4	6901.6	7281.6	682	1744.2	1839.2	3488.4	3678.4	776	1763	1858	3526	3716	870	1781.8	1876.8	3563.6	3753.6
589	1725.6	1820.6	6902.4	7282.4	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	871	1782	1877	3564	3754
590	1725.8	1820.8	6903.2	7283.2	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	1821	6904	7284	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	6904.8	7284.8	686	1745	1840	3490	3680	780	1763.8	1858.8	3527.6	3717.6	874	1782.6	1877.6	3565.2	3755.2
593	1726.4	1821.4	6905.6	7285.6	687	1745.2	1840.2	3490.4	3680.4	781	1764	1859	3528	3718	875	1782.8	1877.8	3565.6	3755.6
594	1726.6	1821.6	6906.4	7286.4	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	876	1783	1878	3566	3756
595	1726.8	1821.8	6907.2	7287.2	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	1822	6908	7288	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	6908.8	7288.8	691	1746	1841	3492	3682	785	1764.8	1859.8	3529.6	3719.6	879	1783.6	1878.6	3567.2	3757.2
598	1727.4	1822.4	6909.6	7289.6	692	1746.2	1841.2	3492.4	3682.4	786	1765	1860	3530	3720	880	1783.8	1878.8	3567.6	3757.6
599	1727.6	1822.6	6910.4	7290.4	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	881	1784	1879	3568	3758
600	1727.8	1822.8	6911.2	7291.2	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	1823	6912	7292	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	6912.8	7292.8	696	1747	1842	3494	3684	790	1765.8	1860.8	3531.6	3721.6	884	1784.6	1879.6	3569.2	3759.2
603	1728.4	1823.4	6913.6	7293.6	697	1747.2	1842.2	3494.4	3684.4	791	1766	1861	3532	3722	885	1784.8	1879.8	3569.6	3759.6
604	1728.6	1823.6	6914.4	7294.4	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4					
605	1728.8	1823.8	6915.2	7295.2	699	1747.6	1842.6	3495.2	3685.2	793	1766.4	1861.4	3532.8	3722.8					

SMD Guidelines for PA

Since the PA is a LGA package removal and attachment must be done in a way specified below.

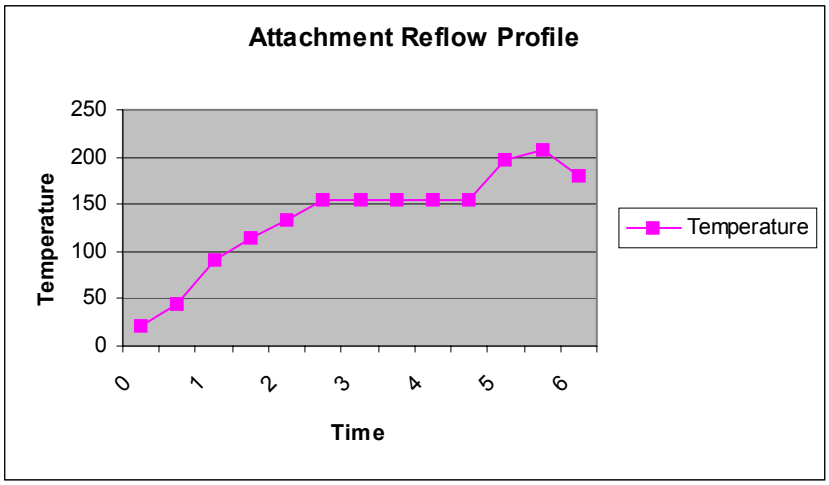
Removal instuctions

- ESD Protection Follow RFMD's ESD Work Instructions when handling microcircuit devices.
- Before removal, the modules to be removed MUST BE BAKED in a calibrated oven/ chamber for 24 hours at 125°C to remove moisture from the package.
- Set up the PC board to be repaired so that it is directly over the blower section of the Hako 853 heater. The PC board should be 0.5 inches above the Hako 853.
- Set the Hako 853 heater to 250°C and the Thermo Flow BGA/SMD blower temperature to 250°C. The Thermo Flow blower speed should be set to 8. The actual remove profile is shown at the figure below.
- Turn the Hako 853 ON and preheat the PC board for 1.5 minutes.
- After the 1.5 minutes, set the Hako 853temperature to 200°C and continue preheating for another 2.5 minutes.
- Set the Hako 853 temperature back to 250°C.
- Turn on the blower for the Thermo Flow BGA/SMD blower. Verify that the temperature setting is 250°C with a blower speed of 8 and then heat the top of the module. Hold the blower nozzle approximately 0.25 inches from the top of module.
- Module should be removable with in 1 minute. Use tweezers to carefully remove the module from the PC board.
- Turn OFF the Hako 853 heater and the Thermo flow blower.
- Wait 5 minutes before handling the PC board as it should be close to room temperature at this time.



Attachment instructions

- ESD Protection Follow RFMD's ESD Work Instructions when handling microcircuit devices.
- Before attachment can begin, the modules to be attached MUST BE BAKED in a calibrated oven/chamber for 24 hours at 125°C to remove moisture from the package.
- Set up the PC board to be attached so that it is directly over the blower section of the Hako 853 heater. The PC board should be 0.5 inches above the Hako 853.
- Set the Hako 853 heater to 250°C and the Thermo Flow BGA/SMD blower temperature to 250°C. The Thermo Flow blower speed should be set to 8. The actual attachment reflow profile is shown at the figure below.
- Turn the Hako 853 ON and preheat the PC board for 2.0 minutes.
- After the 2.0 minutes, set the Hako 853 temperature to 200°C and continue preheating for another 1.0 minute.
- Using ESD protection and tweezers, carefully place the module to be attached, on the board. Verify the proper alignment and pin 1 orientation.
- Turn on the blower for the Thermo Flow BGA/SMD blower. Verify that the temperature setting is 250°C with a blower speed of 8 and then heat the top of the module. Hold the blower nozzle approximately 0.25 inches from the top of module.
- Module should be solder with in 1 minute.
- Turn OFF the Hako 853 heater and the Thermo flow blower.
- Wait 5 minutes before handling the PC board as it should be close to room temperature at this time.



Phoenix tuning

Before any tuning the phone should syncronised with the PC.

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

Start Phoenix Service Software

Select	File	Alt-F
	Scan Product	Ctrl-R

Wait until phone information shows 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" and in some cases require "RX AM Suppression" tuning, "RX Channel Select Filter Calibration" and/or "RX Band Filter Response Compensation" tuning.

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, mechanichal parts or similar, there is no need to do any RF tuning.

RX Calibration

The "RX calibration" is used to determine gain at different gain-settings for front-end and Hagar and needs to be done in both bands.

EGSM

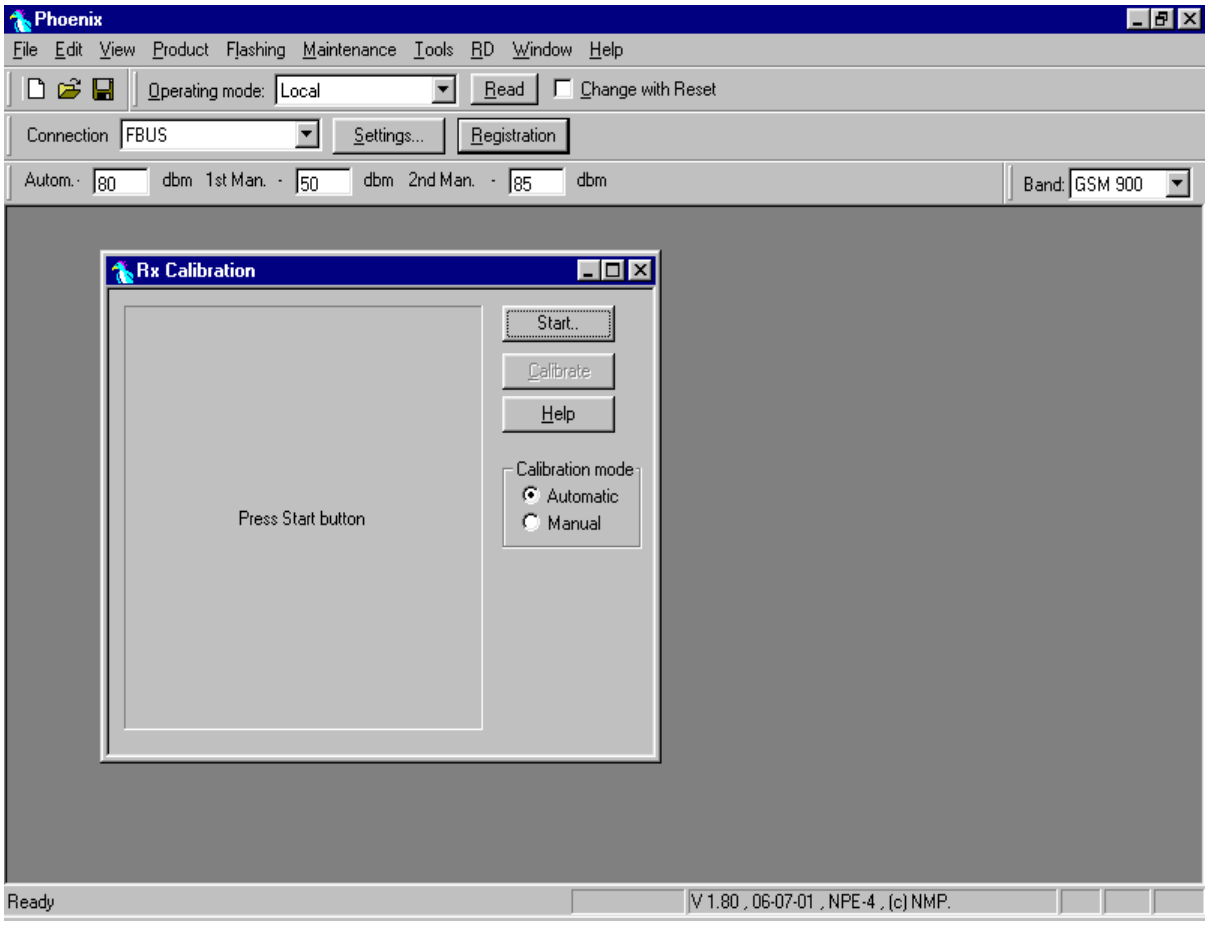
Set operating mode to local mode

Select	Maintenance		Alt-M
	Tuning		T
		RX Calibration	C

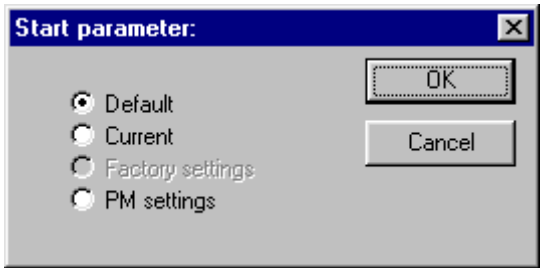
Wait until the RX Calibration window pops up.

Select	Band	GSM 900
	Autom.-	80
	1st Man.-	50
	2nd Man.-	85

The setup should now look like this:



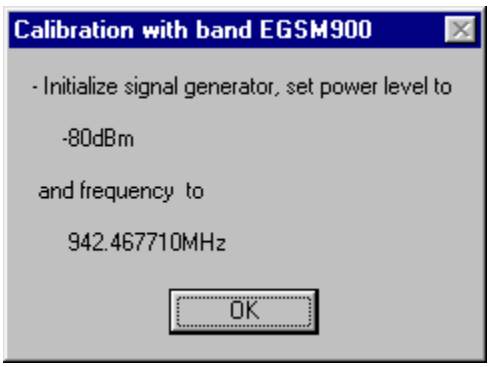
Select Automatic, press Start and a new window pops up:



Select default, press OK and the window closes.

Now it is possible to press the calibrate button in the RX Calibration window.

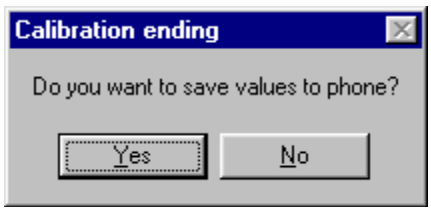
Press Calibrate and a window pops up:



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

Press ok and the window closes.

Press Stop in the RX Calibration window and a new window pops up:



Press Yes and the EGSM RX Calibration is finished.

PCN

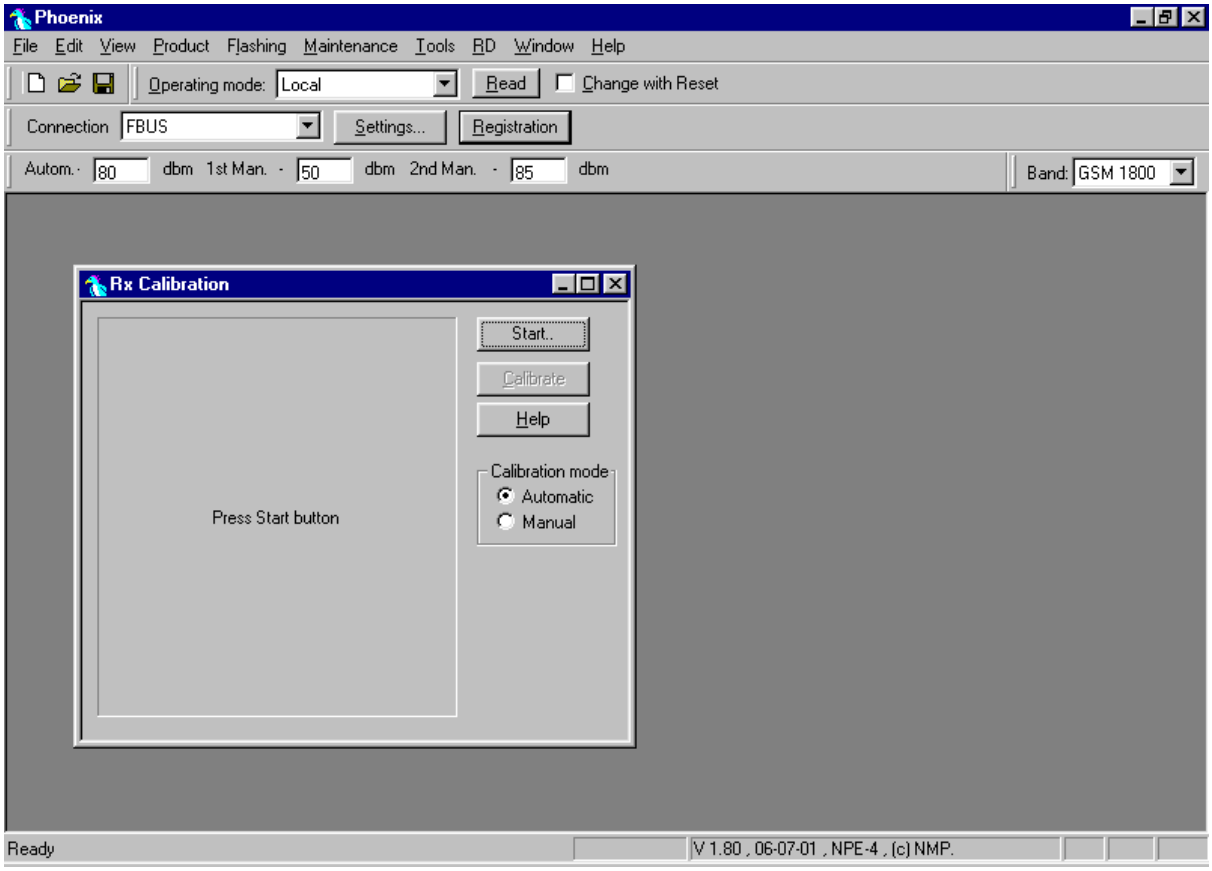
Set operating mode to local mode

Select	Maintenance		Alt-M
	Tuning		T
		RX Calibration	C

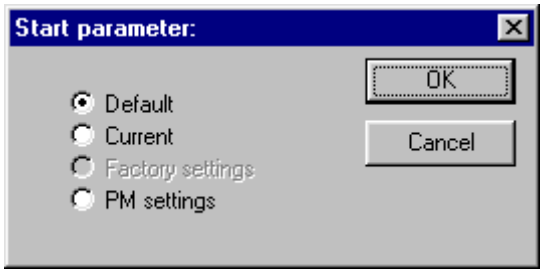
Wait until the RX Calibration window pops up

Select	Band	GSM 1800
	Autom.-	80
	1st Man.-	50
	2nd Man.-	85

The setup should now look like this:



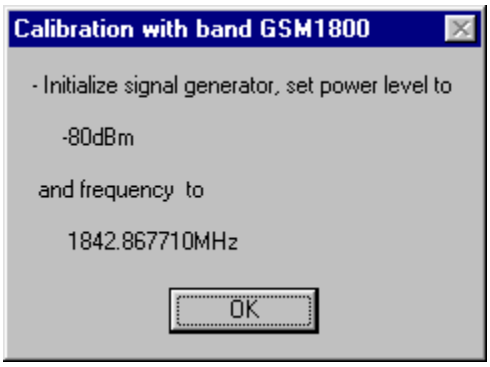
Select Automatic, press Start and a new window pops up:



Select default, press OK and the window closes.

Now it is possible to press the calibrate button in the RX Calibration window.

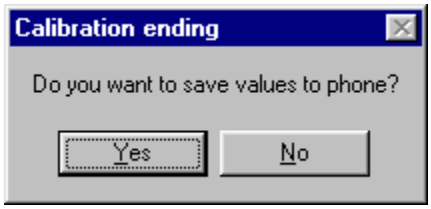
Press Calibrate and a window pops up:



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

Press ok and the window closes.

Press Stop in the RX Calibration window and a new window pops up:



Press Yes and the PCN RX Calibration is finished.

RX Band Filter Response Compensation

EGSM

Set operating mode to local mode

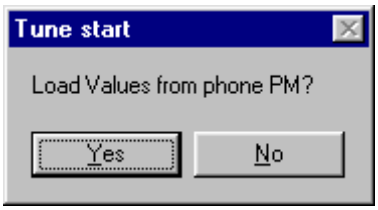
Select	Maintenance		Alt-M
	Tuning		T
		RF Controls	F

Wait until the RF Controls window pops up

Select	Band	GSM 900	

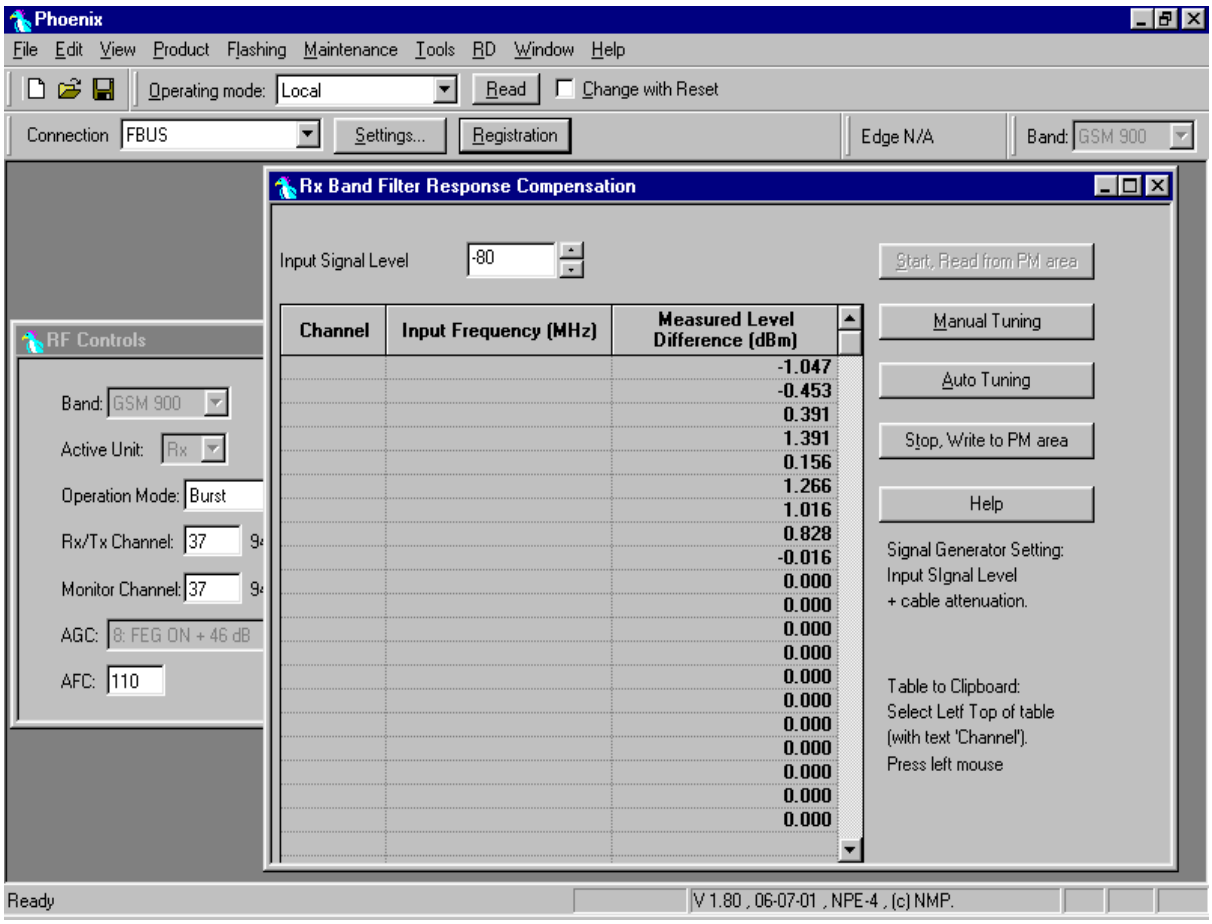
Select	Maintenance		Alt-M
	Tuning		T
		RX Band Filter Response Compensation	B

A window pops up:



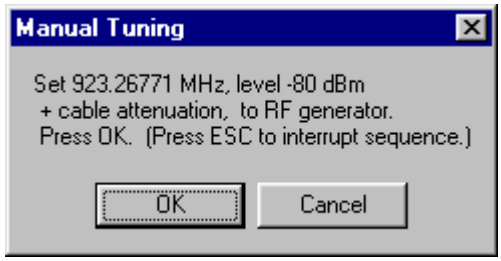
Select Yes and the RX Band Filter Response Compensation window pops up.

The setup should now look like this:



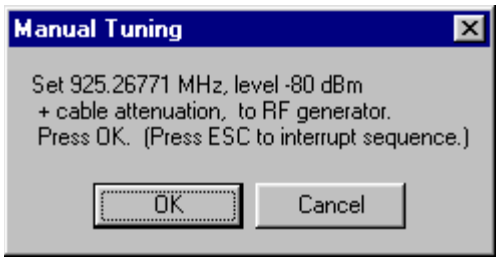
Select Input Signal Level -80

Press Manual tuning 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.

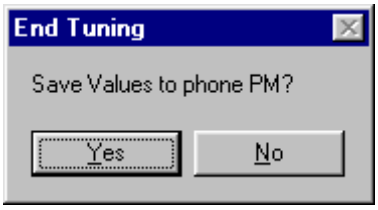
Press OK and a new window pops up:



Set the generator as told in the window.

Press OK and a new window pops up. Repeat this sequense **9 times** until all channels are done.

Press Stop, Write to PM Area (In the RX Band Filter Response Compensation window) and a window pops up:



Press Yes and the EGSM RX Band Filter Response Compensation is finished.

PCN

Set operating mode to local mode

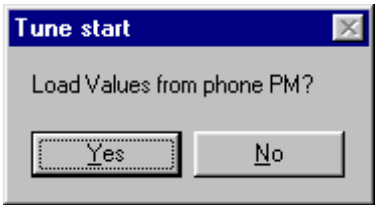
Select	Maintenance	Alt-M
	Tuning	T
	RF Controls	F

Wait until the RF Controls window pops up

Select Band GSM 1800

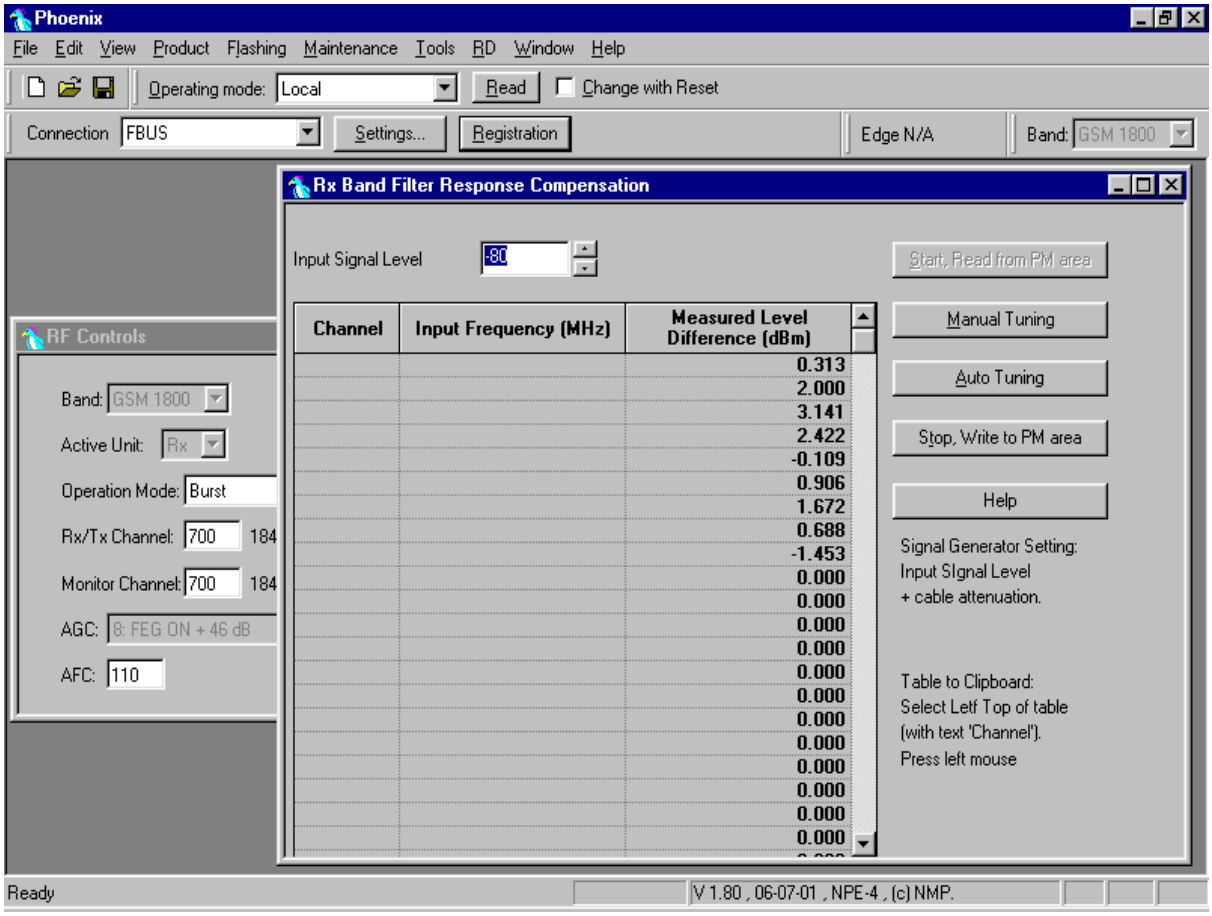
Select Maintenance Alt-M
Tuning T
RX Band Filter Response Compensation B

A window pops up:



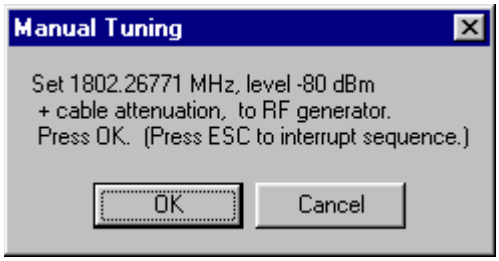
Select Yes and the RX Band Filter Response Compensation window pops up.

The setup should now look like this:



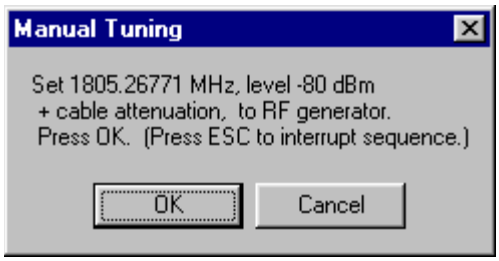
Select Input Signal Level -80

Press Manual tuning 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.

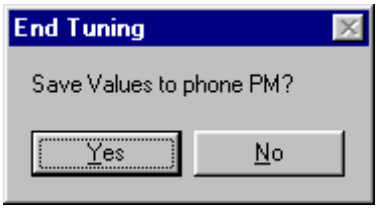
Press OK and a new window pops up:



Set the generator as told in the window.

Press OK and a new window pops up. Repeat this sequense **9 times** until all channels are done.

Press Stop, Write to PM Area (In the RX Band Filter Response Compensation window) and a window pops up:



Press Yes and the PCN RX Band Filter Response Compensation is finished.

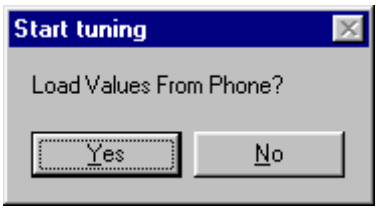
RX Channel Select Filter Calibration

This calibration is calibrating the Baseband filter inside Hagar, for this reason the calibration is not done in both bands.

Set operating mode to local mode

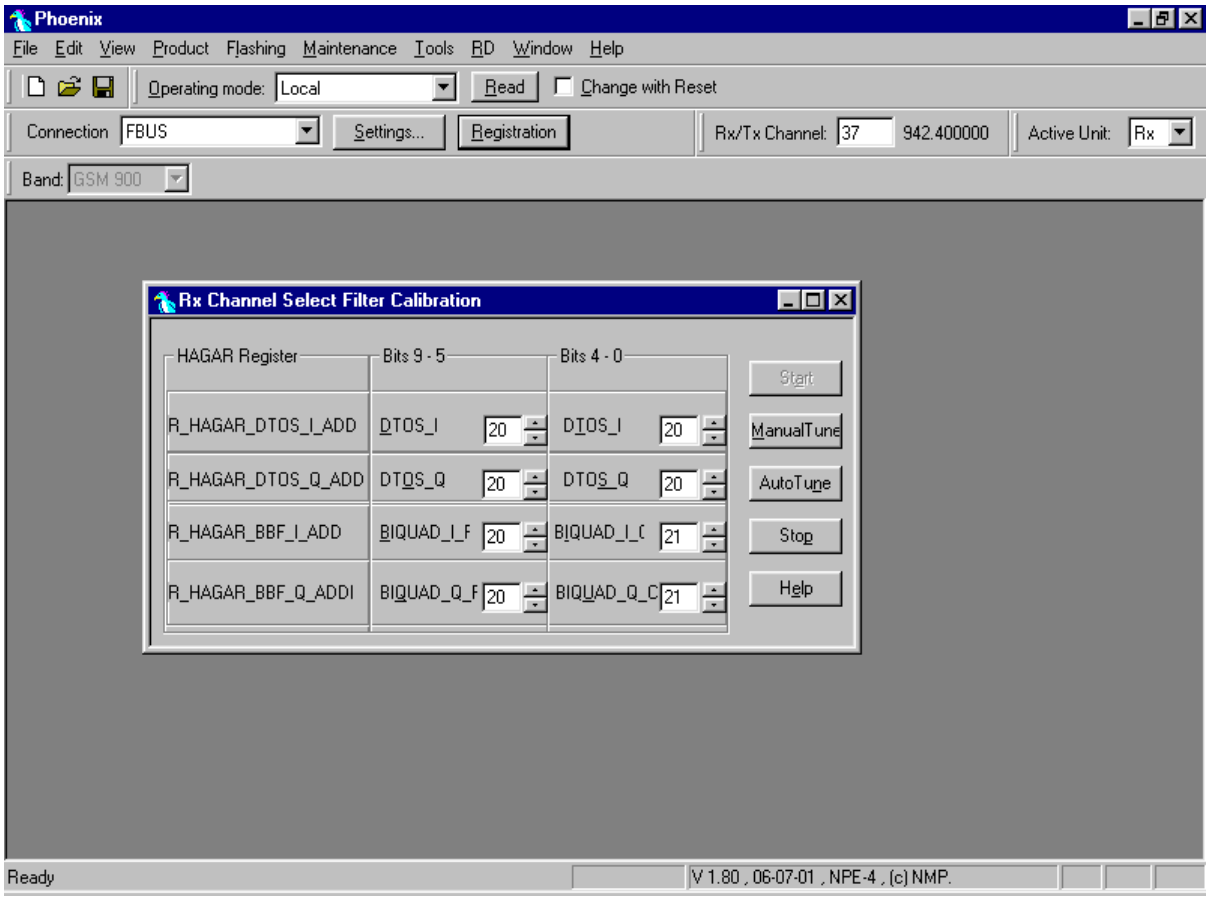
Select	Maintenance	Alt-M
	Tuning	T
	RX Channel Select filter Calibration	H

A window pops up:



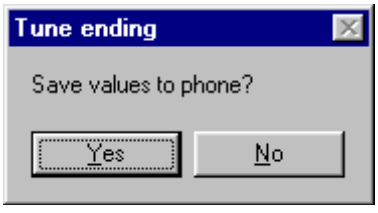
Select Yes and the RX Channel Select Filter Calibration window pops up.

The setup should now look like this:



Press Autotune and the optimal values are found.

Press Stop and a new window pops up:



Press Yes and the RX Channel Select Filter Calibration is finished.

RX AM Suppression

This calibration is tuning the AM suppression performance of Hagar mixers and will have to be done in both bands. If flash or Hagar have been replaced or Full Factory settings have been performed RX AM Suppression must be done.

EGSM

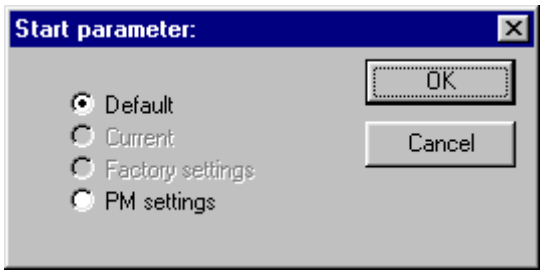
Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	RX AM Suppression	S

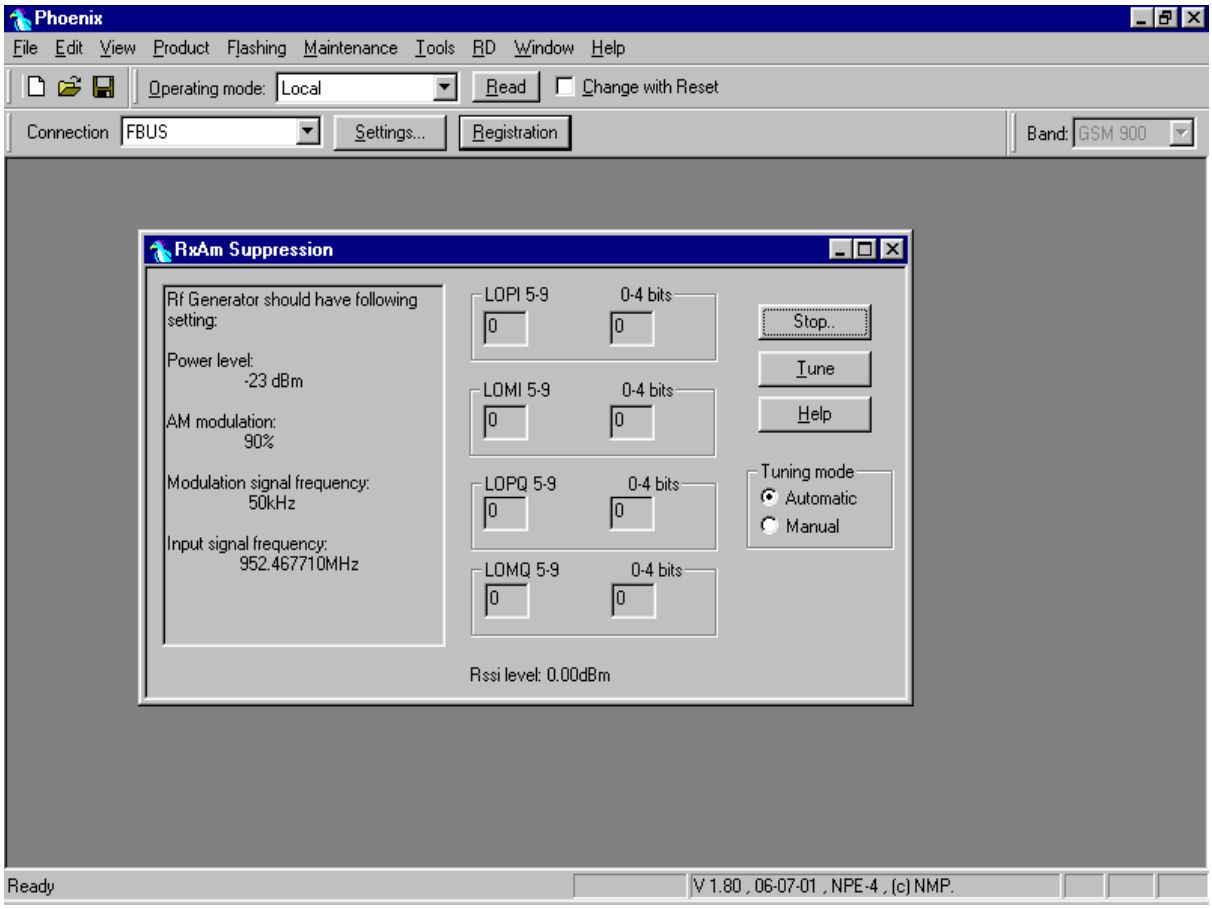
Wait until the RX AM Suppression window pops up

Select	Band	GSM 900

Press Start and a window pops up:



Select Default, press OK and the setup should now look like this:

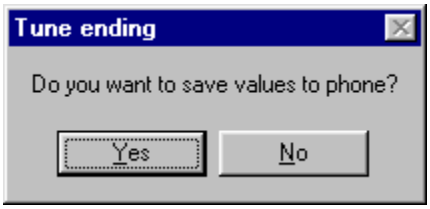


Connect an external signal generator to the RF connector of the phone and set the generator as told in the window.

Select Tuning mode Automatic

Press Tune and the optimal values are found.

Press Stop and a window pops up:



Press Yes and the EGSM RX AM Suppression tuning is finished.

PCN

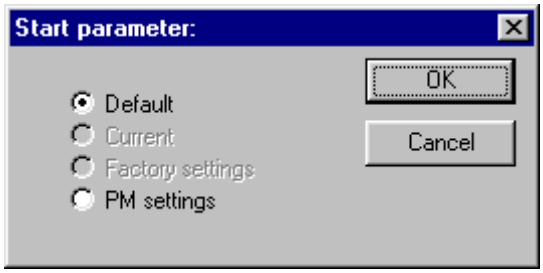
Set operating mode to local mode

Select Maintenance Alt-M
Tuning T
RX AM Suppression S

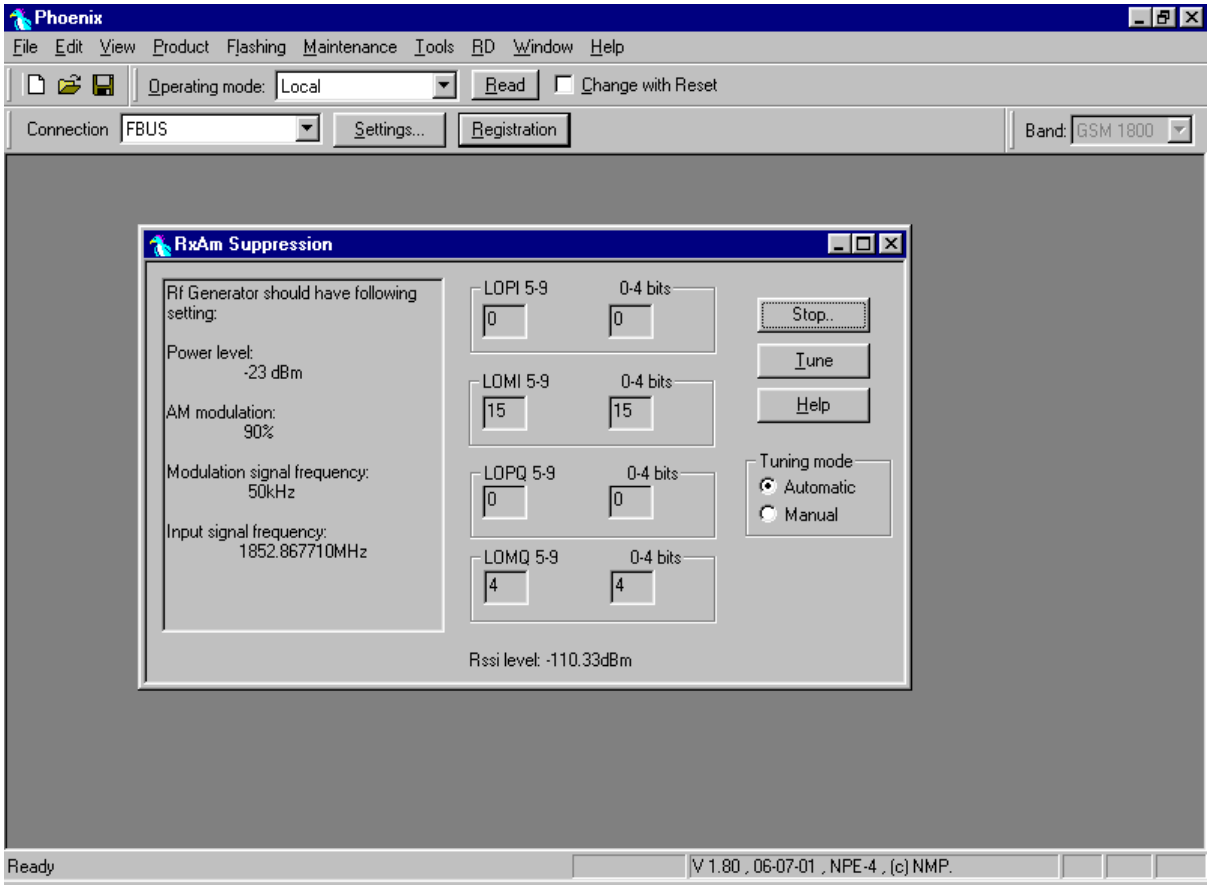
Wait until the RX AM Suppression window pops up

Select Band GSM 1800

Press Start and a window pops up:



Select Default, press OK and the setup should now look like this:

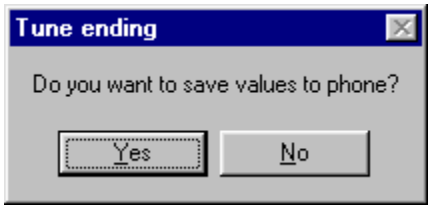


Connect an external signal generator to the RF connector of the phone and set the generator as told in the window.

Select Tuning mode Automatic

Press Tune and the optimal values are found.

Press Stop and a window pops up:



Press Yes and the PCN RX AM Suppression tuning is finished.

TX Power tuning

This tuning must be done in both bands.

Note: TX Power tuning must be done with a peak power meter, e.g. Rohde & Schwarz model NRVD with a Rohde & Schwarz Peak Power Sensor TDMA Model NRV-Z31 and a suitable attenuator.

The use of 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.

EGSM

Set operating mode to local mode

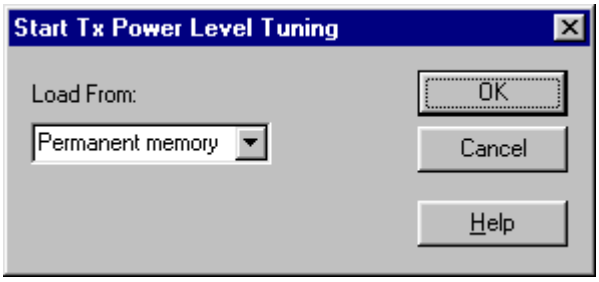
Select Maintenance Alt-M
Tuning T
TX Power Level Tuning L

Wait until the TX Power Level Tuning window pops up.

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

Select Band GSM 900
Active Unit TX

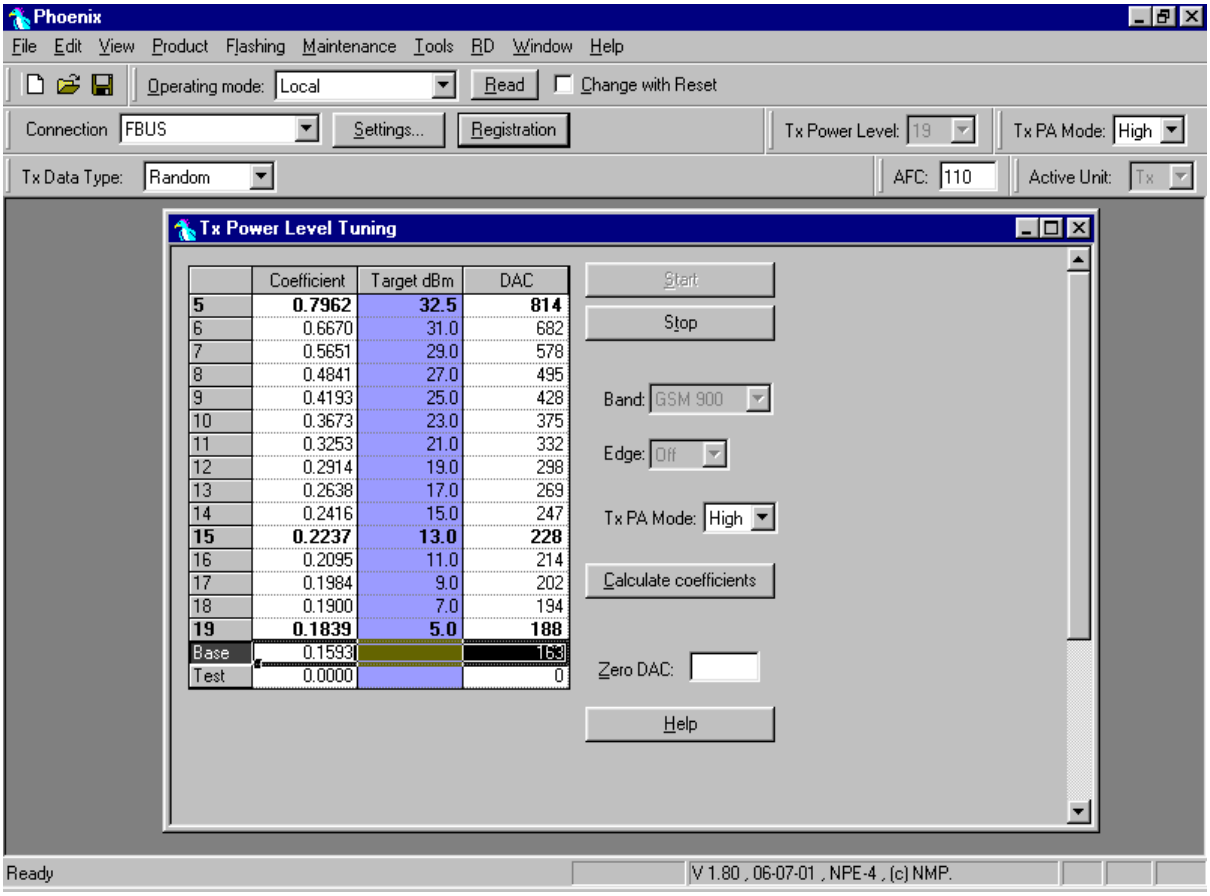
Press Start and a window pops up:



Select Permanent memory, press OK and the window closes.

Select TX Data Type Random

The setup should now look like this:



Select TX PA Mode High

Adjust DAC Values for Power Level 5, 15 and 19 according to Target values.

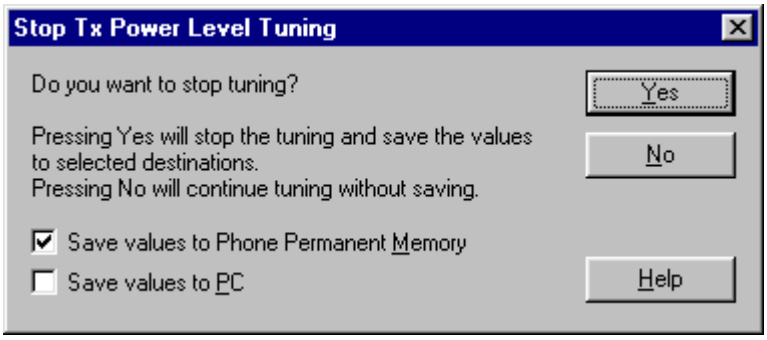
Press calculate, check if all levels match the target values, correct if necessary.

Select TX PA Mode Low

Adjust DAC Values for Power Level 7, 15 and 19 according to Target values.

Press calculate, check if all levels match the target values, correct if necessary.

Press Stop and a window pops up:



Select 'Save values to Phone Permanent Memory'

Press Yes and the EGSM TX Power Level Tuning is finished.

PCN

Set operating mode to local mode

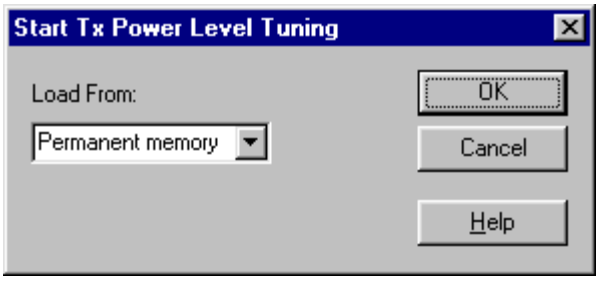
Select Maintenance Alt-M
Tuning T
TX Power Level Tuning L

Wait until the TX Power Level Tuning window pops up.

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

Select Band GSM 1800
Active Unit TX

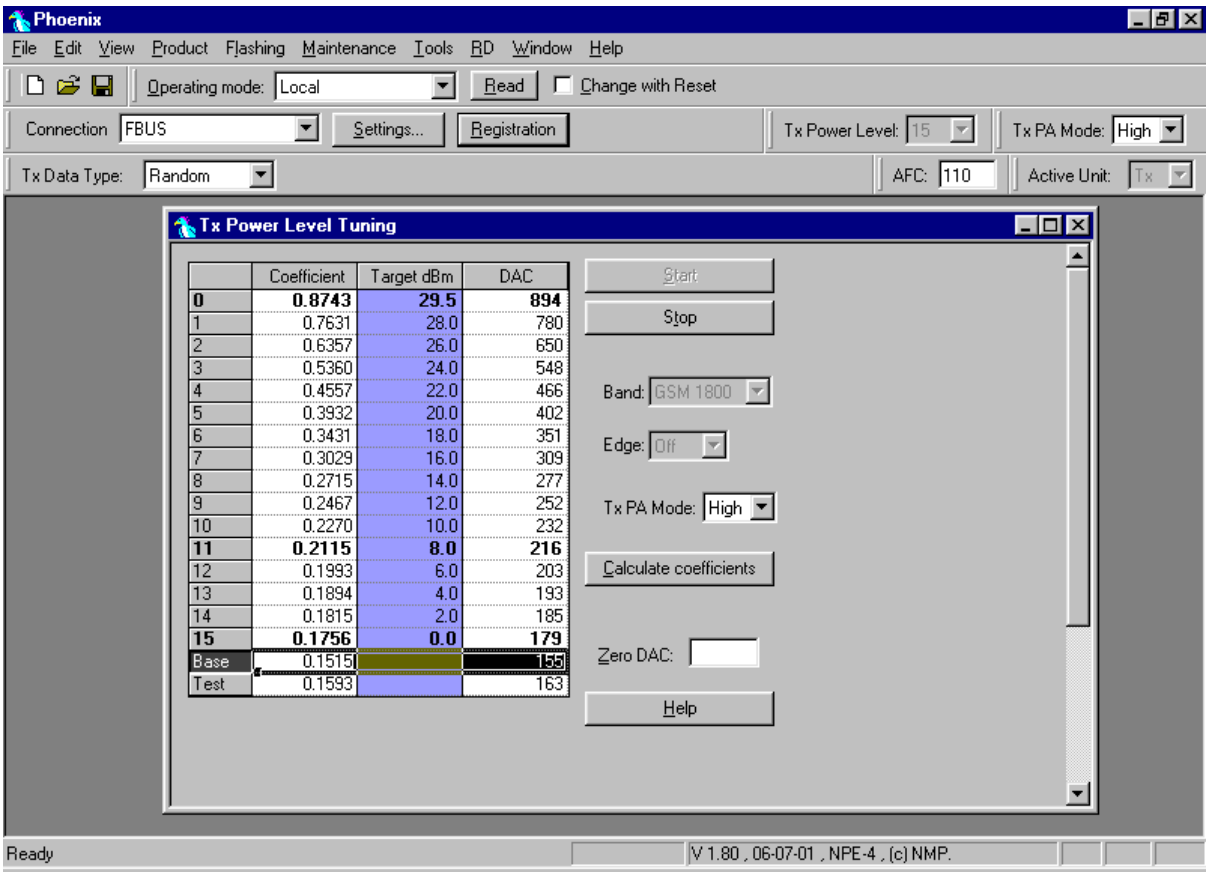
Press Start and a window pops up:



Select Permanent memory, press OK and the window closes.

Select TX Data Type Random

The setup should now look like this:

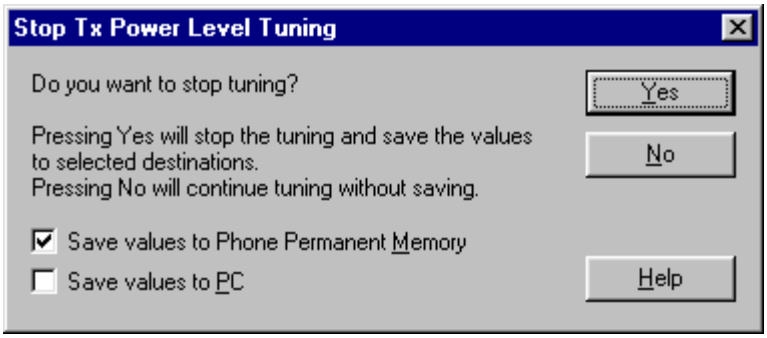


Select TX PA Mode High

Adjust DAC Values for Power Level 0, 11 and 15 according to Target values.

Press calculate, check if all levels match the target values, correct if necessary.

Press Stop and a window pops up:



Select 'Save values to Phone Permanent Memory'

Press Yes and the EGSM TX Power Level Tuning is finished.

TX I/Q Tuning

This tuning must be done in both bands.

EGSM

Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	TX IQ Tuning	I

Wait until the TX IQ Tuning window pops up.

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

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

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

Use an appropriate attenuator 10 or 20dB insertion loss and set the Reference Level Offset according to insertion loss from the phone to the Spectrum Analyzer.

Select	Band	GSM 900
	Operation Mode	Burst
	RX/TX Channel	37

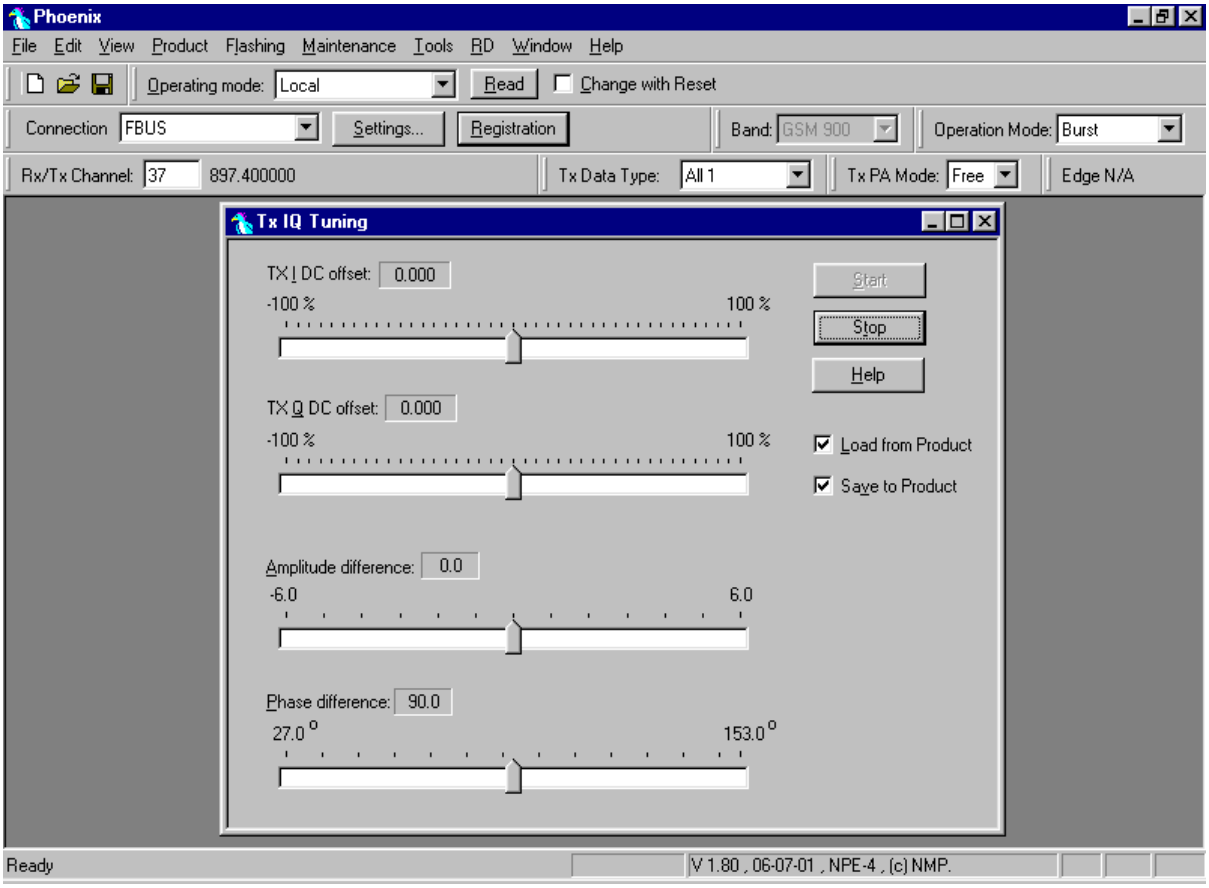
Select 'Load from Product'

Press Start

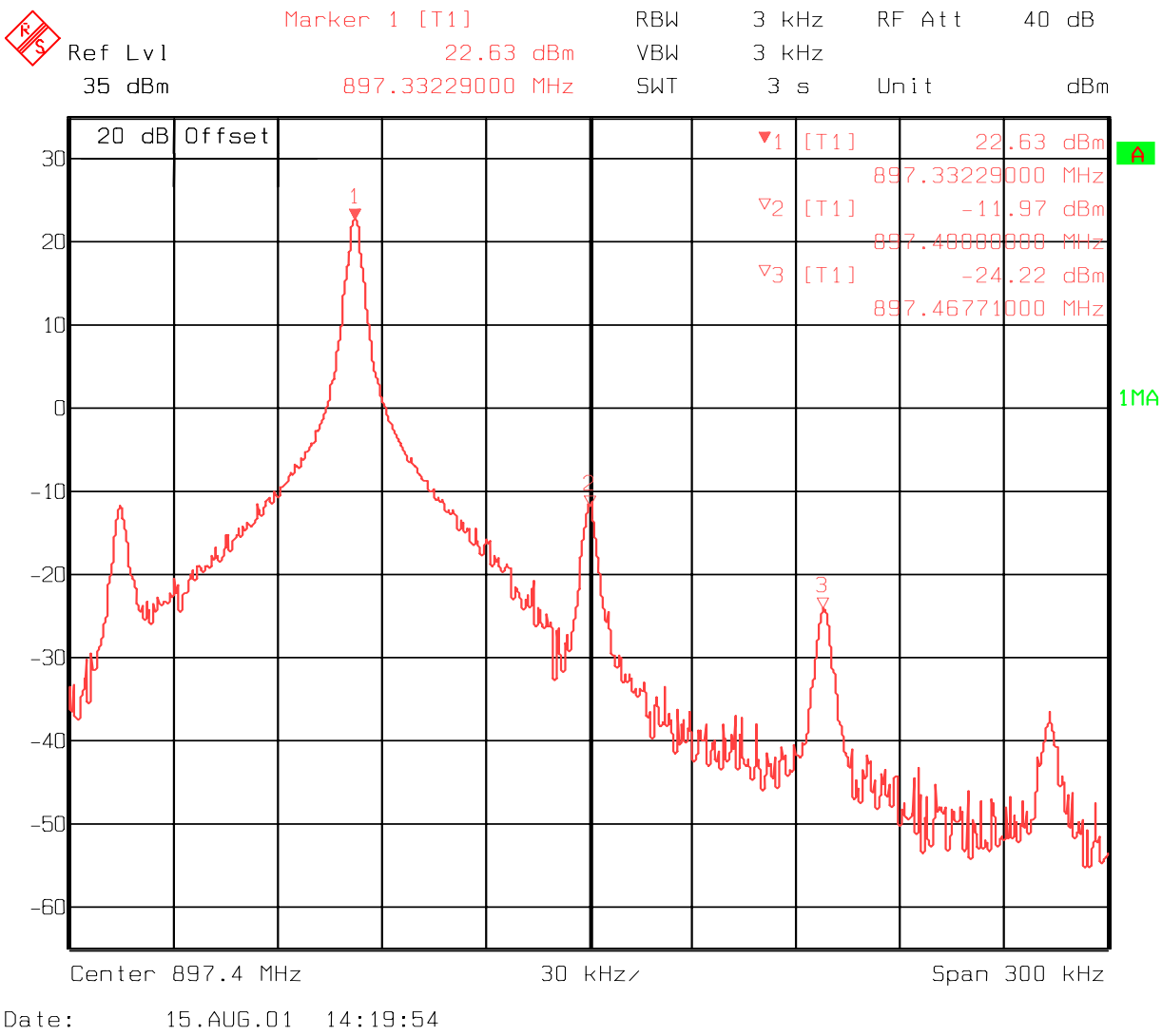
Select TX Data Type All1

TX PA Mode Free

The setup should now look like this:



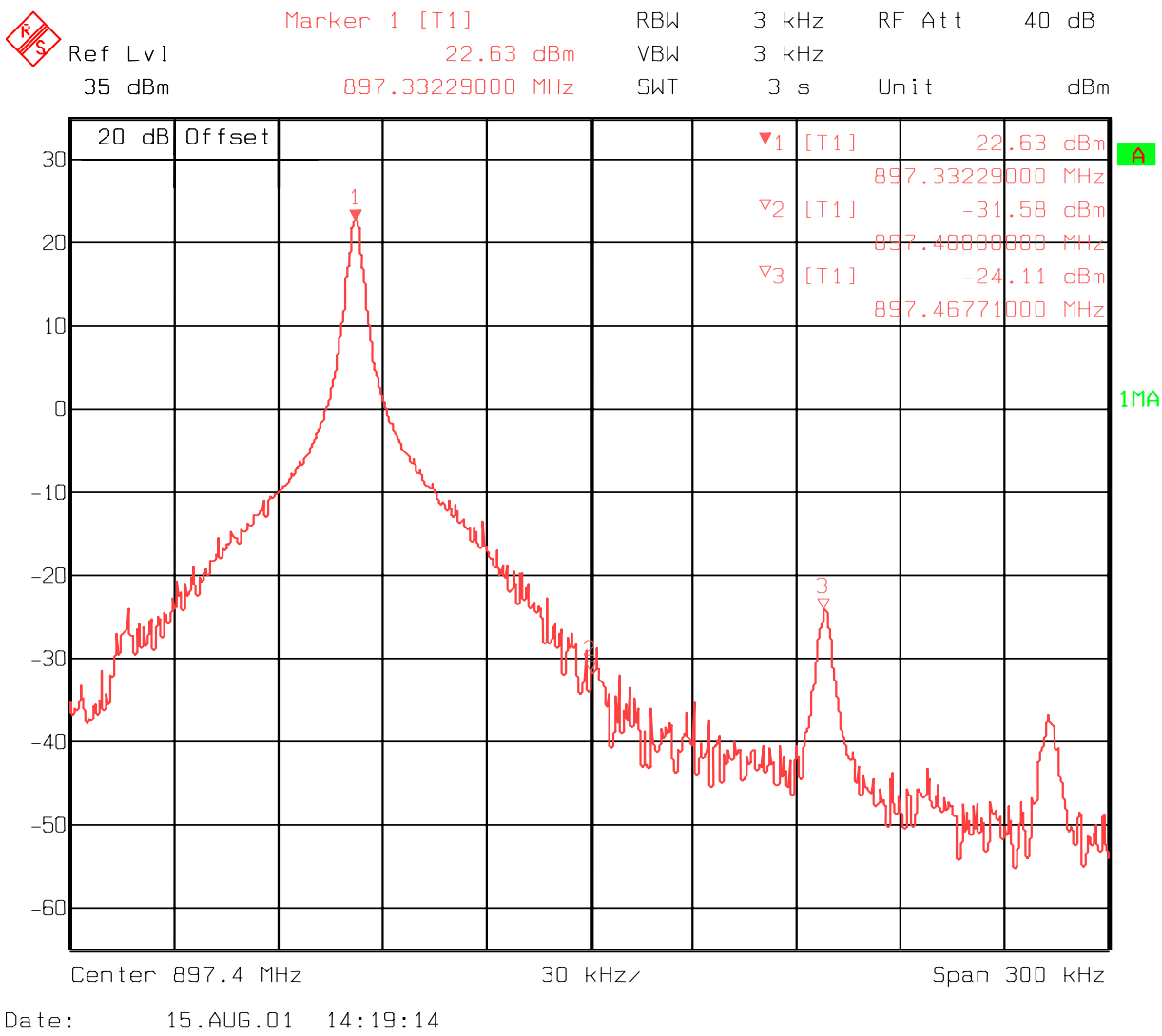
The Spectrum Analyzer now shows a plot like this:



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

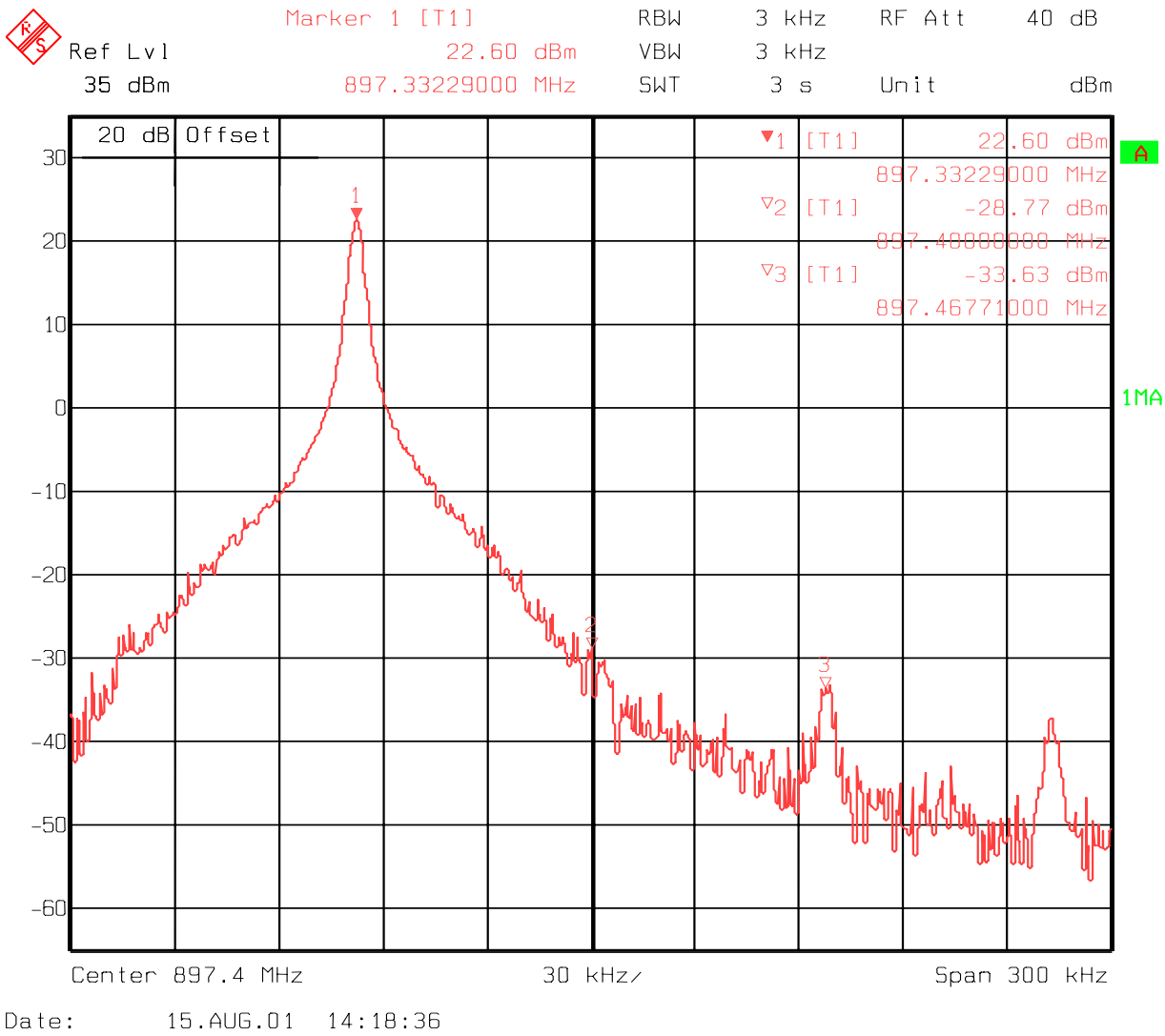
Use the varables 'TX I DC offset' and 'TX Q DC offset' to adjust the carrier signal to a minimum level (Marker 2).

The Spectrum Analyzer now shows a plot like this:



Use the varables 'Amplitude difference' and 'Phase difference' to adjust the +67kHz signal to a minimum level (Marker 3).

The Spectrum Analyzer now shows a plot like this:



Select 'Save to Product'

Press Stop and the values are stored in the phone.

The EGSM TX IQ Tuning is now finished.

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

PCN

Set operating mode to local mode

Select	Maintenance	Alt-M
	Tuning	T
	TX IQ Tuning	I

Wait until the TX IQ Tuning window pops up.

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

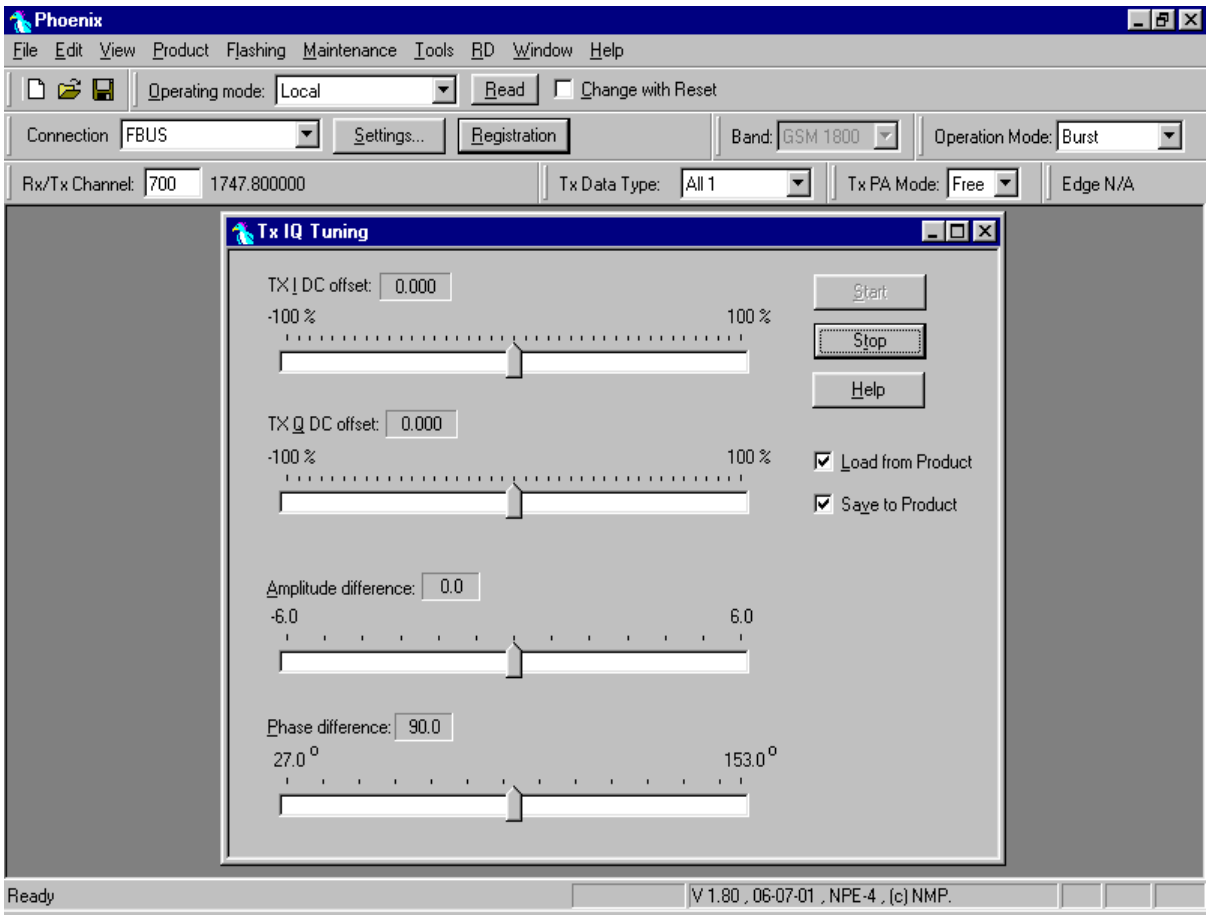
If a spectrum analyzer is used then use the following settings.

	PCN
Center Frequency	1747.8MHz
Frequency Span	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	1747.73229 MHz
Marker 2	1747.8 MHz
Marker 3	1747.86771 MHz

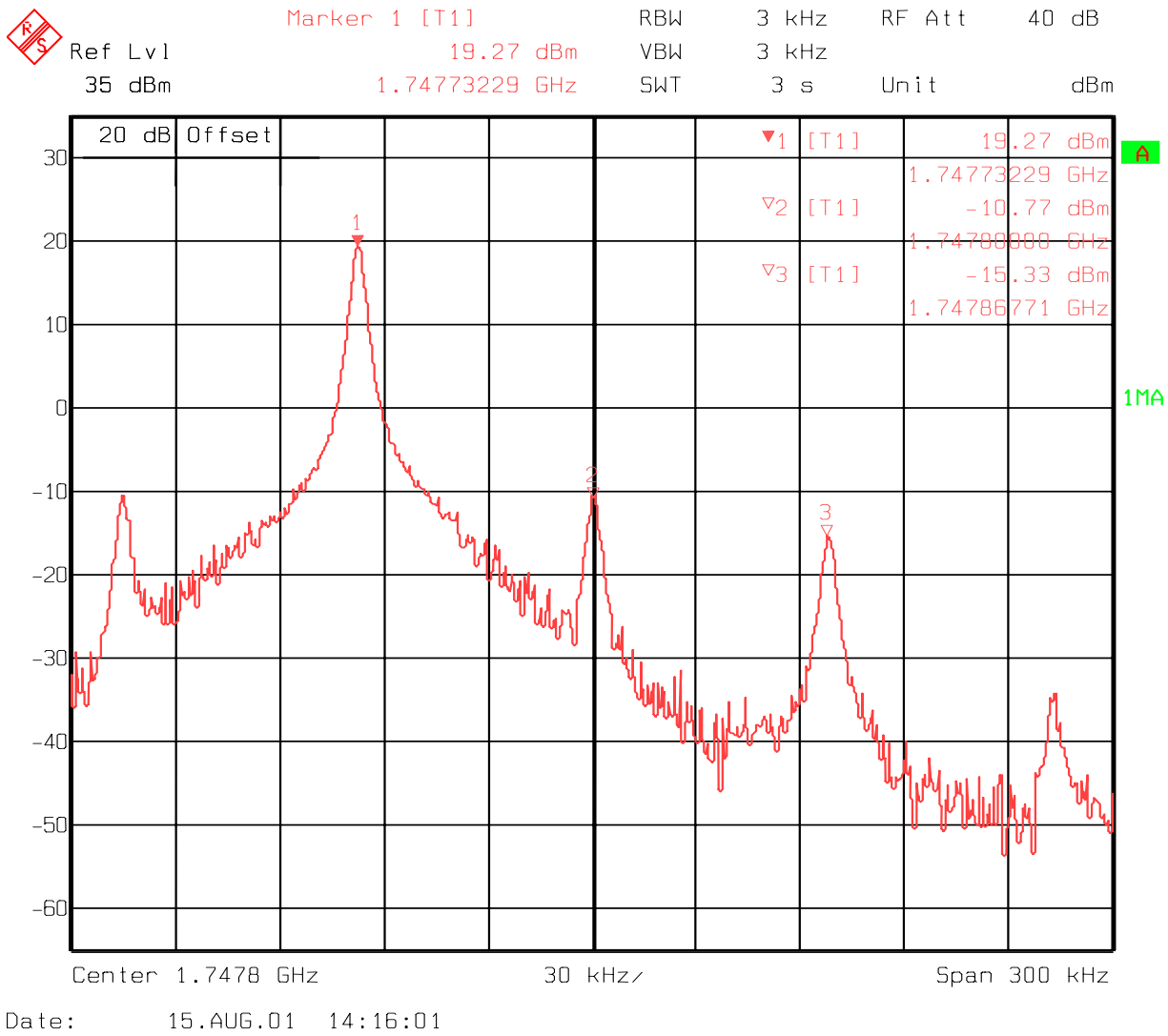
Use an appropriate attenuator 10 or 20dB insertion loss and set the Reference Level Offset according to insertion loss from the phone to the Spectrum Analyzer.

Select	Band	GSM 1800
	Operation Mode	Burst
	RX/TX Channel	700
Select	'Load from Product'	
Press	Start	
Select	TX Data Type	All1
	TX PA Mode	Free

The setup should now look like this:



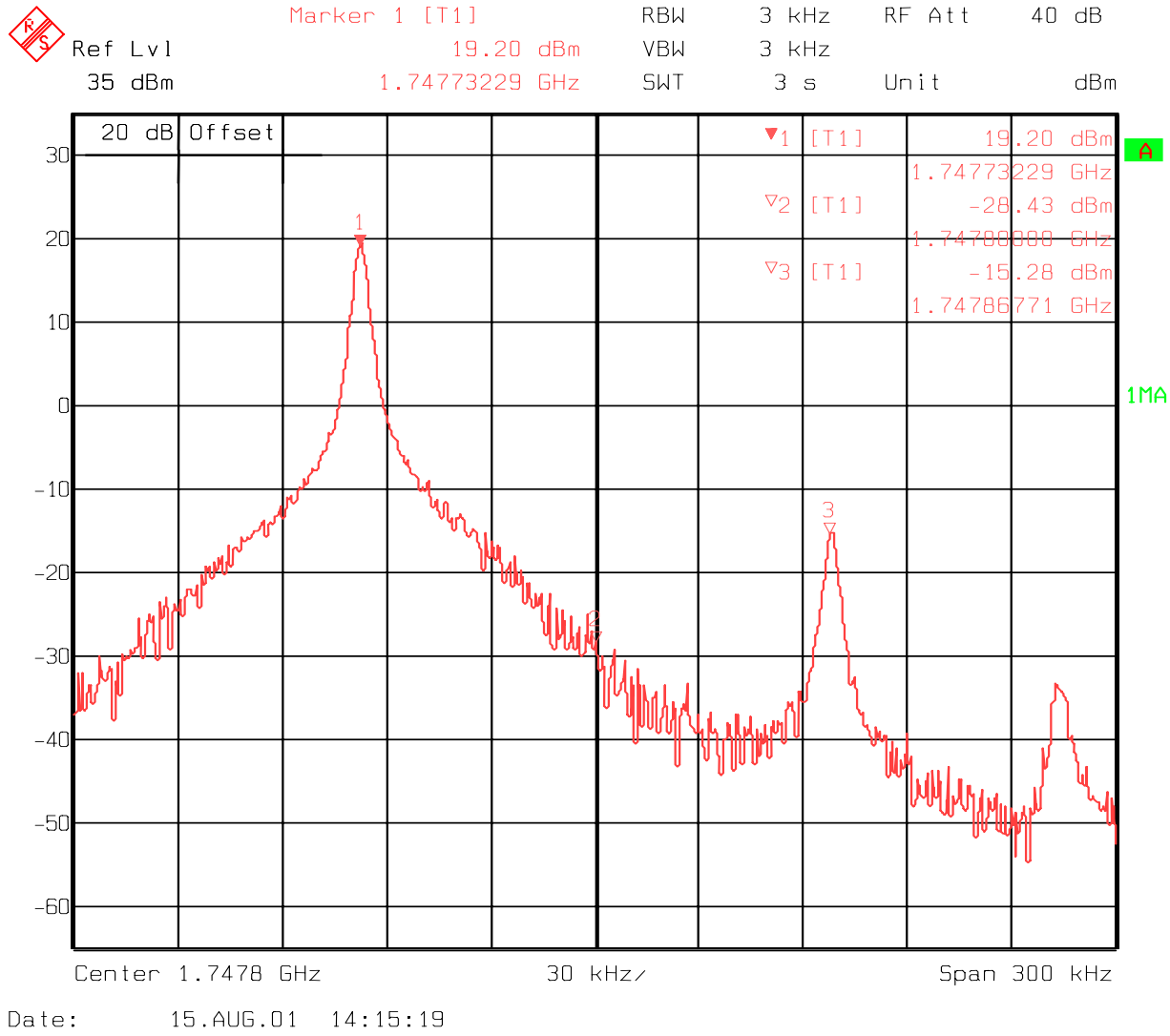
The Spectrum Analyzer now shows a plot like this:



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

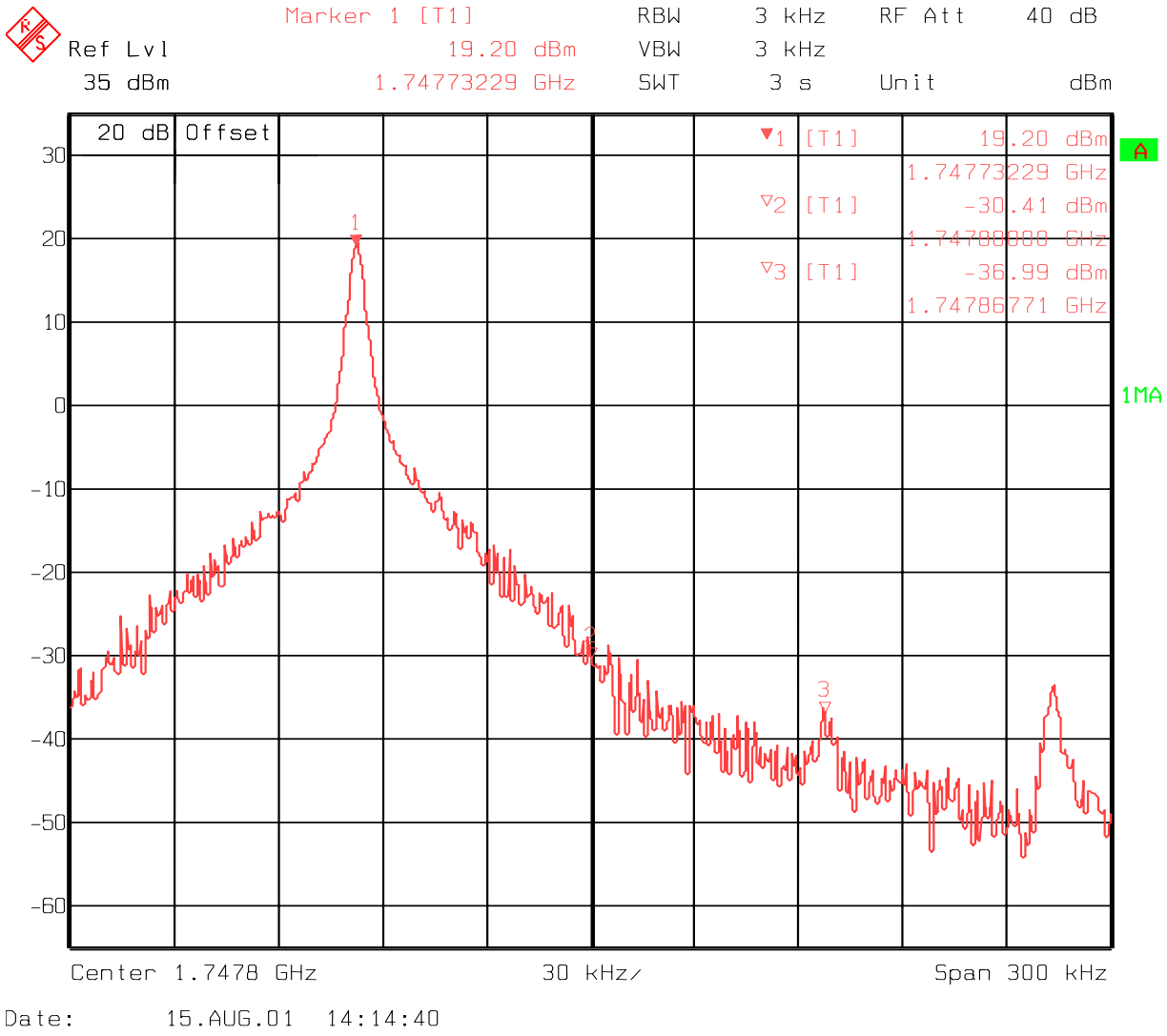
Use the varables 'TX I DC offset' and 'TX Q DC offset' to adjust the carrier signal to a minimum level (Marker 2).

The Spectrum Analyzer now shows a plot like this:



Use the varables 'Amplitude difference' and 'Phase difference' to adjust the +67kHz signal to a minimum level (Marker 3).

The Spectrum Analyzer now shows a plot like this:



Select 'Save to Product'

Press Stop and the values are stored in the phone.

The PCN TX IQ Tuning is now finished.

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