

# CCS Technical Documentation

## RH-9 Series Transceivers

# Troubleshooting Instructions

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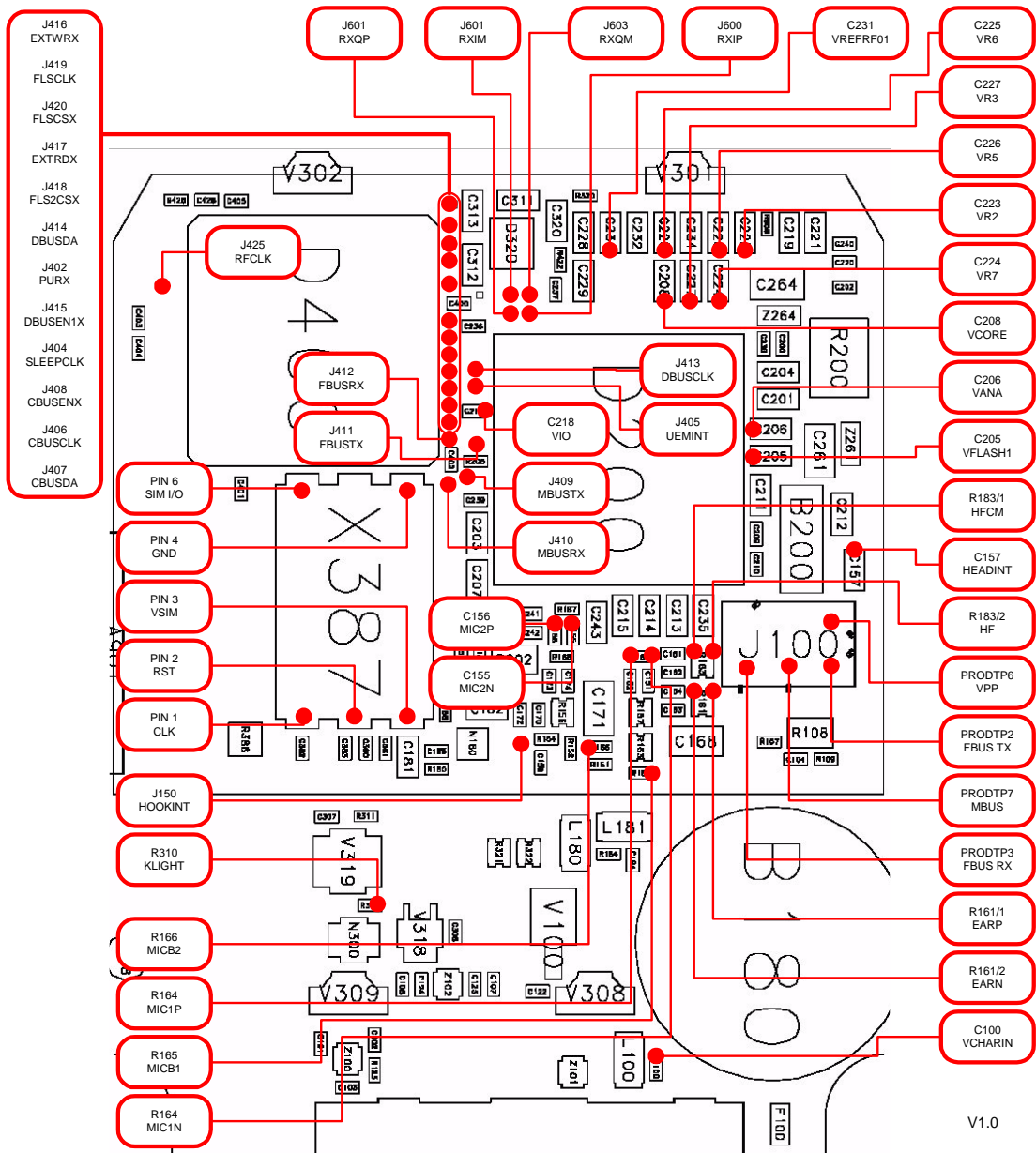
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## Introduction

This document contains the Popeye fault finding charts. Furthermore it includes the baseband testpoint guide. This document is based on the PIPPI troubleshooting document.

# Baseband Testpoints



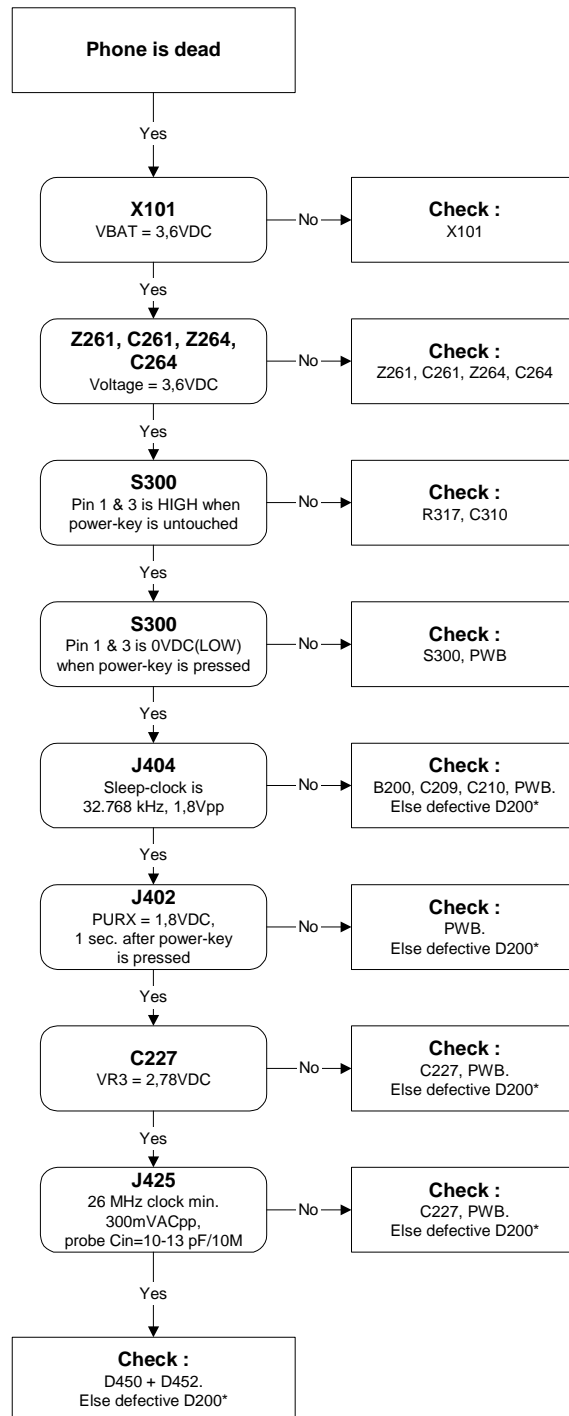
## Fault Finding Charts

In this section, fault finding charts are provided for the most common Popeye errors.

*NOTE: Since both D200 (UEM) and D400(UPP) is underfilled, they can not be replaced. If either D200 or D400 is defective, the whole PWB has be discarded.*

### Phone is dead

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 does not work

The flash programming can only be done via the pads on the PWB (J100).

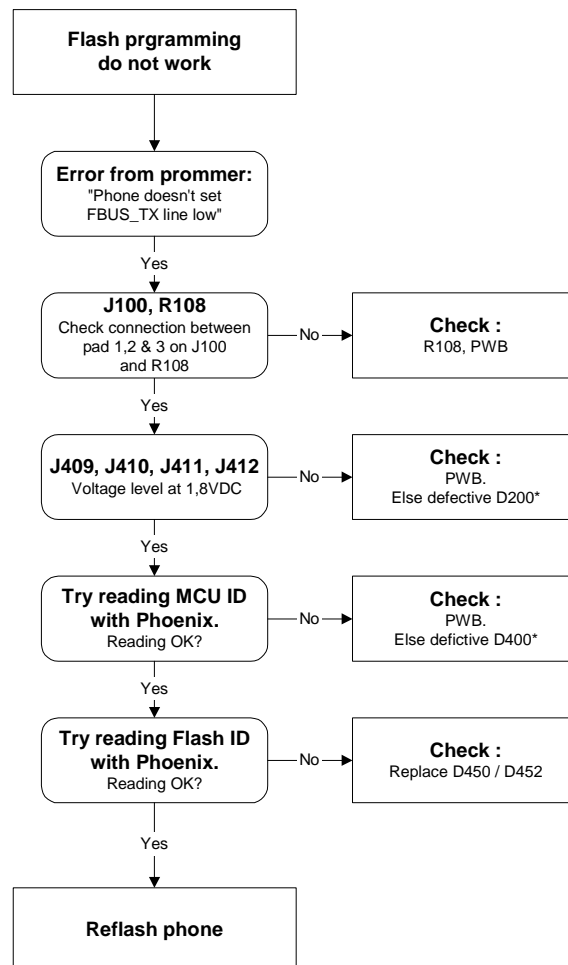
In case of Flash failure in FLALI station, problem is most likely related to SMD problems. Possible failures could be short-circuit of balls under  $\mu$ BGAs (UEM, UPP, FLASH). Missing or misaligned components.

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

The fault information messages could be:

- Phone does not set FBUS\_TX line low

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

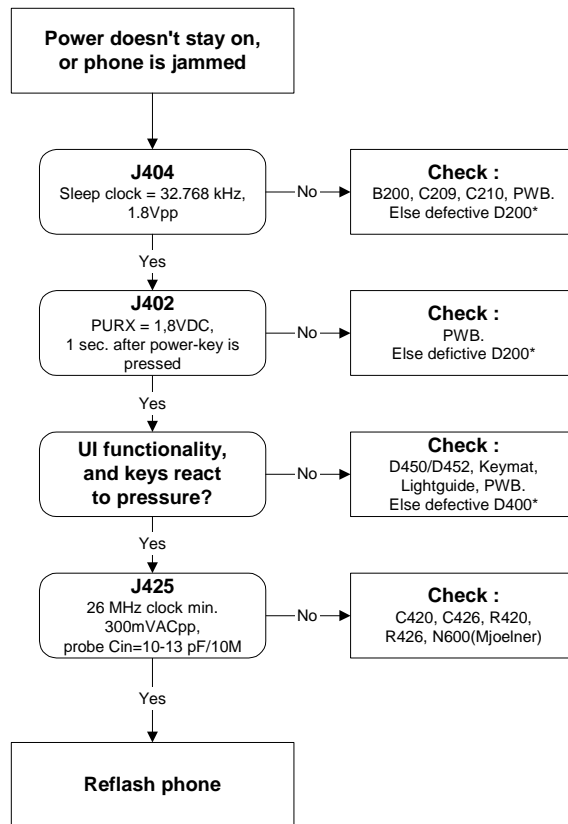




### Power does not stay on or phone is jammed

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

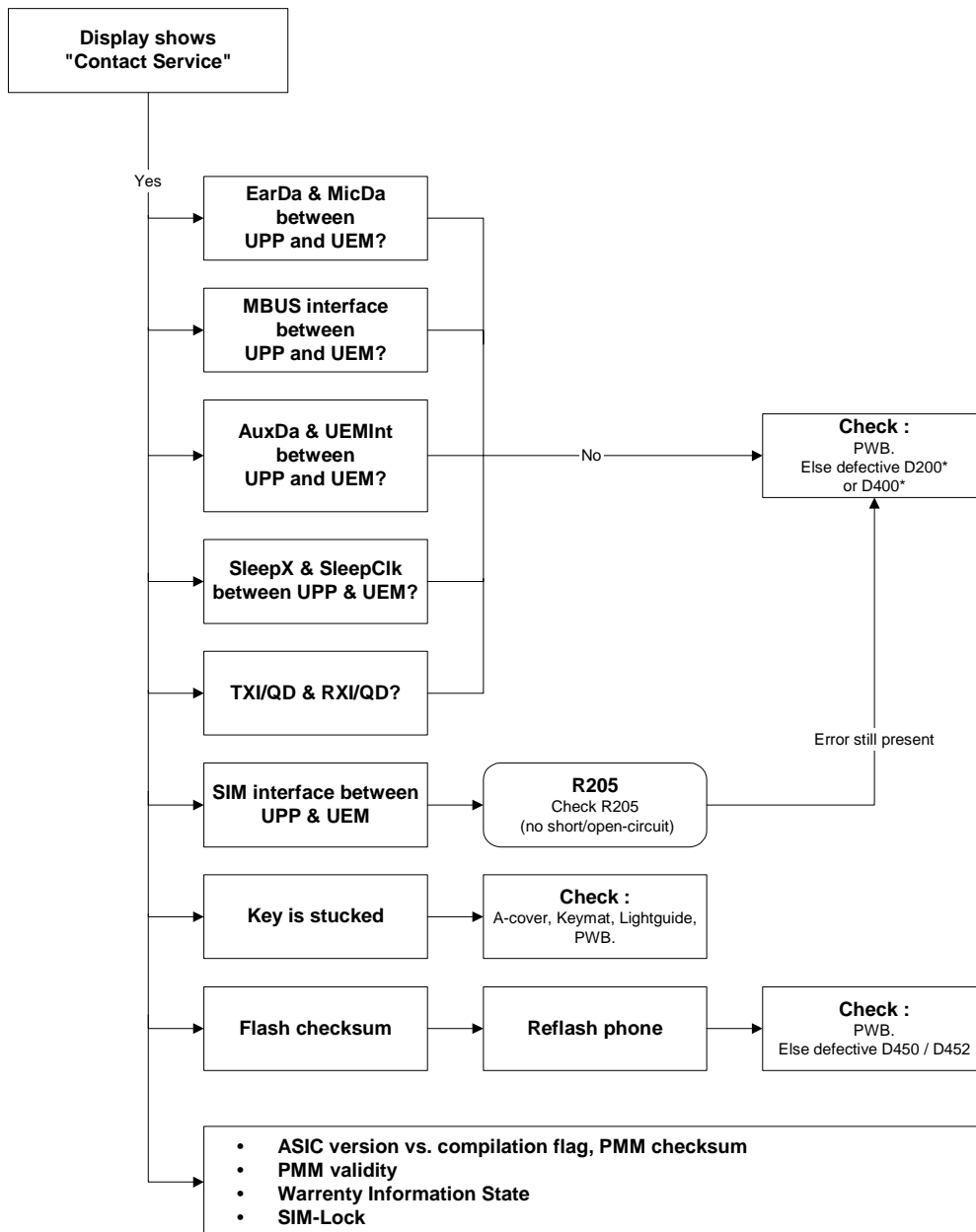
If for some reason the MCU does not service the watchdog register within the UEM, the operations watchdog will run out after approximately 32 seconds. Unfortunately, the service routine cannot be measured.



## Display information: "Contact Service"

This error can only happen at power up where several self-tests are run. If any of these test cases fail, the display will show the message: "Contact Service".

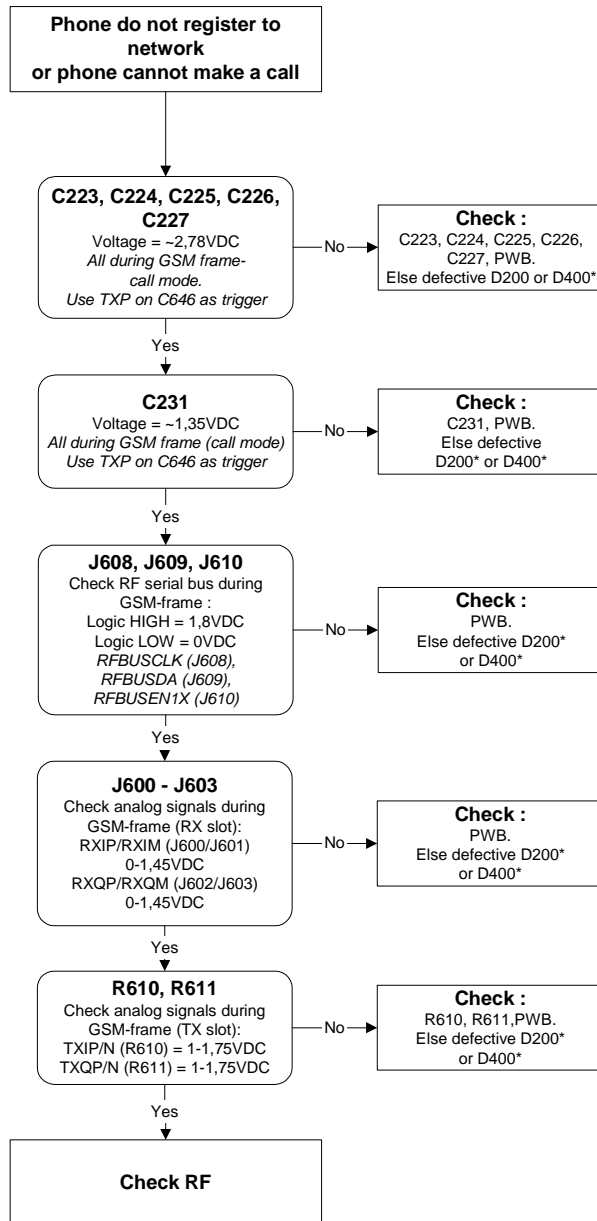
The individual test cases are individual so the below line-up of error hunting has no chronological order. Use common sense and experience to decide which test case to start error hunting at.



### The phone does not register to the network, or the phone cannot make a call

If the phone does not register to the network, the fault can be in either BB or RF. Only few signals can be tested since several signals are 'buried' in one or more of the inner layers of the PWB.

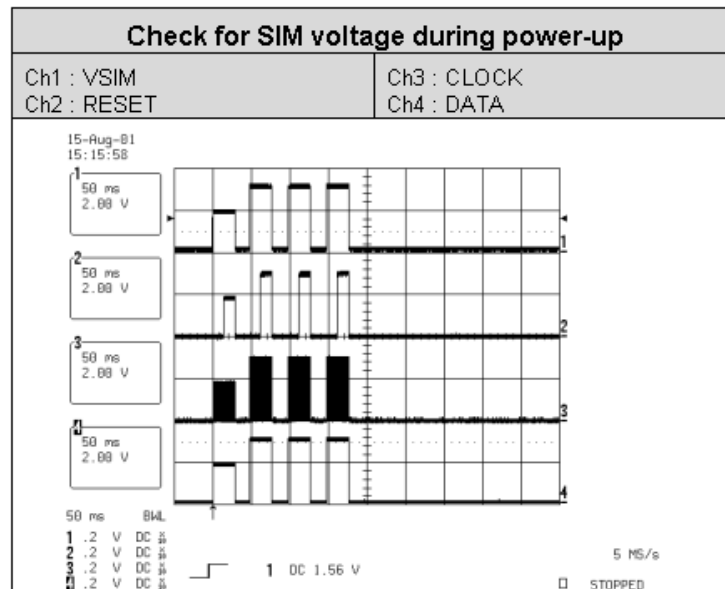
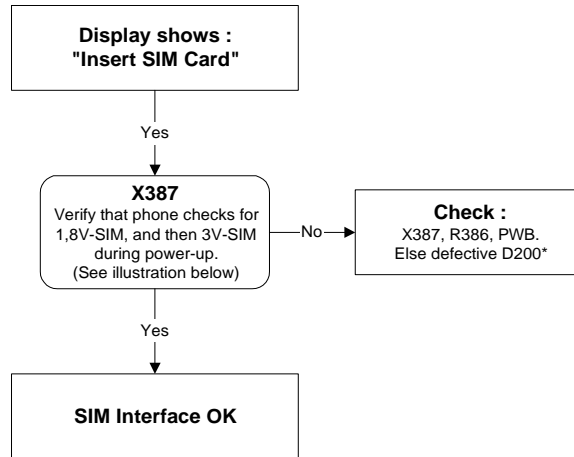
First of all check that SIM LOCK is not causing the error by using a Test-SIM card and connect the phone to a tester.



## SIM related faults

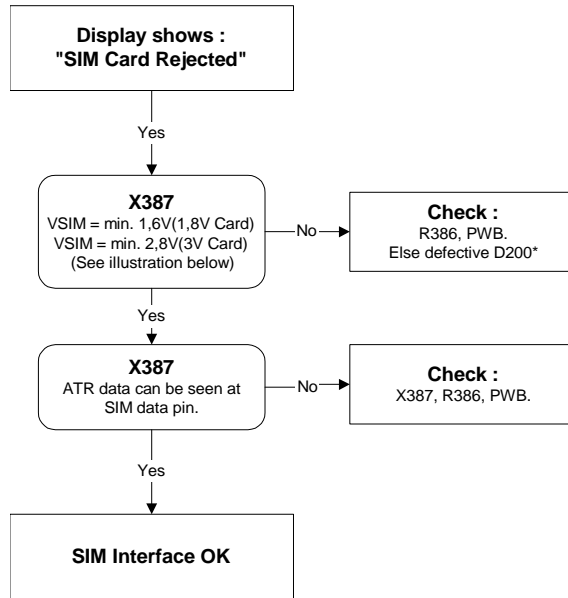
### Insert SIM card fault

The hardware of the SIM interface from UEM (D200) to the SIM connector (X387) 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, where after it will display "Insert SIM card".

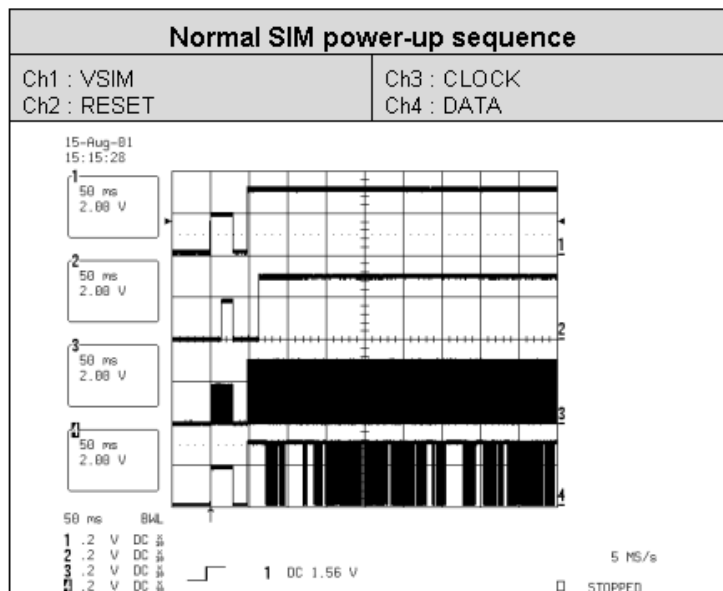


**SIM-Card rejected**

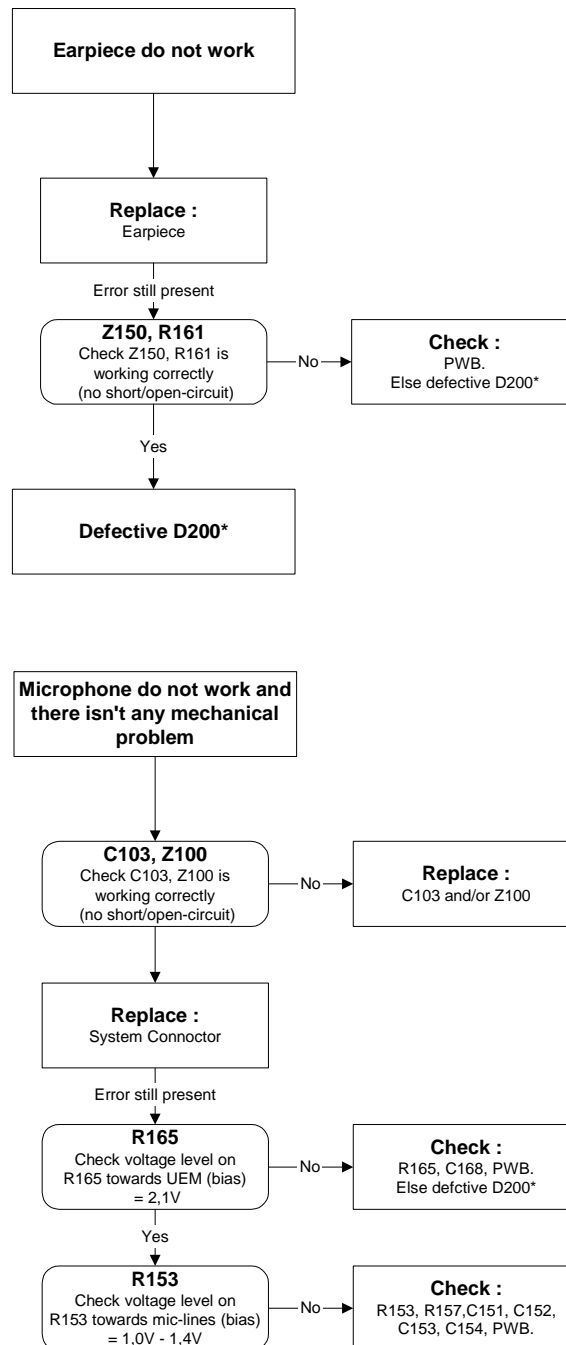
The error "SIM card rejected" means that the ATR message received from SIM card is corrupted, e.g. data signal levels are wrong. The first data is always ATR and it is sent from card to phone.

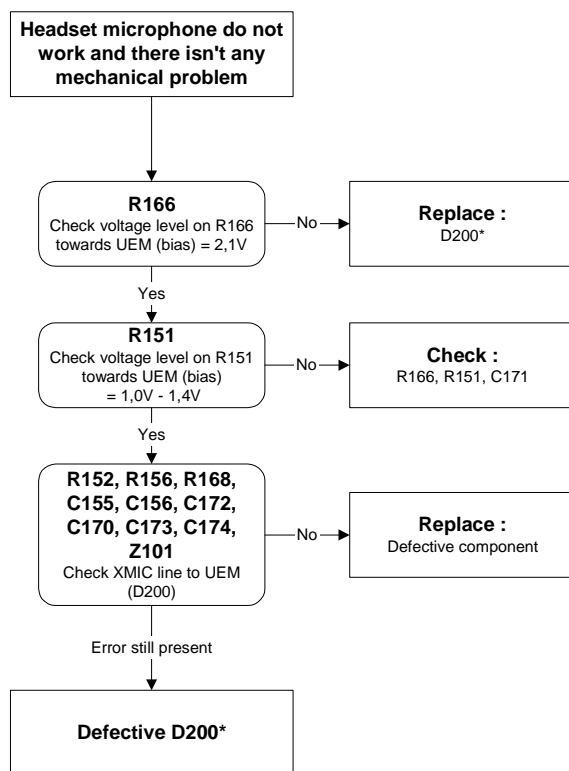
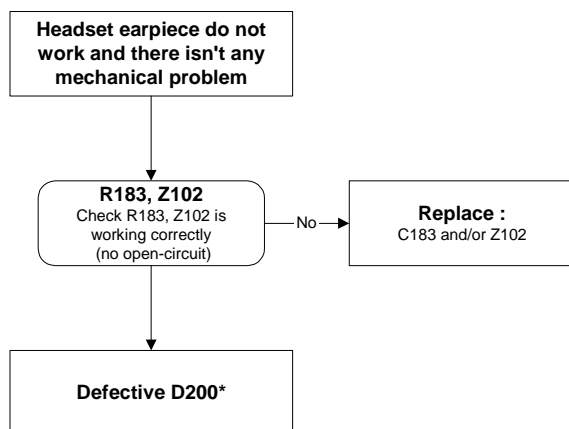


For reference a picture with normal SIM power-up is shown below.

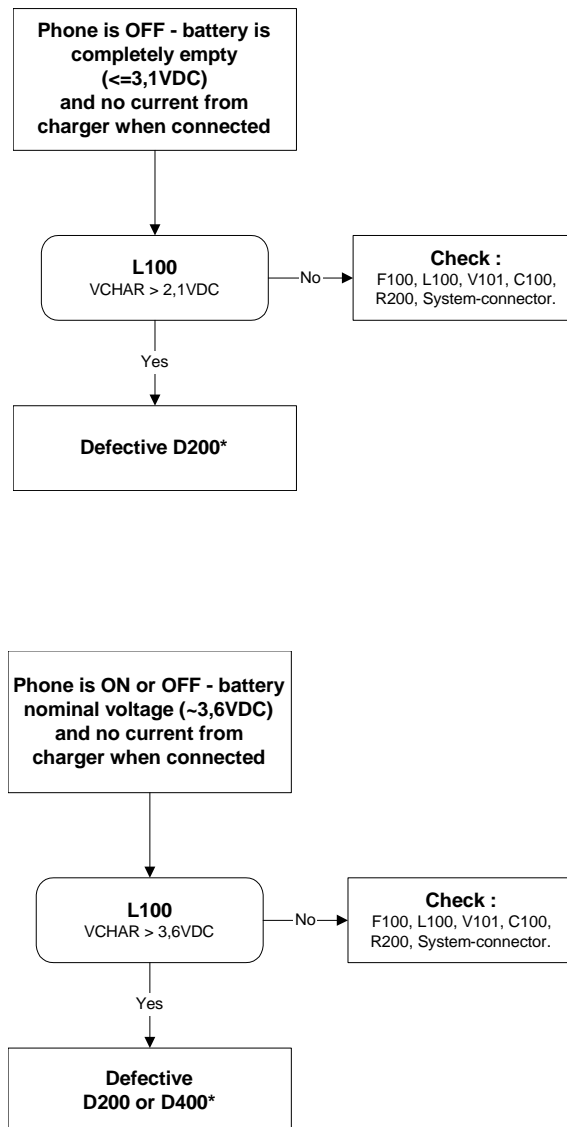


## Audio related faults

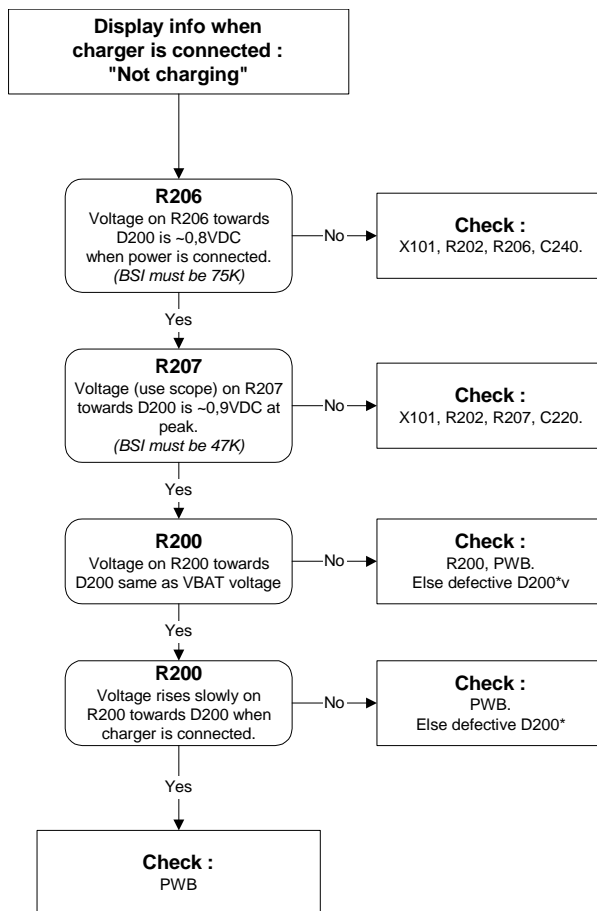




## Charging failure







## RF Troubleshooting

Two types of measurements are used in the following. It will be specified if the measurement type is "RF" or "LF".

- RF measurements should be done with a Spectrum Analyser and a high-frequency 500 ohm passive probe, for example HP54006A. (Note that when measuring with the 500 ohm probe the signal will be around 20 dB attenuated. The values in the following will have these 20 dB subtracted and represent the real value seen on the spectrum analyser).

*Note that the testjig have some losses which must be taken into consideration when calibrating the test system.*

- LF (Low frequency) and DC measurements should be done with a 10:1 probe and an oscilloscope. The probe used in the following is 10M0hm/8pF passive probe. If using another probe then bear in mind that the voltages displayed may be slightly different.

Always make sure the measurement set-up is calibrated when measuring RF parameters on the antenna pad. Remember to include the loss in the module repair jig when realigning the phone.

**Most RF semiconductors are static discharge sensitive.** So ESD protection must be taken during repair (ground straps and ESD soldering irons). Mjoelner is moisture sensitive so parts must be pre-baked prior to soldering.

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 ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

In the following both the name EGSM and GSM900 will be used for the lower band and both PCN and GSM1800 will be used for the upper band.

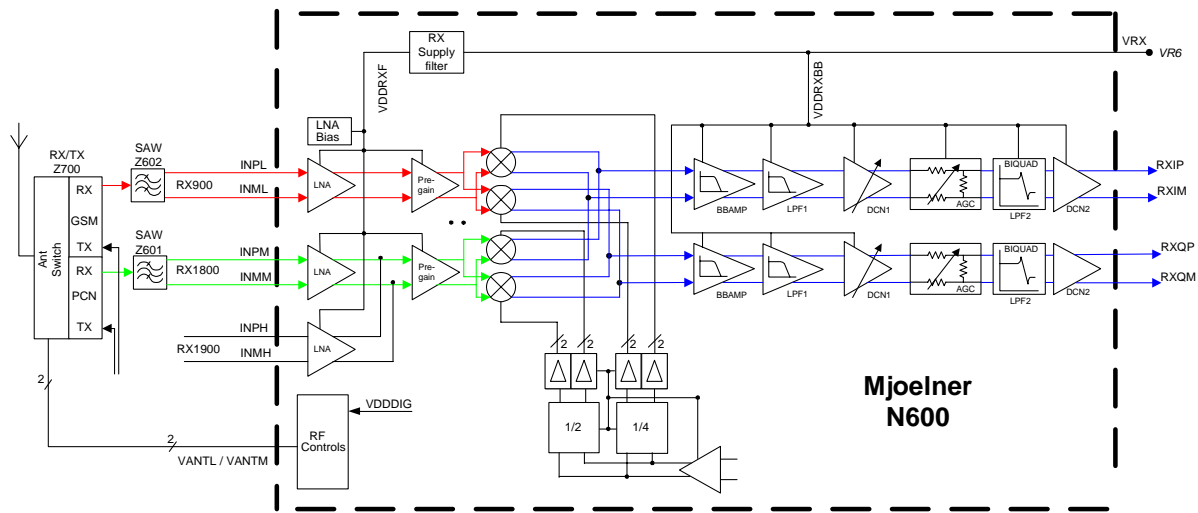
### General description of the RF circuits

In the following general descriptions different colours are used in the block diagram. The GSM 900 signal route is shown in red, the GSM1800 route in green and the common signal lines are shown in blue. Signal lines which is common for both

### Receiver signal path

The signal from the antenna pad is routed to the RX/TX switch ( Z700). If no control voltage is present at VANT2 and VANT1 the switch works as a diplexer and the GSM900 signal is passed through the RX/TX switch to GSM-RX and the GSM1800 signal is passed to DCS-RX.

Figure 1: Receiver signal path



From the RX/TX switch the GSM900 signal is routed to the SAW filter (Z602). The purpose of the SAW filter is to provide out-of band blocking immunity and to provide the LNA in Mjoelner (N600) with a balanced signal. The front end of Mjoelner is divided into a LNA and Pre-Gain amplifier before the mixers.

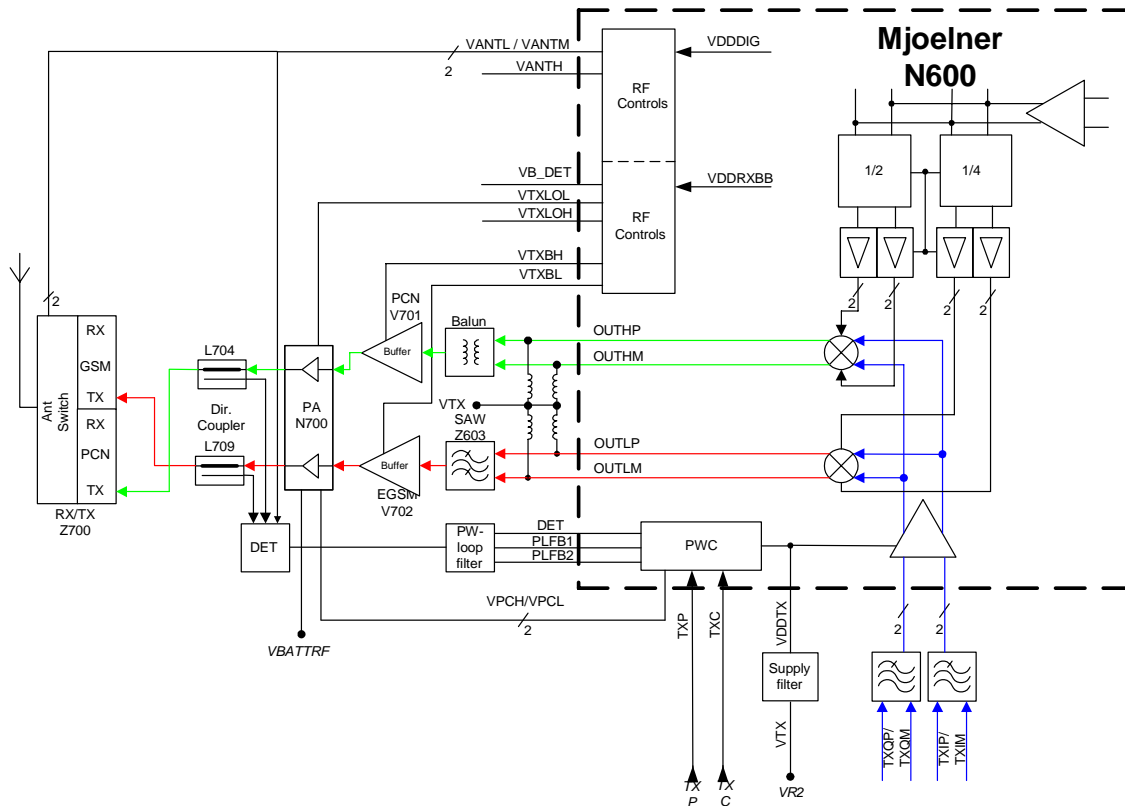
The output from the mixer is feed to Baseband part of Mjoelner where the signals amplified in the BBAMP and low pass filtered in LPF1 before the DC compensation circuits in DCN1. The DCN1 output is followed by a controlled attenuator and a second lowpass filter LPF2. The output from LPF2 is DC centered in DCN2 before being fed to the BB for demodulation.

The GSM1800 signal chain is similar to GSM900, the SAW filter numbered Z601.

**Transmitter signal path**

The I/Q signal from the BB is routed to the modulators for both 900 and 1800 MHz. The output of the modulators is either terminated in a SAW filter ( Z603 ) for GSM 900 or a balun for GSM1800. Both signals are amplified in buffers whereby a limiting effect takes place to suppress some of the AM contents of the signal. The amplitude limited signal is then amplified in the PA (N700) where the gain control takes place. In order to control the TX level a sample of the signal is taken in a directional coupler ( L709 for GSM900 and L704 for GSM1800) and used in the power loop amplifier in Mjoelner to establish the right output power. The TX signal from the couplers is fed to the RX/TX switch, used to select which signal to route to the antenna.

Figure 2: Transmitter signal path



## PLL

The PLL supplies Local Oscillator (LO) signals for the RX and TX-mixers. In order to be able to generate LO-frequencies for the required EGSM and PCN channels, a regular synthesiser-circuit is used. All blocks for the PLL except for the VCO, reference X-tal and loopfilter is located in the Mjoelner IC.

The reference frequency is generated by a 26MHz Voltage Controlled X-tal Oscillator (VCXO) which is located in the Mjoelner IC. Only the X-tal is external. 26MHz is supplied to BB where a divide-by-2 circuit (located in the UPP IC) generates the BB-clock at 13MHz. The reference frequency is supplied to the reference divider (RDIV) where the frequency is divided by 65. The output of RDIV (400kHz) is used as reference clock for the Phase Detector ( $\phi$ ).

The PLL is a feedback control system controlling the phase and frequency of the LO-signal. Building blocks for the PLL are: Phase detector, Charge Pump, Voltage Controlled Oscillator (VCO), N-Divider and loopfilter. As mentioned earlier only the VCO and loopfilter is external to the Mjoelner IC.

The VCO (G600) is the component that actually generates the LO-frequency. Based on the control voltage input the VCO generates a single-ended RF output. The signal is then differentiated through a balun. This signal is fed to the Prescaler and N-divider in Mjoelner, these 2 block will together divide the frequency by a ratio based on the selected channel. The divider output is supplied to the phase detector which compares the frequency and phase to the 400kHz reference clock. Based on this comparison the phase

detector controls the charge pump to either charge or discharge the capacitors in the loopfilter. By charging/discharging the loopfilter the control voltage to the VCO changes and the LO-frequency will change. Therefore the PLL will make the LO-frequency stay locked to the 26MHz VCXO frequency.

The loopfilter consists of the following components: C639-C641 and R618-R619.

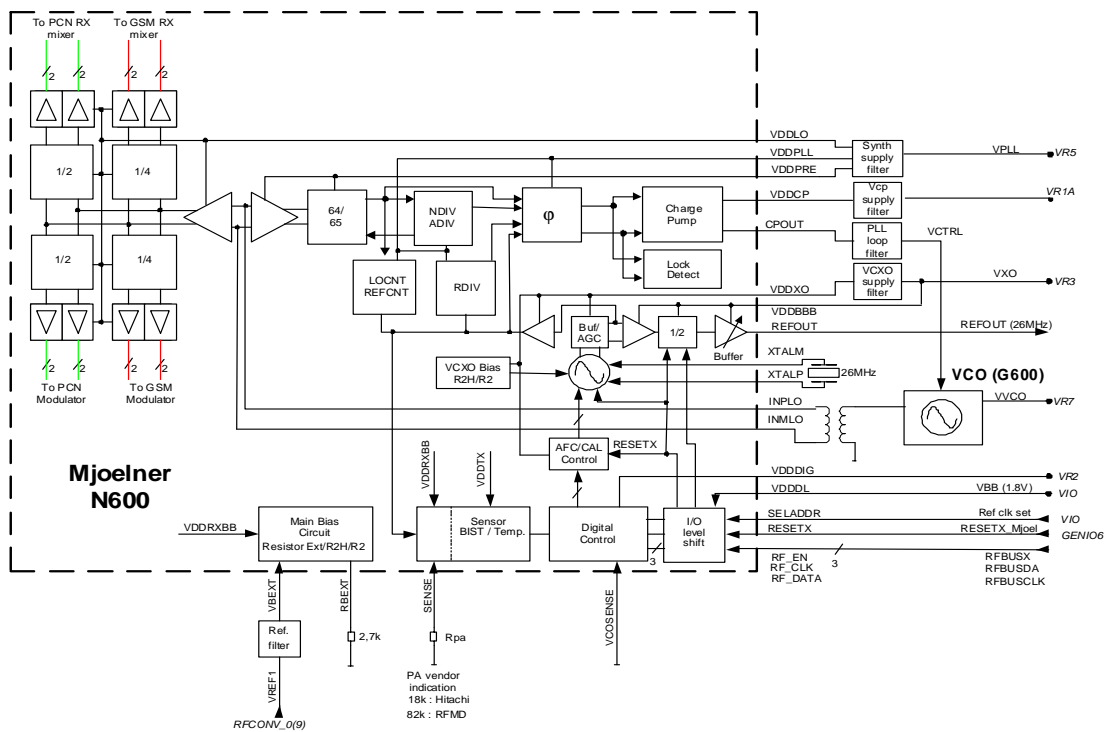
The PLL is operating at twice the channel center frequency when transmitting or receiving in the PCN band. For the EGSM band the PLL is operating at 4-times the channel frequency. Therefore divide-by-2 and divide-by-4 circuits are inserted between the PLL output and LO-inputs to the PCN and EGSM mixers.

Table 1: Frequency plan

Frequency band		Channel	System Frequency Band (MHz)	PLL Frequency band (MHz)
EGSM	RX	975-1023 1 - 124	925.2 - 959.8	3700.8 - 3839.2
	TX		880.2 - 914.8	3520.8 - 3659.2
PCN	RX	512 - 885	1805.2 - 1879.8	3610.4 - 3759.6
	TX		1710.2 - 1784.8	3420.4 - 3569.6

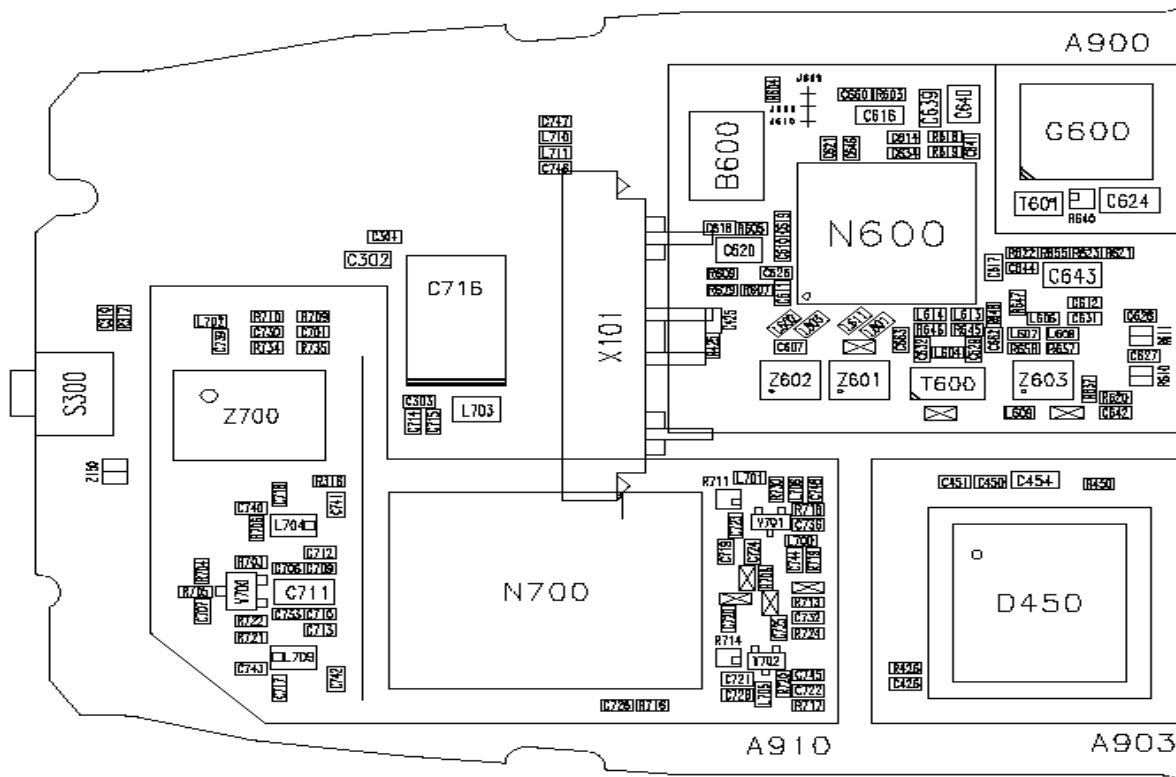
According to the table above the PLL must be able to cover the frequency range 3420.4MHz to 3839.2MHz.

Figure 3: Synthesiser



RF Key component placement

Figure 4: Key component location



*Note! This is a copy of NHM-8. Use only for RF-part!*

Table 2:

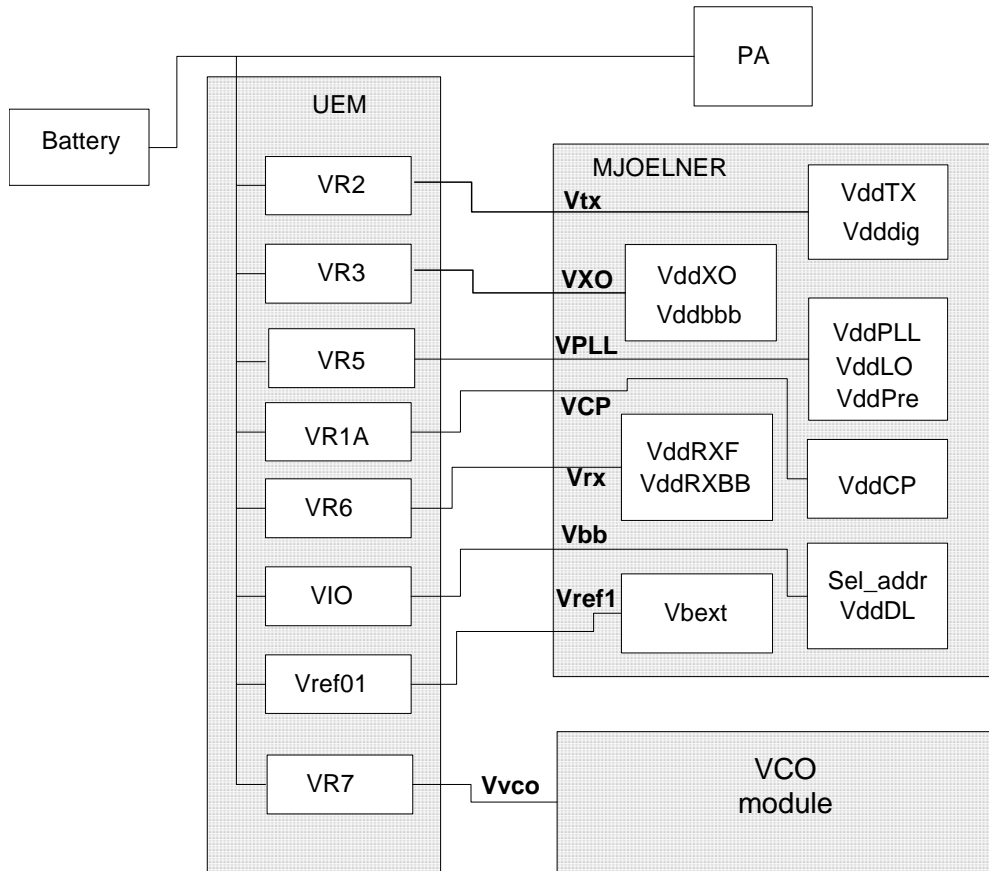
N600	Mjoelner RF IC
Z601	PCN RX SAW
Z602	EGSM RX SAW
Z603	EGSM TX SAW
B600	26 MHz crystal
G600	VCO ( 3.6 GHz UHF VCO )
N700	Power Amplifier (PA)
Z700	RX/TX switch

### Power Supply Configuration

All power supplies for the RF Unit are generated in the UEM IC (D200). All power outputs from this IC has a decoupling capacitor at which the supply voltage can be checked.

The power supply configuration used in the HDb12 phone is shown in the blockdiagram below:

Figure 5: Power supply configuration



The names in **bold** are signal names used on the RF schematic pages. Names in the boxes within the Mjoelner and the VCO refers to pin names on the respective ICs (N600, G600).

Table 3:

Supply name RF	Supply name UEM	Min	Typ	Max	Unit
VTX	VR2	2.64	2.78	2.86	V
VXO	VR3	2.64	2.78	2.86	V
VCP	VR1A		4.75		V
VPLL	VR5	2.64	2.78	2.86	V
VRX	VR6	2.64	2.78	2.86	V
WCO	VR7	2.64	2.78	2.86	V
VBB	VIO	1.72	1.8	1.88	V
VREF2	VrefRF01	1.334	1.35	1.366	V
VBATT	BATTERY	3.1	3.6	5.2	V

Please see the picture below for measuring points at the UEM (D200).

Figure 6: Supply points at UEM (D200)

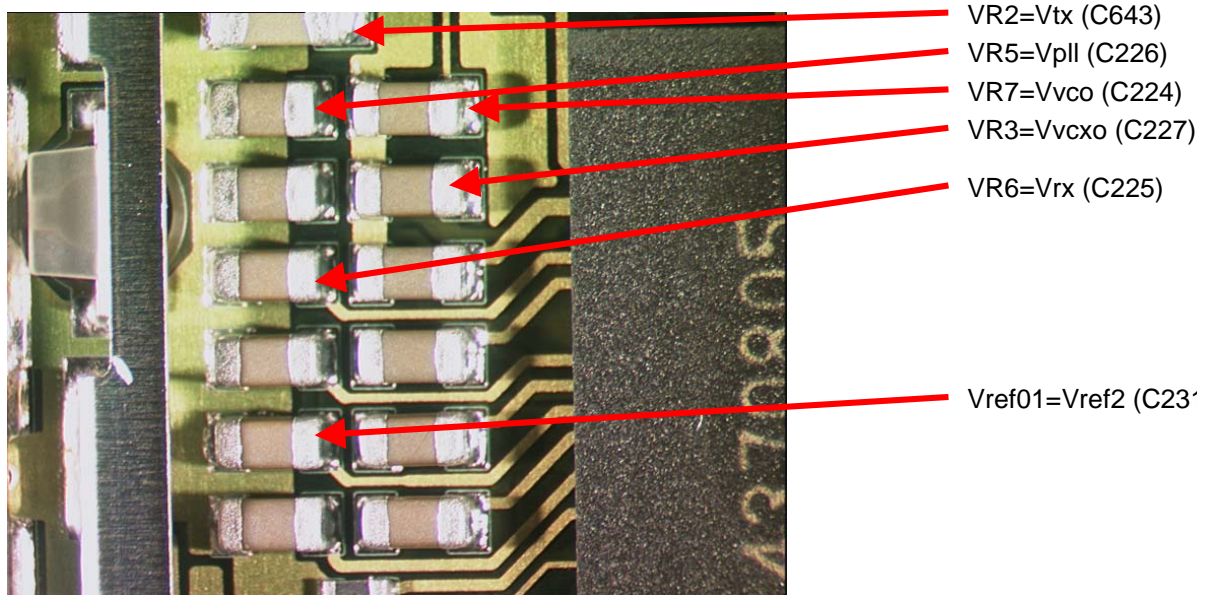
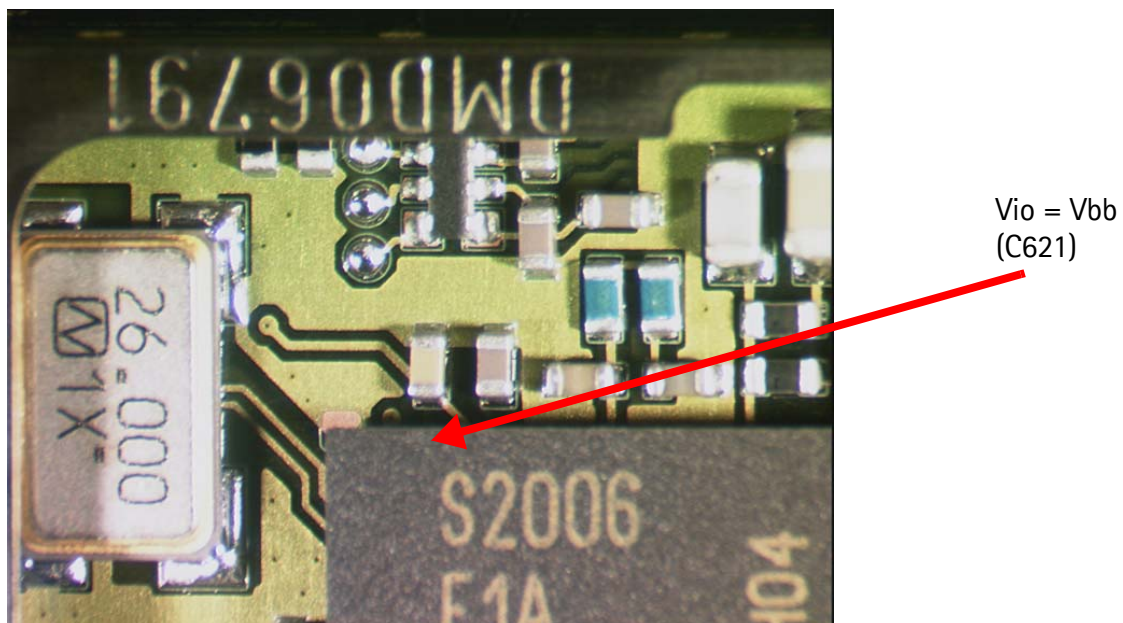


Figure 7: Supply point at Mjoelner (N600)



## Receiver

### General Instructions for GSM900 RX Troubleshooting

Connect the phone to a PC with the module repair jig.

Start Phoenix and establish connection to the phone

Select **File**. Select **Scan for Product** Ctrl-R

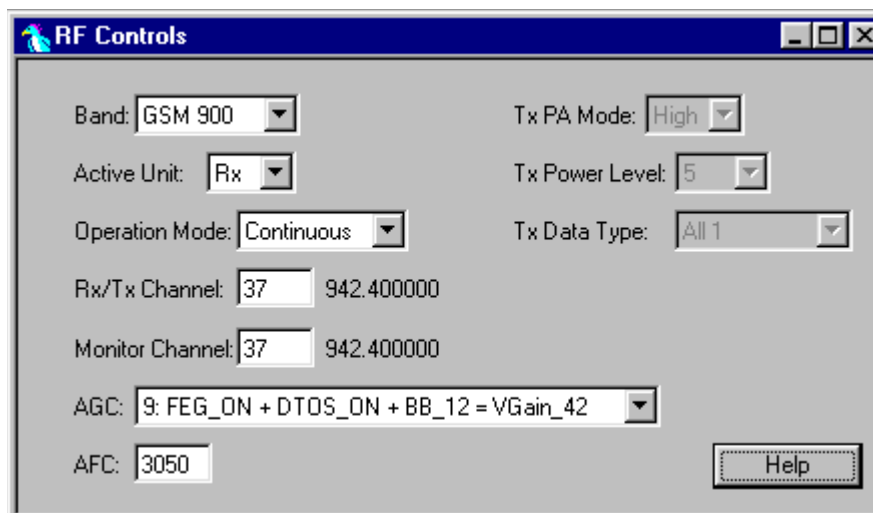
Select **Maintenance, Testing** and then **RF Controls**



Select:

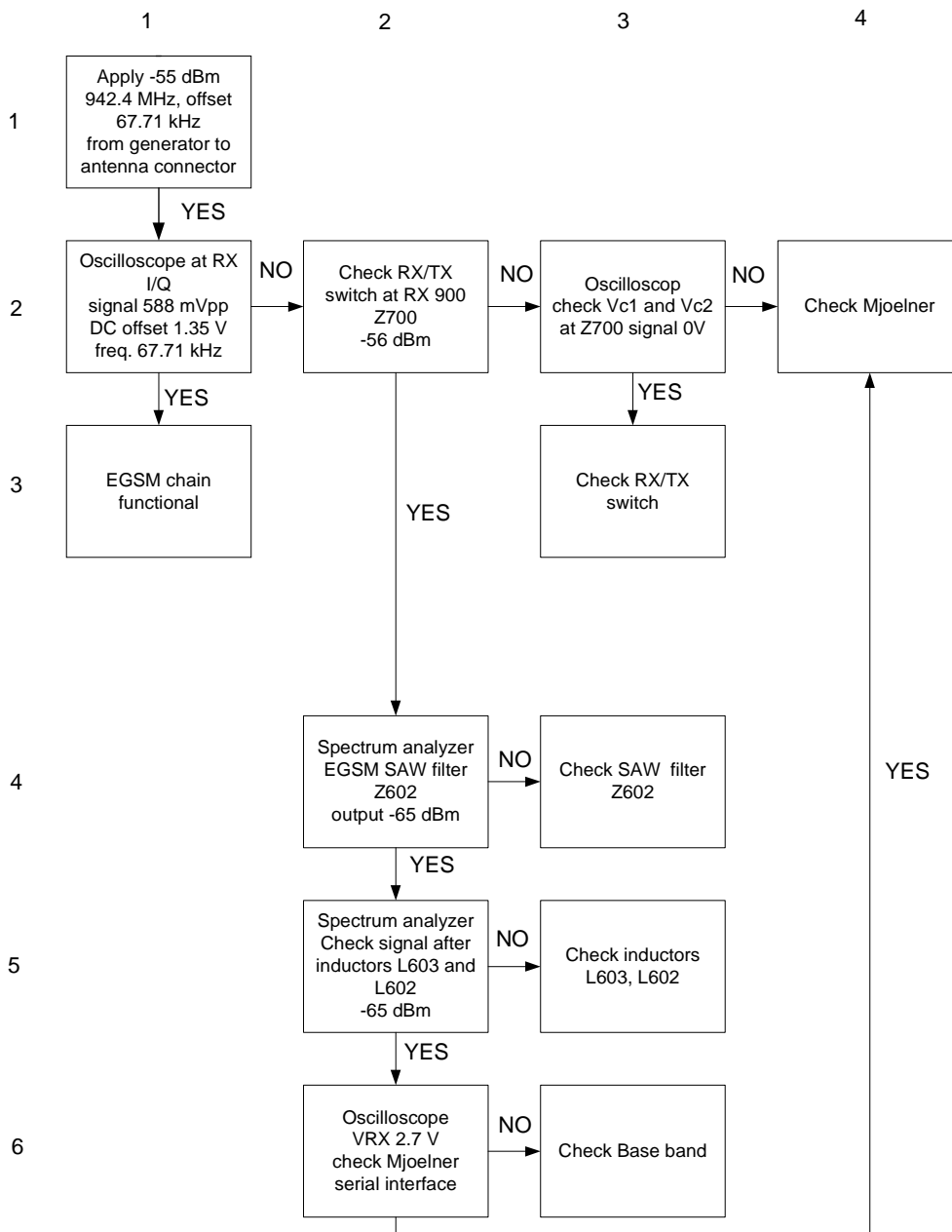
Band: GSM900  
Active Unit: RX  
Operation Mode: Continuous  
Rx/Tx Channel: 37  
AGC: 9

The setup should now look like this:



**Fault Finding Chart for GSM900 Receiver**

**Figure 8: EGSM Receiver fault finding chart**

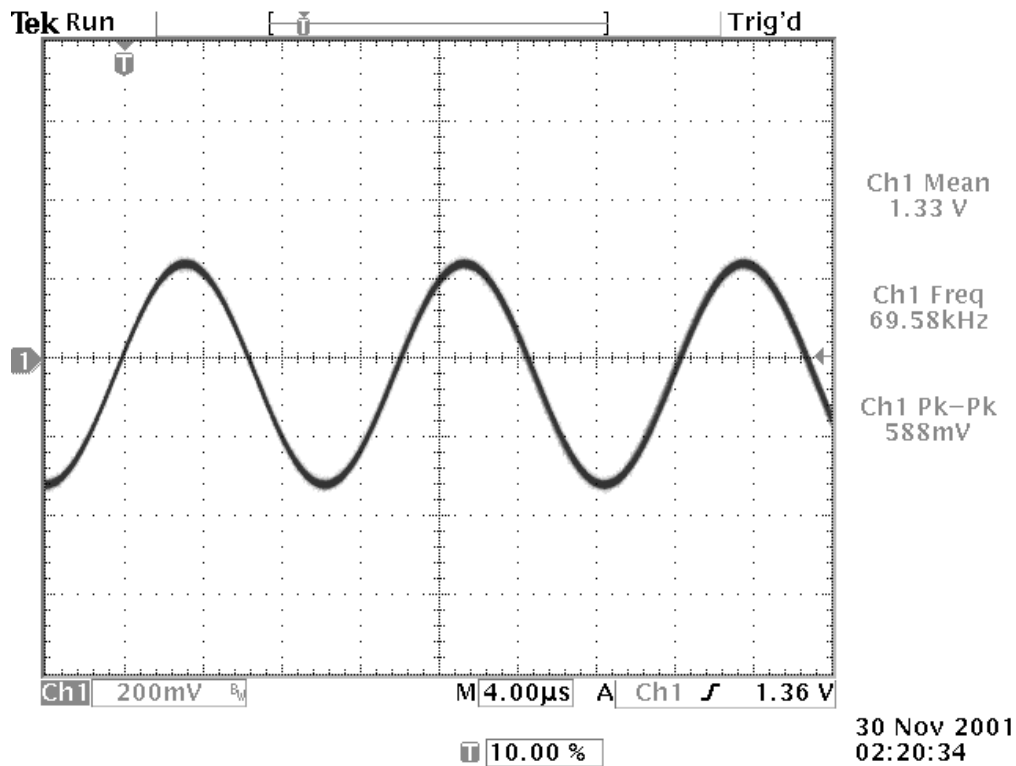


By measuring with an oscilloscope at RXIP or RXQP on a working GSM 900 receiver this picture should be seen.

Signal amplitude peak-peak 588 mV

DC offset 1.33 V

Figure 9: RX900 I/Q signal waveform



**General Instructions for GSM1800 RX Troubleshooting**

Connect the phone to a PC with the module repair jig.

Start Phoenix and establish connection to the phone

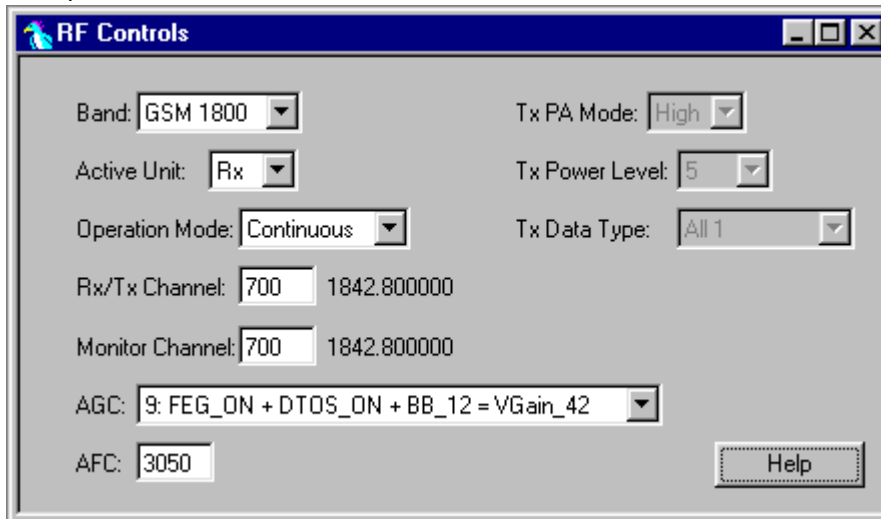
Select **File**. Select **Scan for Product** Ctrl-R

Select **Maintenance, Testing and RF Controls**

Select:

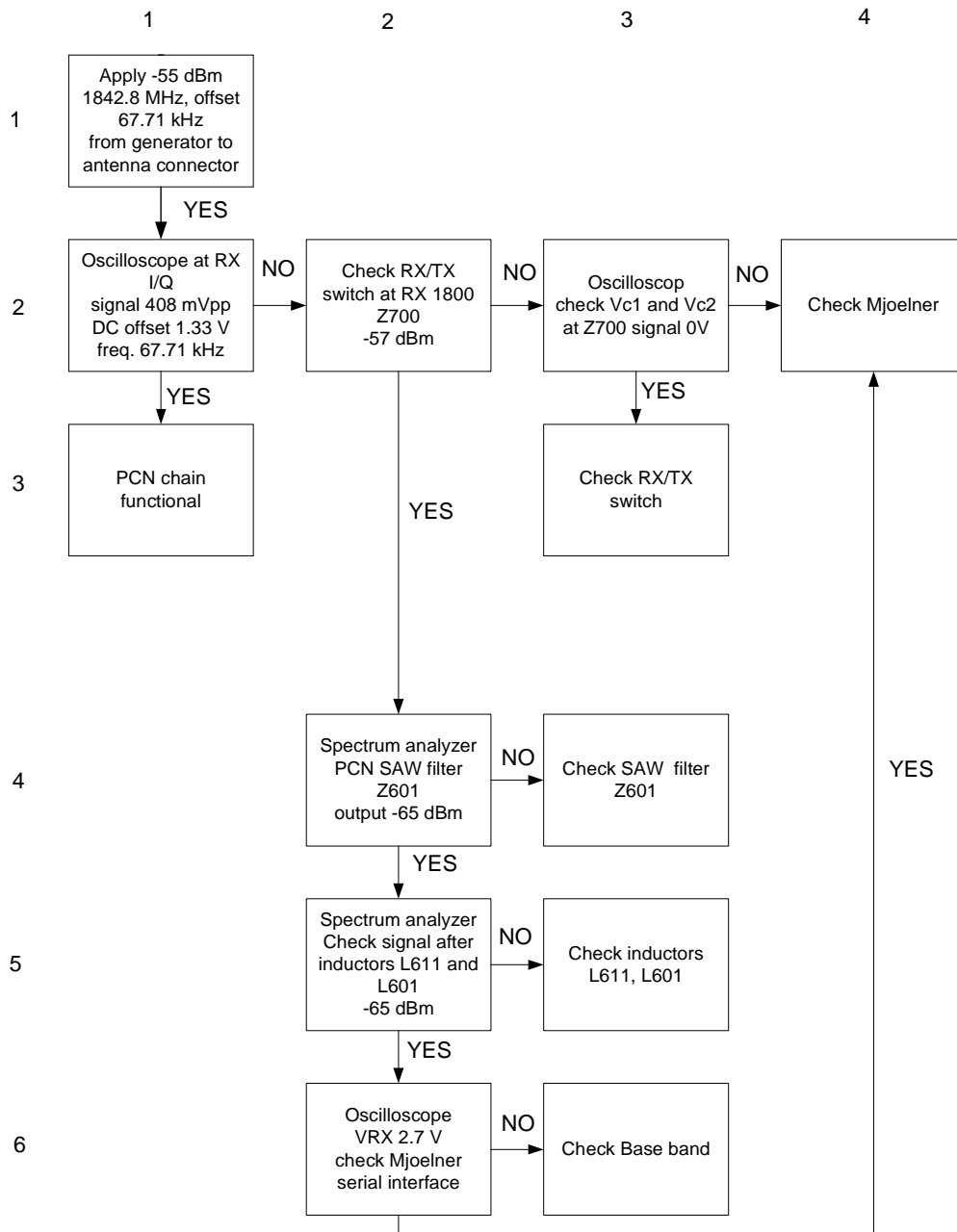
- Band: GSM1800
- Active Unit: RX
- Operation Mode: Continuous
- Rx/Tx Channel: 700
- AGC: 9

The setup should now look like this:



Fault Finding Chart for GSM1800 Receiver

Figure 10: GSM1800 receiver fault finding chart

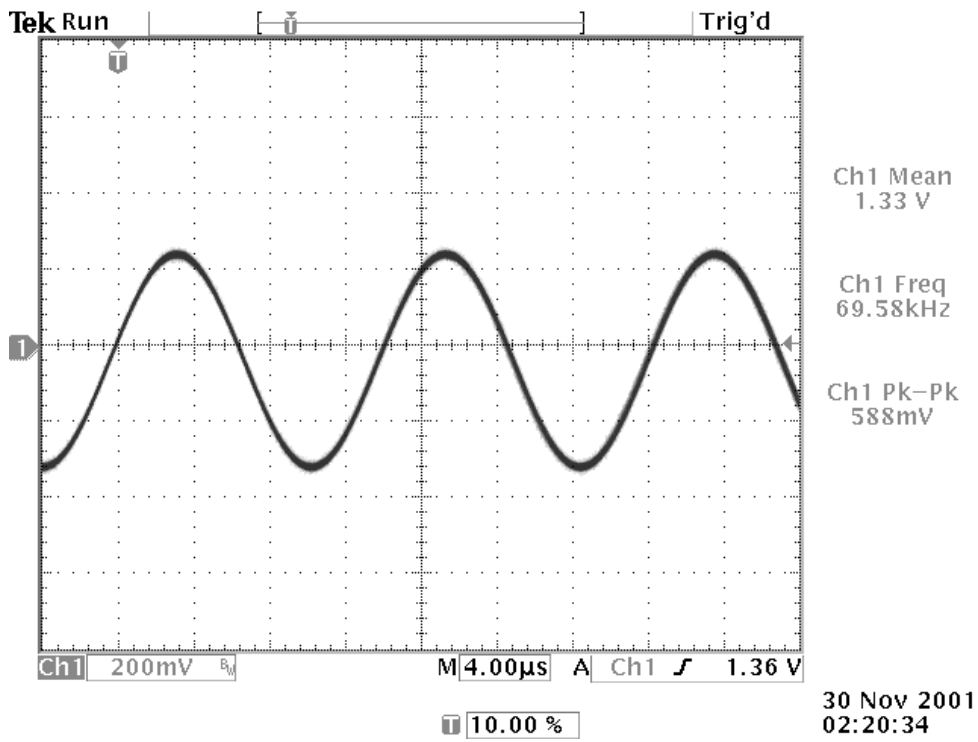


By measuring with an oscilloscope at RXIP or RXQP on a working GSM 900 receiver this picture should be seen.

Signal amplitude peak-peak 588 mV

DC offset 1.33 V

Figure 11: RX1800 I/Q signal waveform



Measurement points in the receiver

Figure 12: RX measurements point at the RX/TX Switch - Z700

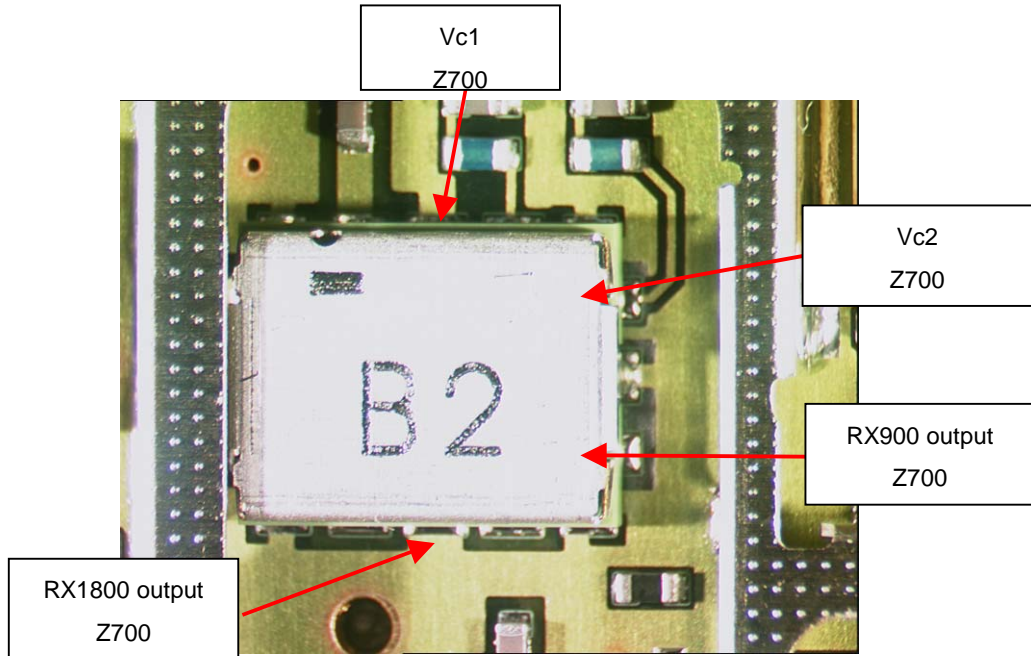


Figure 13: Measurements points at the RX-Filters – Z601/Z602

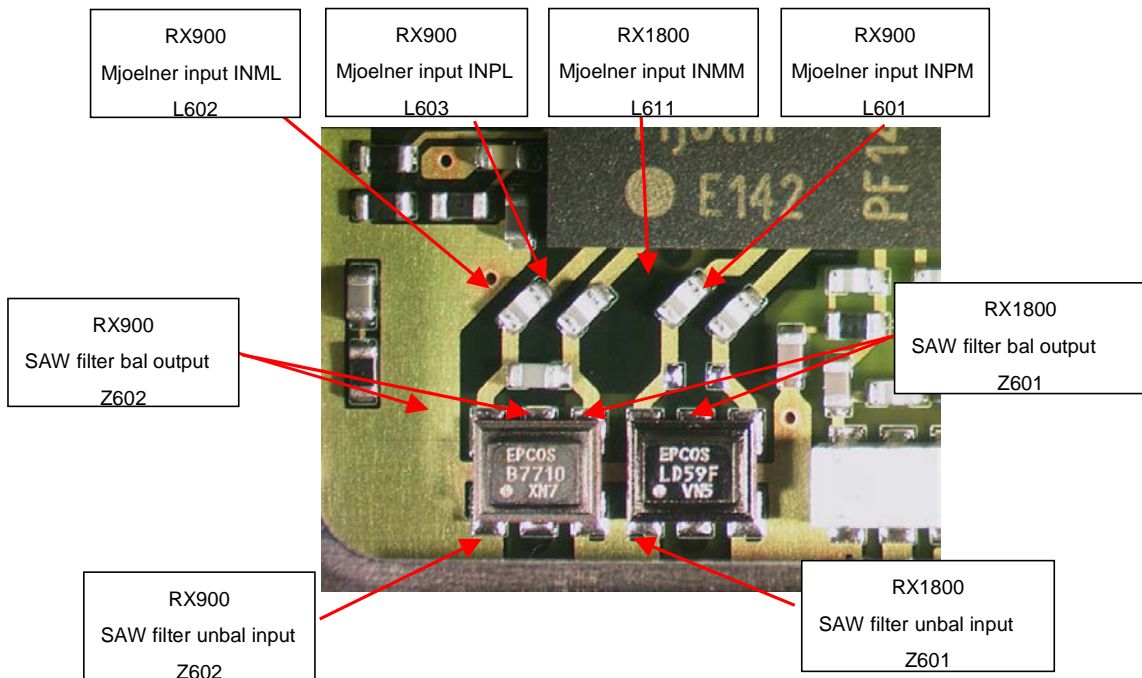
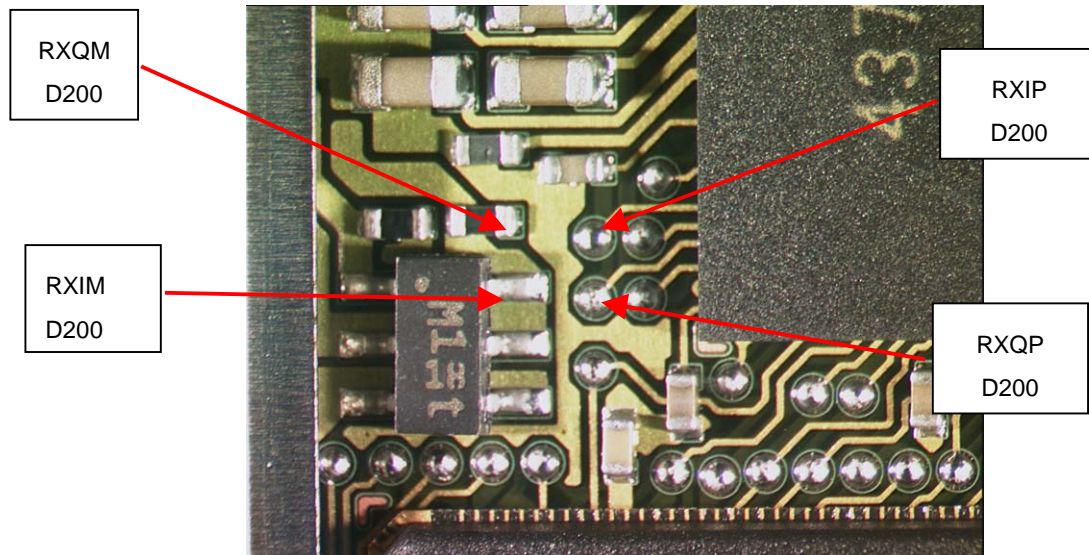


Figure 14: RX I/Q Signals, Baseband shielding can UEM (D200)



## Transmitter

### Measurement points for the transmitter

Figure 15: TX measurement points in the PA ( N700 ) shielding can

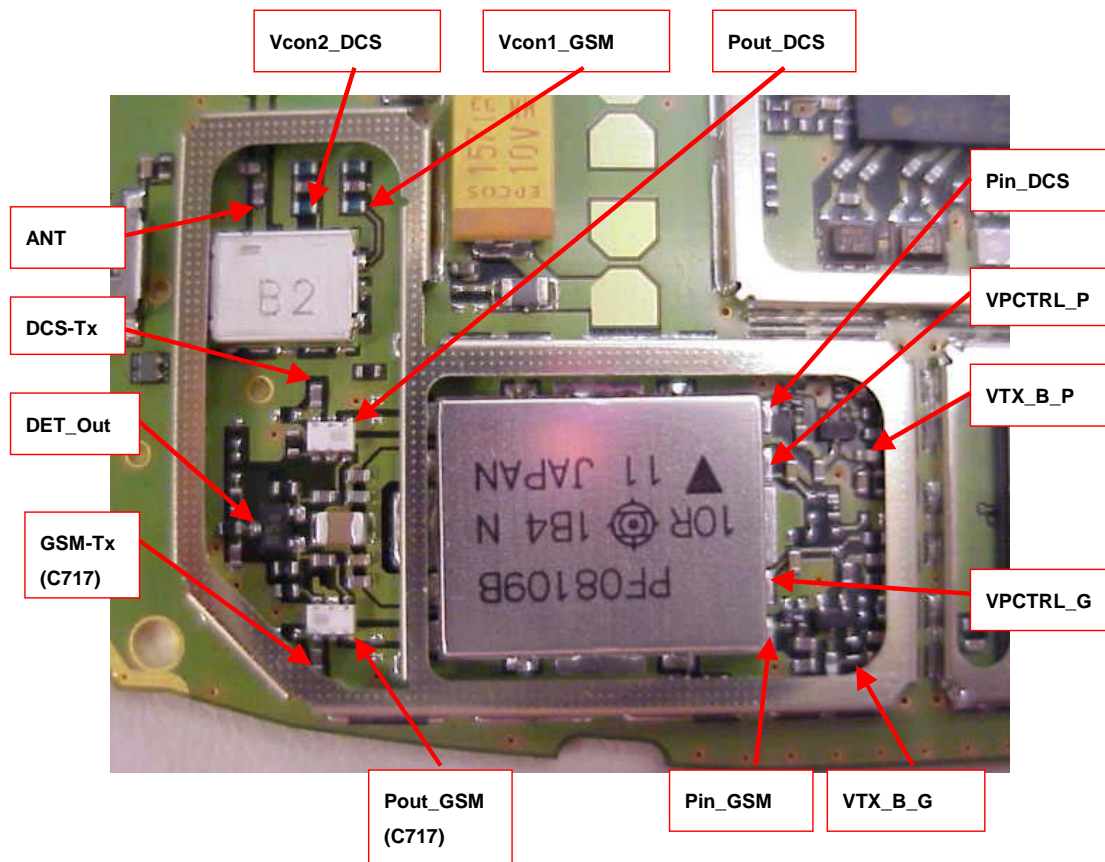
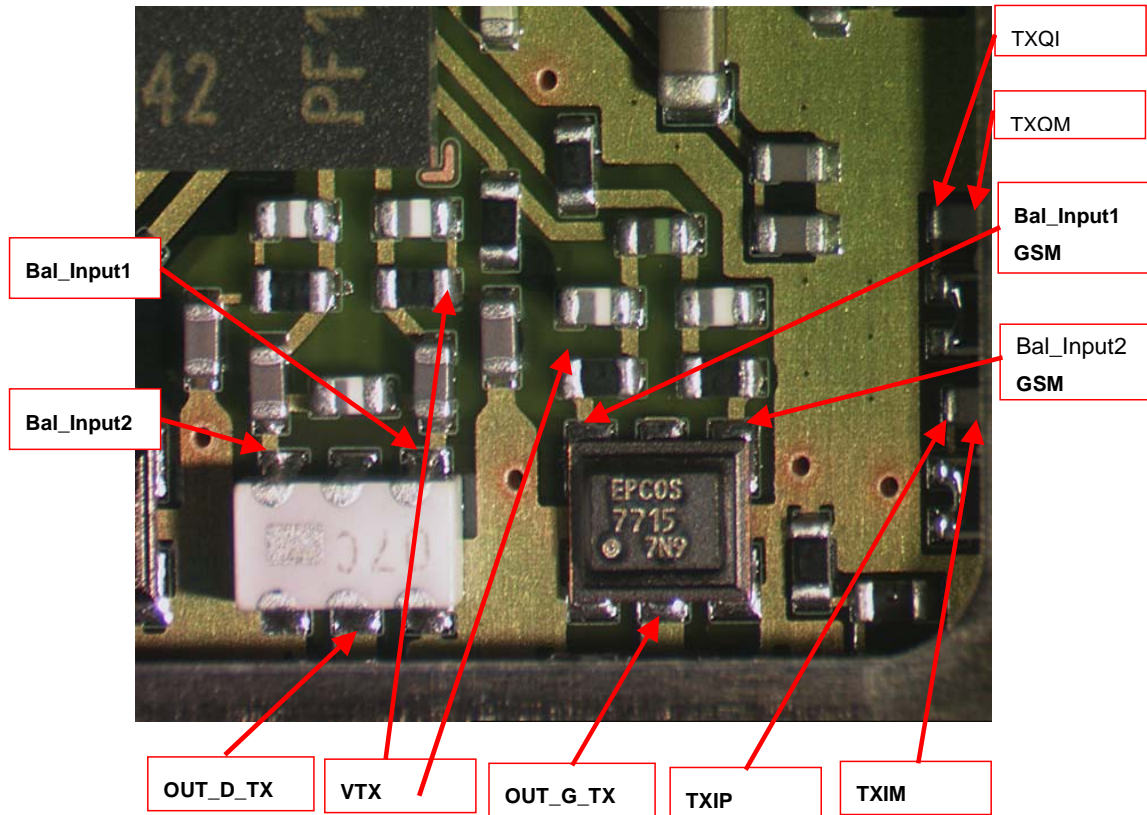




Figure 16 : TX measurement point in Mjolner (N600) shielding can



**General instructions for GSM TX troubleshooting**

Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to measurement equipment or to at least a 10-dB attenuator, otherwise the PA may be damaged.

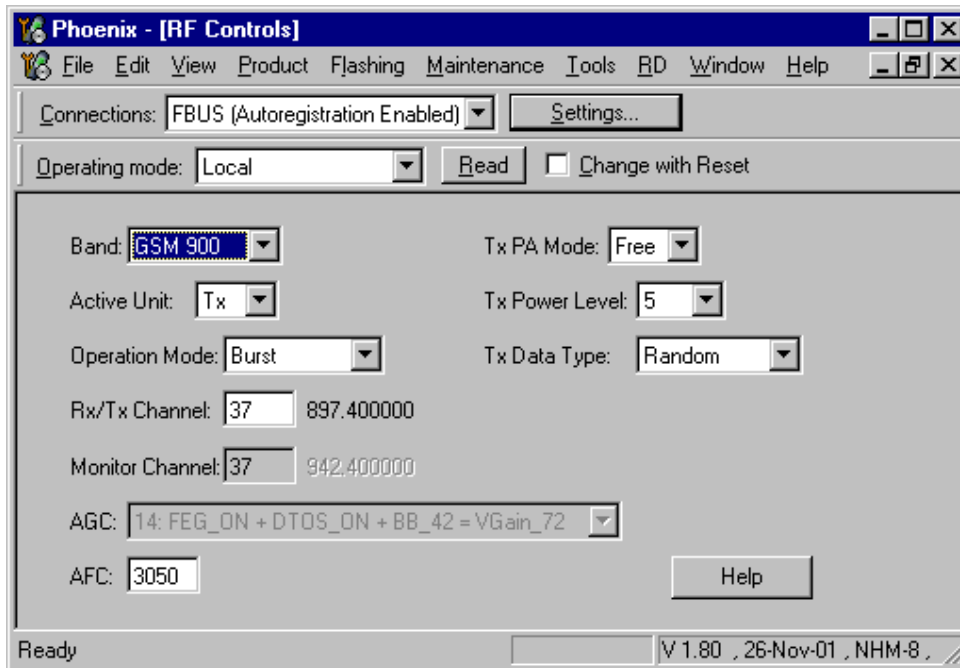
Start Phoenix-Service-Software and establish a connection to the phone e.g. FBUS.

Select File and Product: Gemini

Select: Maintenance, Testing and RF Controls

Band:	GSM 900
Active Unit:	TX
Tx Power Level:	5
Tx Data Type:	Random

Your screen should look like:



Measure the output power of the phone; it should be around 32.5 dBm. Remember the loss in the jig; around 0.3 dB.

### Fault finding chart for GSM900 transmitter

#### Fault finding in output power

For the spectrum analyser measurements in the following chart use the 500 ohm passive probe. Since the signal measured is bursted it is advised to set the analyser to maxhold.

Figure 16: EGSM900 transmitter fault finding chart

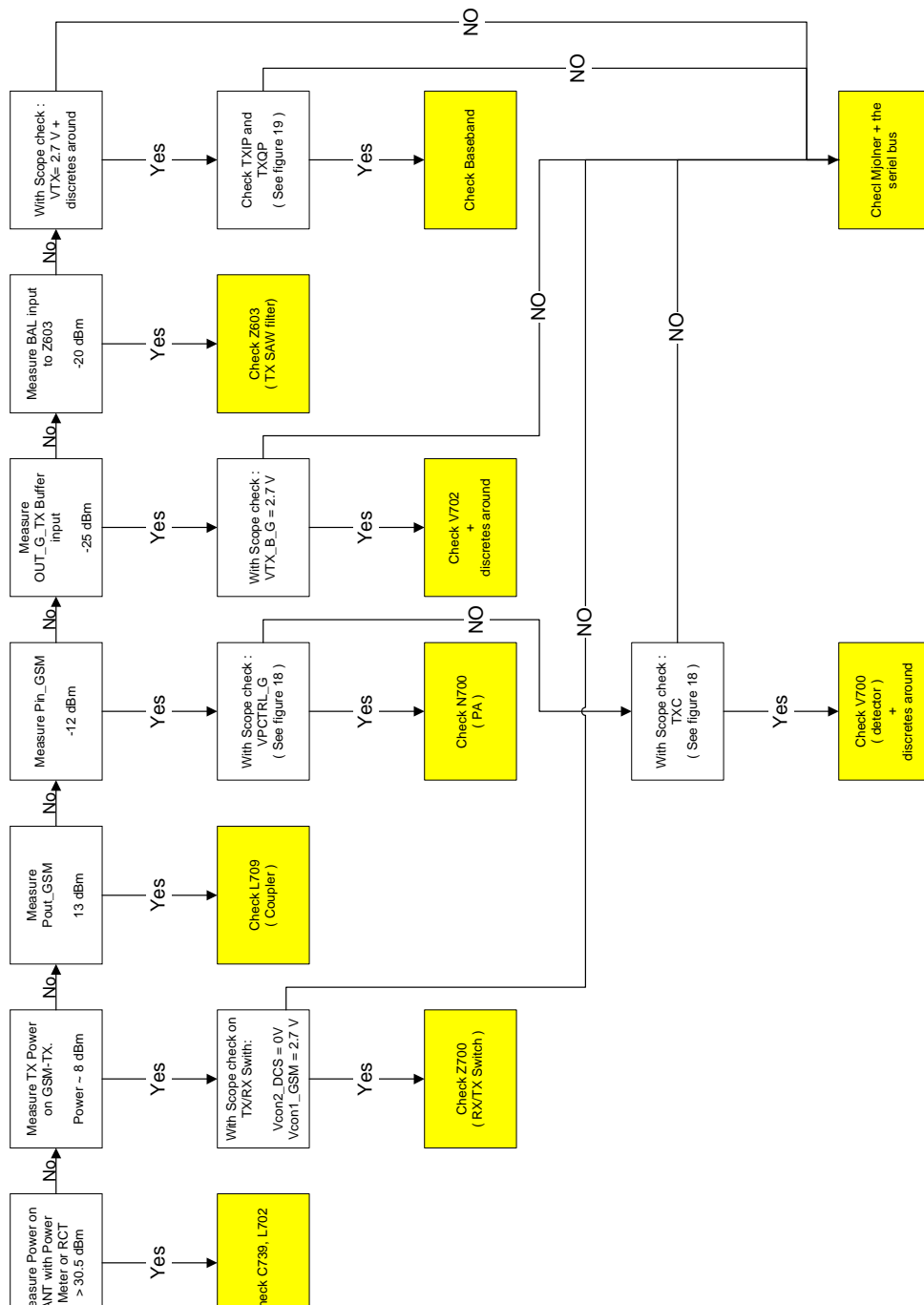
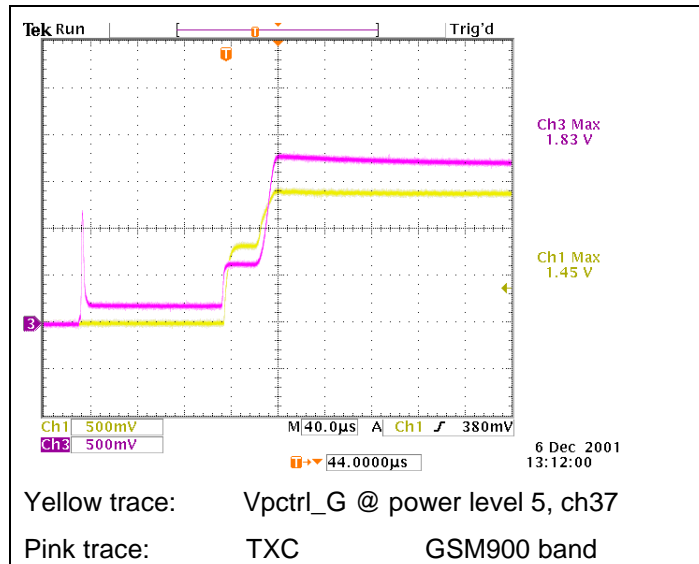


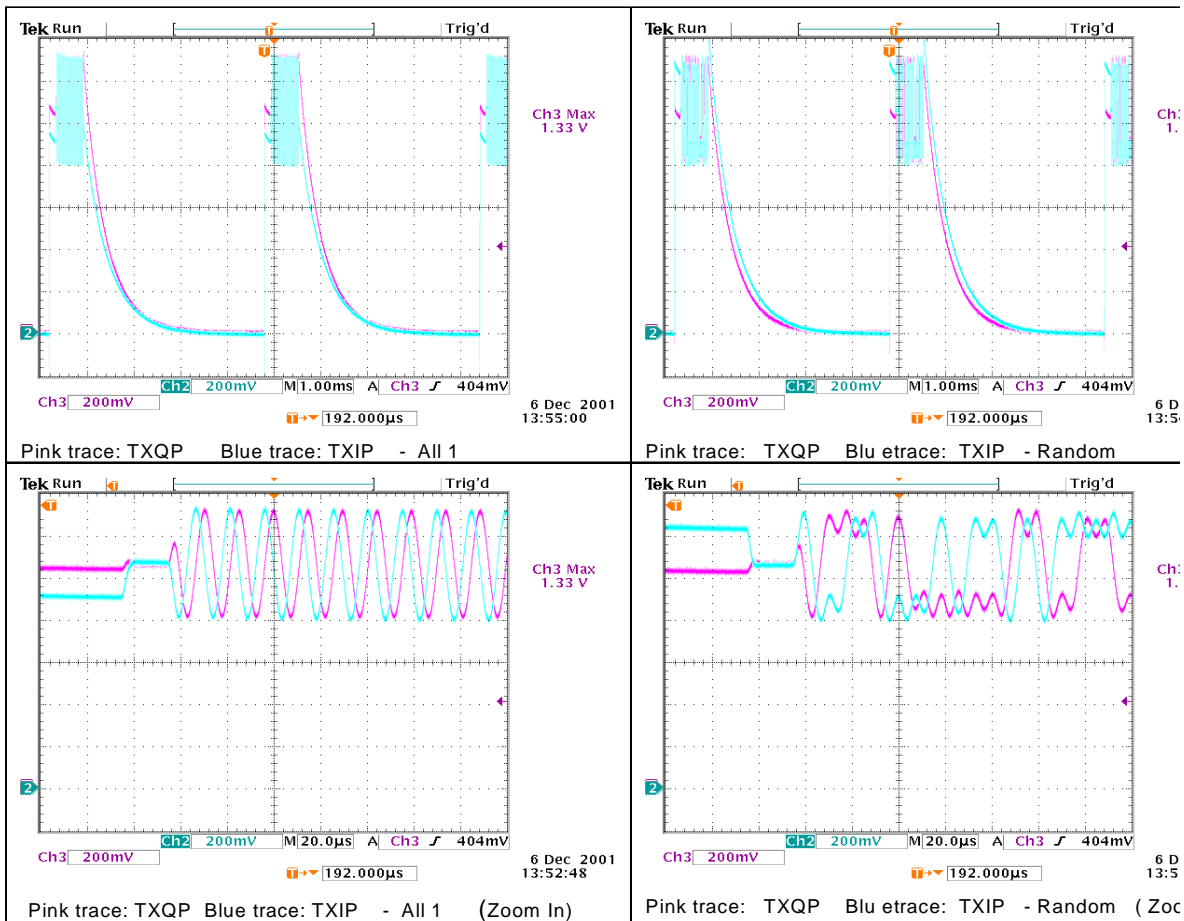
Figure 17: VPCTRL\_G & TXC



**Fault finding in modulation**

The following plots show different situations of TX IQ measurements. Depending on the time the modulation may cause the signal to look differently.

**TX I/Q waveforms**



I/Q signals look almost the same regardless if modulation is by "1" or by "0". There is no significant difference between TXIP and TXIM. The same is valid for TXQP and TXQM.

**PCN Transmitter**General instructions for PCN TX troubleshooting

Apply a RF-cable to the RF-connector to allow the transmitted signal act as normal. RF-cable should be connected to measurement equipment or to at least a 10-dB attenuator, otherwise the PA may be damaged.

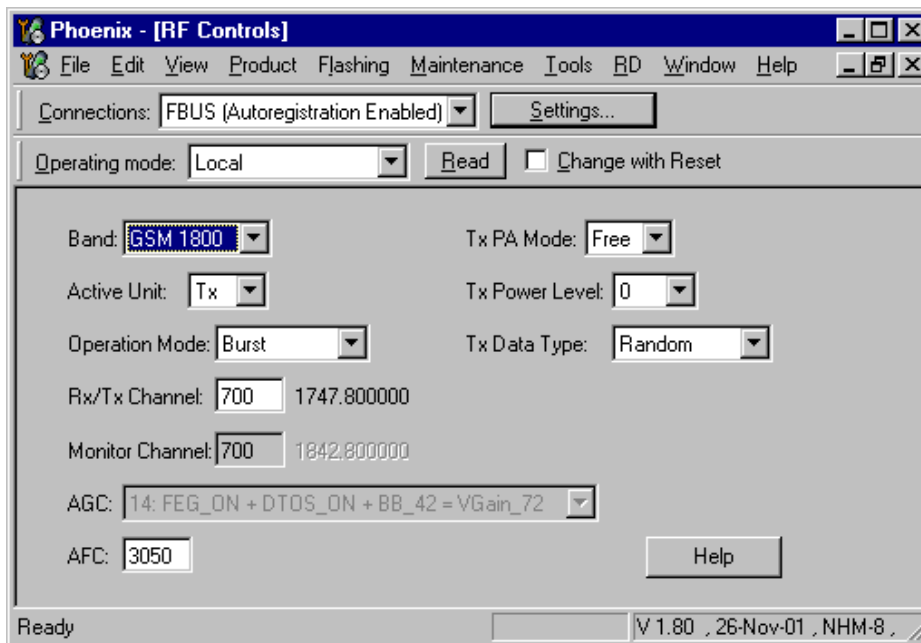
Start Phoenix-Service-Software and establish a connection to the phone e.g. FBUS.

Select **File**. Choose **Product**: Gemini

Select: **Maintenance, Testing** and then **RF Controls**.

Band: GSM 1800  
Active Unit: TX  
Tx Power Level: 0  
Tx Data Type: Random

Your screen should look like:



Measure the output power of the phone; it should be around 28.5 dBm. Remember the loss in the jig; around 0.7 dB.

**Path of the transmitted PCN signal**

*Fault finding chart for PCN transmitter*

Figure 18: GSM1800 transmitter fault finding chart

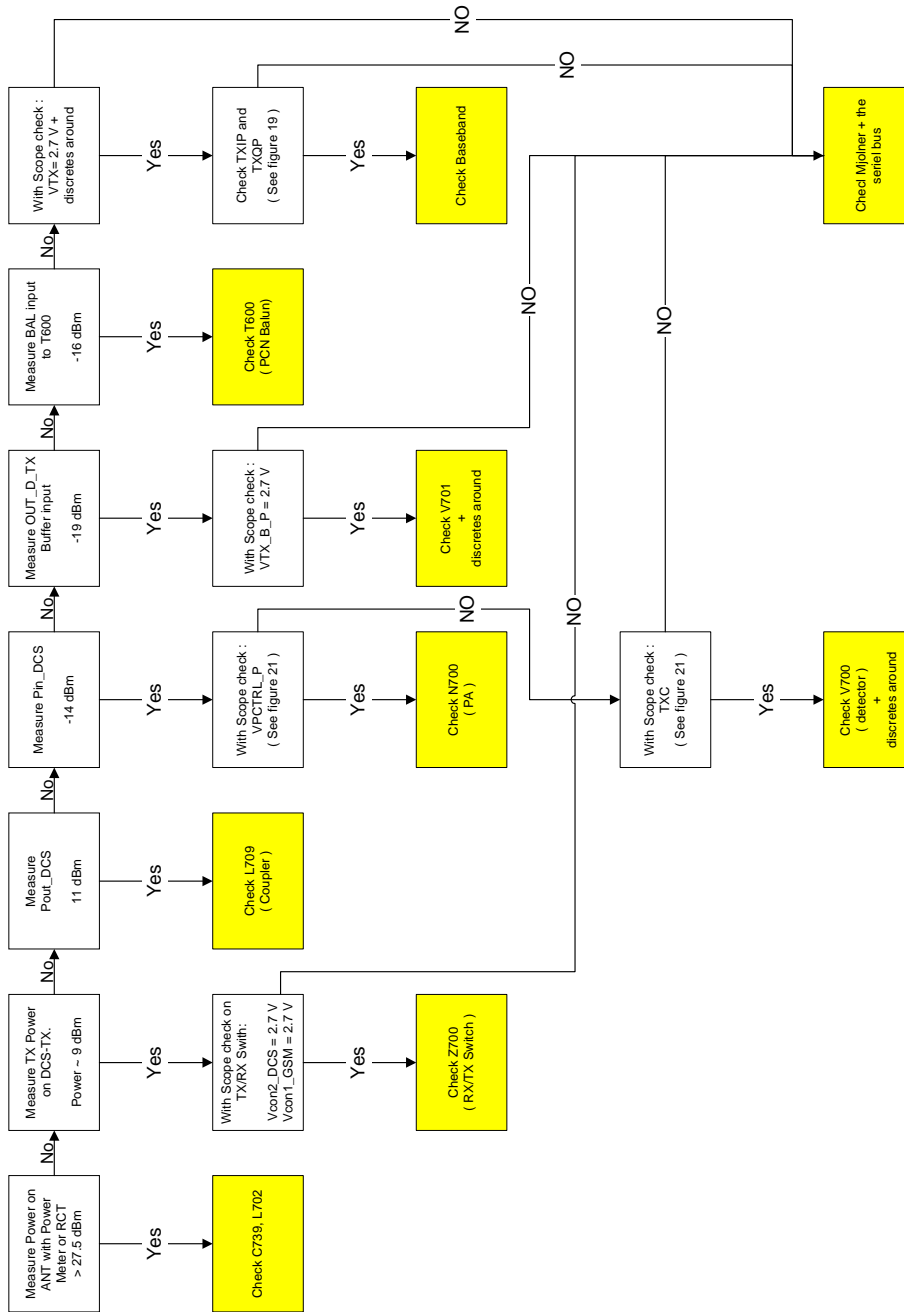
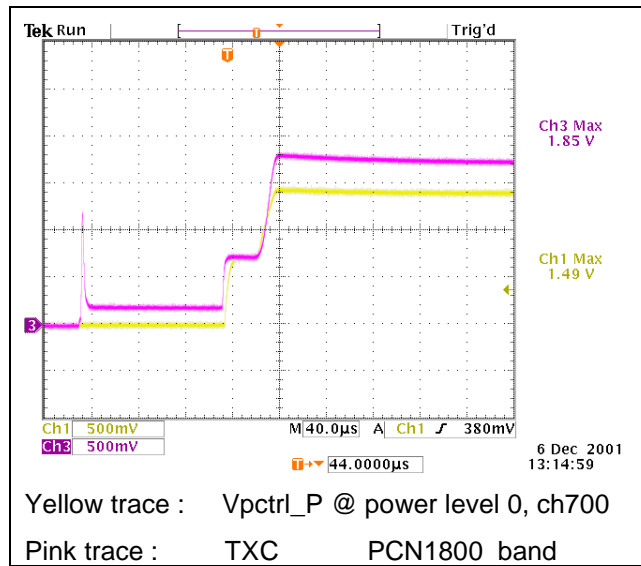


Figure 19: VPCTRL\_P & TXC



\*\* TXIQ signals look the same in PCN and GSM

### Synthesizer

There is only one PLL synthesizer generating Local Oscillator frequencies for both RX and TX in both bands ( PCN and EGSM). The VCO frequency is divided by 2 for PCN operation or by 4 for EGSM operation inside the Mjoelner IC.

### General instructions for Synthesizer troubleshooting

Start the Phoenix-Service-Software and

Select: Product: NHM-8NX

Select: Maintenance, Testing and then RF Controls.

Band	GSM1800
Active Unit	RX
Operation Mode	Continuous
RX/TX Channel	700

It is not possible to measure the output of the VCO (G600) directly as this component is placed underneath a shielding can without detachable lid. However with spectrum analyzer and 500 ohm passive probe it is possible to get an indication if the VCO outputs the correct frequency. To do this probe R656 – the frequency should be 3685.6MHz and the power should be around -50 dBm.

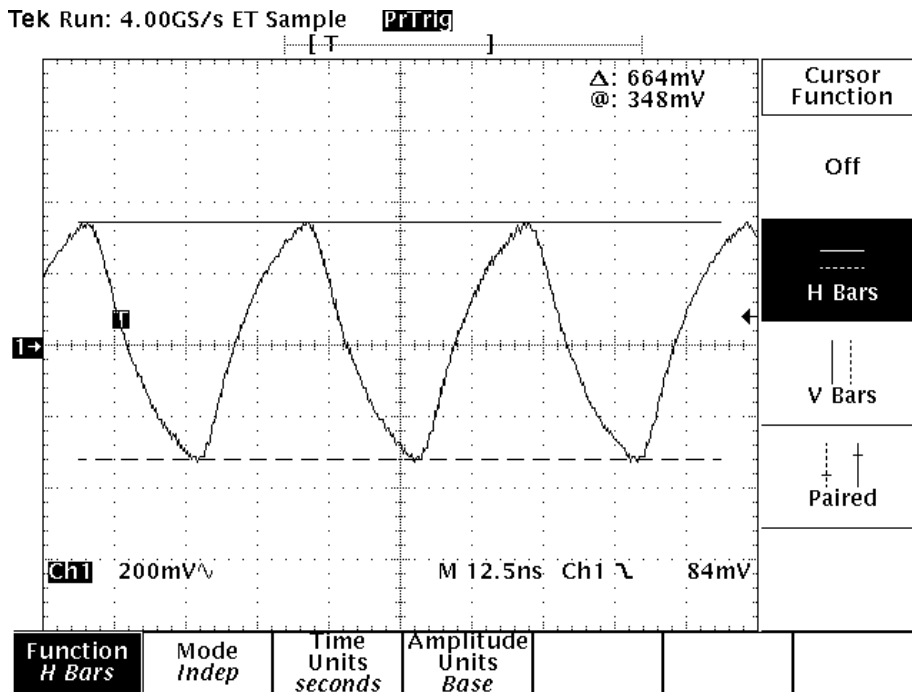
### 26 MHz Reference Oscillator ( VCXO )

The 26 MHz oscillator is located in the Mjoelner IC (N600). The coarse frequency for this oscillator is set by an external crystal (B600). The reference oscillator is used as a reference frequency for the PLL synthesizer and as the system clock for BaseBand. The

26MHz signal is divided by 2 to achieve 13MHz inside the UPP IC (D400). The 26 MHz signal from the VCXO can be measured by probing R425 (must be measured on the UPP side of R425 i.e. the end **not** connected to C425). The level at this point is approx. 700mVpp. Frequency of this oscillator is adjusted by changing the AFC-register inside the Mjoelner IC. This is done via the Mjoelner serial interface.

Example Signal Measured at VCXO output (R425)

Figure 20: VCXO 26 MHz waveform



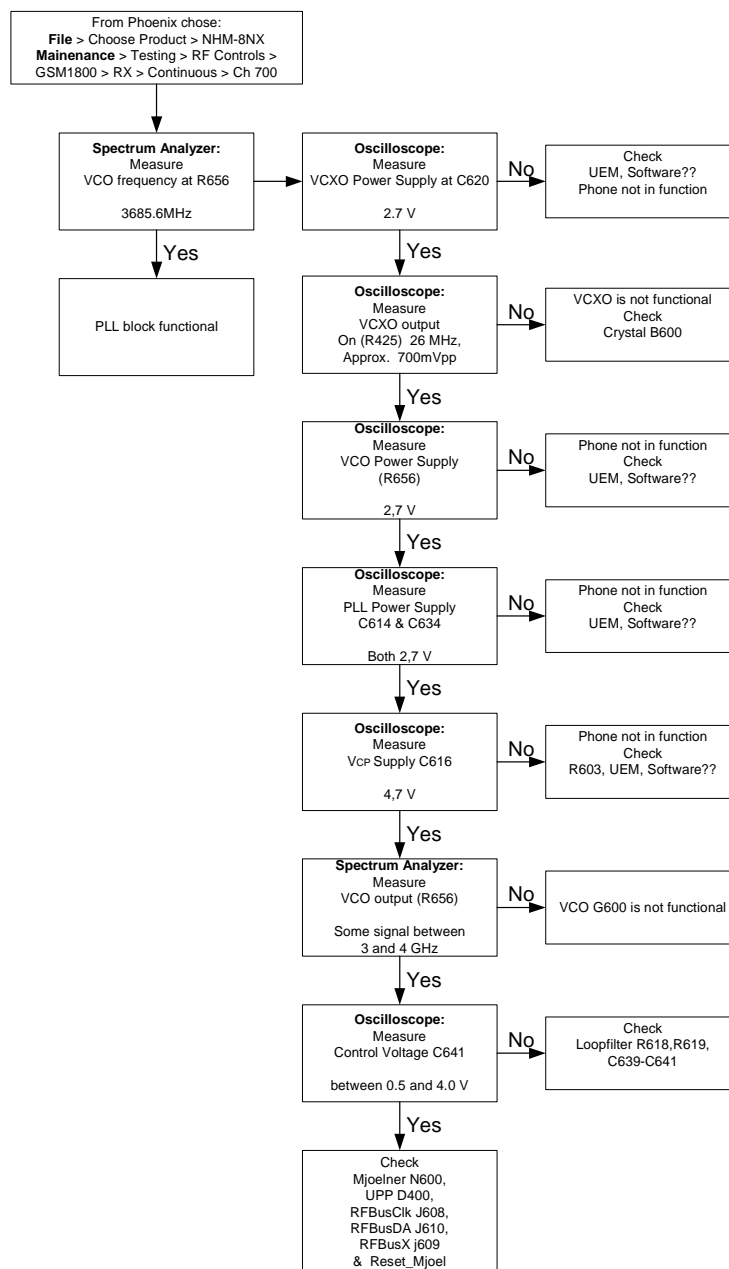


VCO

The VCO is generating frequencies in the range of 3420.2MHz – 3839.2 MHz when the PLL is running. The output frequency from the VCO is led to the Local oscillator input of the Mjoelner IC (N600), where the frequency is divided by 2 or 4 so that they can generate all channels in EGSM and PCN respectively. Frequency of the VCO is controlled by a DC-voltage ( Vctrl ) coming from the loopfilter. The loopfilter consists of the components R618, R619 and C639-C641. Range of the Vctrl when the PLL is running (locked) is 0.7V – 3.8V. Even if the PLL is not in locked state (Vctrl out of range) there is some frequency at the output of the VCO (G600) which is between 3 and 4 GHz. This is of course only true if the VCO is working and if the VCO power supply is present (2.7V).

Fault finding chart for PLL Synthesizer

Figure 21: PLL fault finding chart



If the phone stops working a short time after the power is turned ON, a possible reason for this might be that the 26MHz system clock signal is not getting to the UPP clock-input in BaseBand. In this case check the following:

- 1 Turn on the phone and check
- 2 VCXO Power supply (C620) = 2.7V
- 3 VCXO output (R425 – end **not** connected to C425) is 26MHz and approx. 700mVpp

If this is not the case check the reference crystal (B600) and Mjolner (N600) as well as R425, R426, C425, C426.

### Measurement points for the PLL

Measurement points at the VCXO

Figure 22: Measurement point for VCXO supply

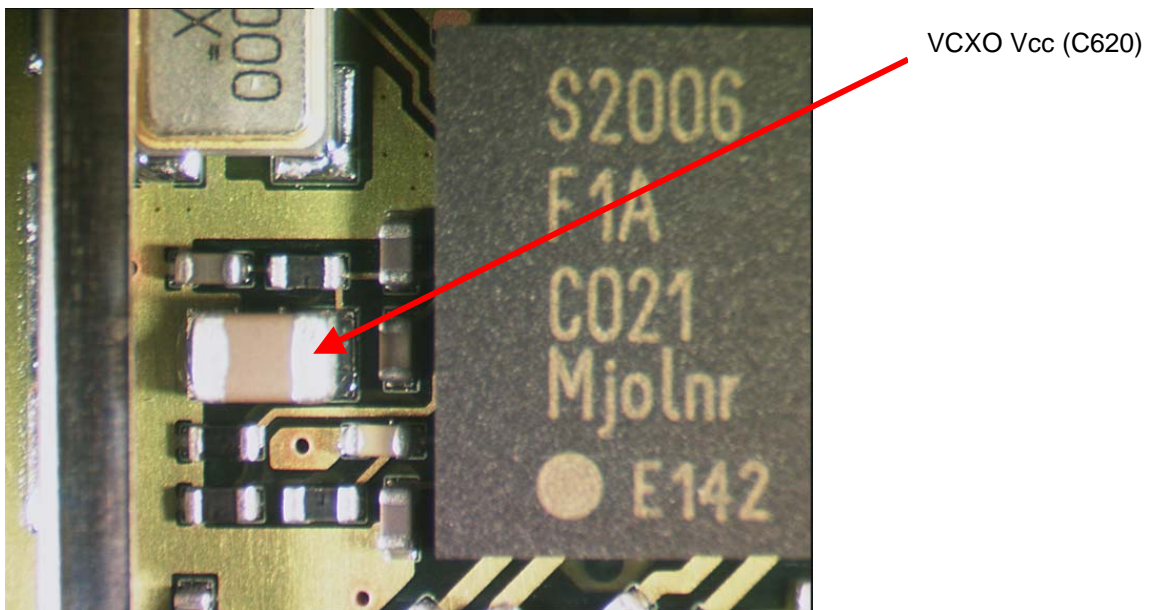
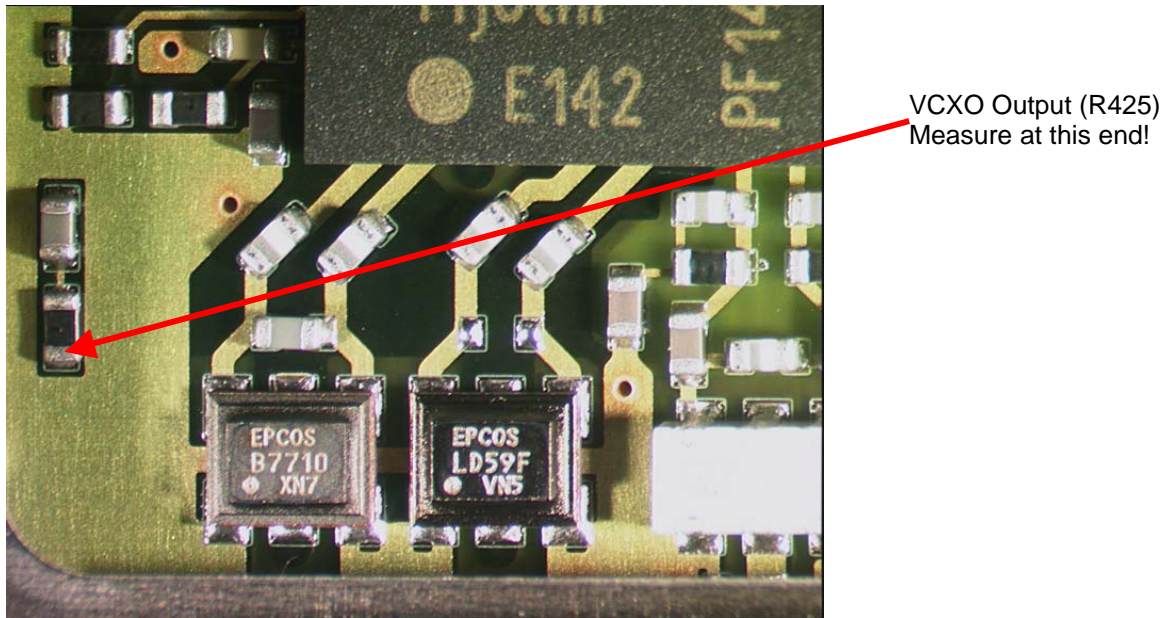
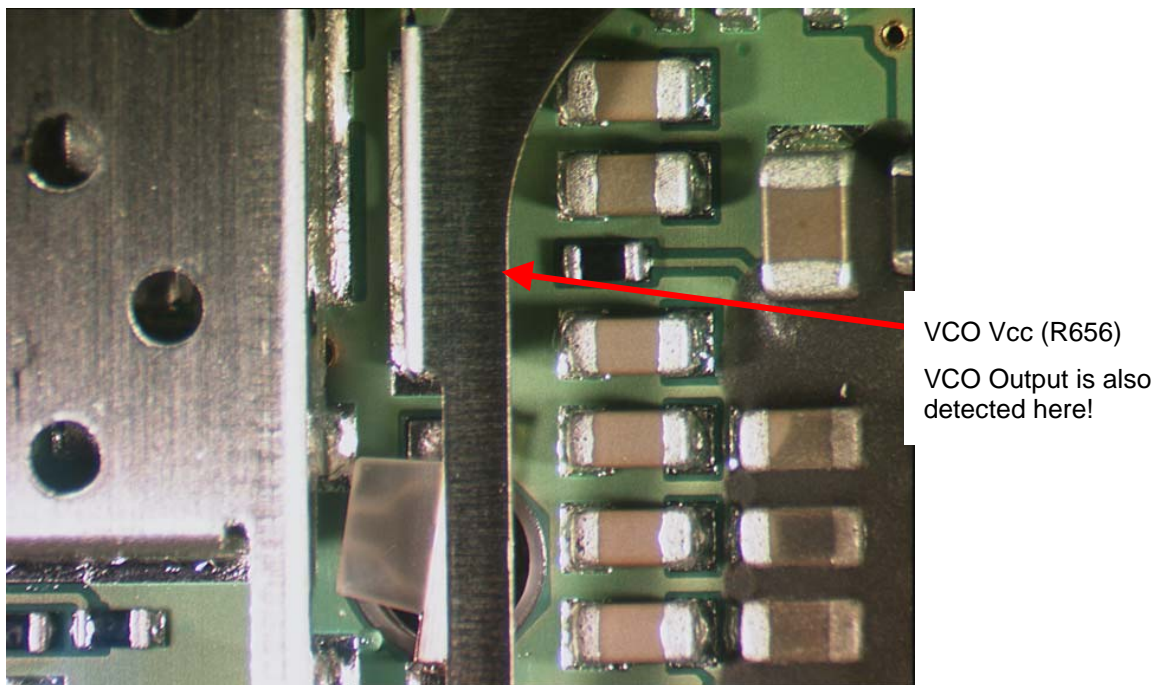


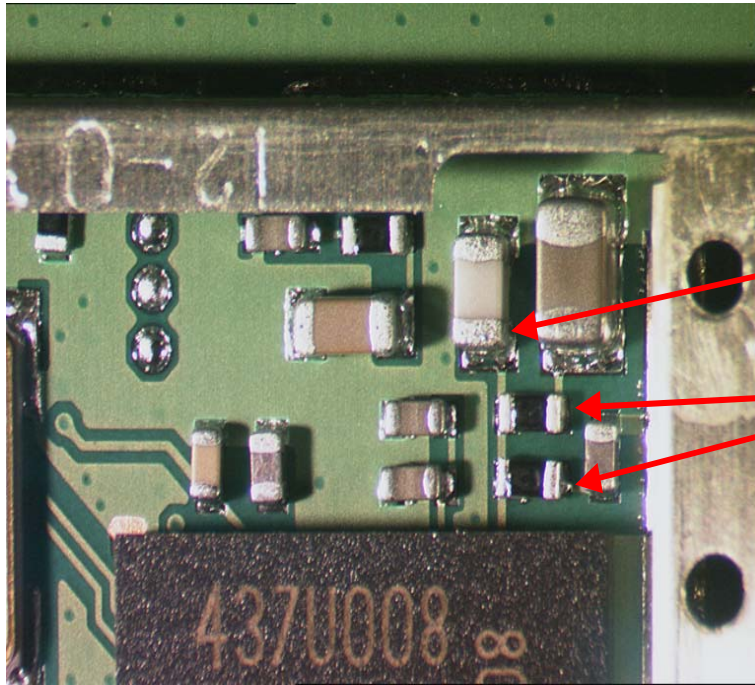
Figure 23: Measurement point for VCXO output



Measurement points at the PLL/VCO

Figure 24: Measurement point for PLL





CP V<sub>cp</sub> (C616)  
V<sub>cp</sub>=VR1A

PLL V<sub>cc</sub>  
(C614, C634)

Frequency lists

GSM900

Frequency list NHM-5 GSM900														
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

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	3420.8	3610.8	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	3421.2	3611.2	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	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	1806	3422	3612	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	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	3422.8	3612.8	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	3423.2	3613.2	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	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	1807	3424	3614	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	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	3424.8	3614.8	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	3425.2	3615.2	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	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	1808	3426	3616	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	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	3426.8	3616.8	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	3427.2	3617.2	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	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	1809	3428	3618	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	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	3428.8	3618.8	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	3429.2	3619.2	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	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	1810	3430	3620	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	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	3430.8	3620.8	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	3431.2	3621.2	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	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	1811	3432	3622	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	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	3432.8	3622.8	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	3433.2	3623.2	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	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	1812	3434	3624	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	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	3434.8	3624.8	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	3435.2	3625.2	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	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	1813	3436	3626	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	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	3436.8	3626.8	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	3437.2	3627.2	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	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	1814	3438	3628	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	3438.4	3628.4	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	3438.8	3628.8	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	3439.2	3629.2	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	3439.6	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	1815	3440	3630	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	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	3440.8	3630.8	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	3441.2	3631.2	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	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	1816	3442	3632	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	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	3442.8	3632.8	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	3443.2	3633.2	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.																		

## Alignment

### NHM-8NX manual align with Phoenix

In Phoenix select connection Fbus and Product Gemini. If you power up the board before selecting Fbus, it works without any error messages. Use Jig or other device for RF and bus connection. Attenuation in the probe alone is 0.5dB for 900 and 1dB for 1800. Use CMD55 or other suitable device. Default channels are 37 for GSM900 and 700 for GSM1800. The alignments and calibrations must be performed in the order shown to give reliable results.

The way to save data to the phone and to load data from the phone is made different in the various tunings. Always look what is shown in the windows regarding these issues and act accordingly.

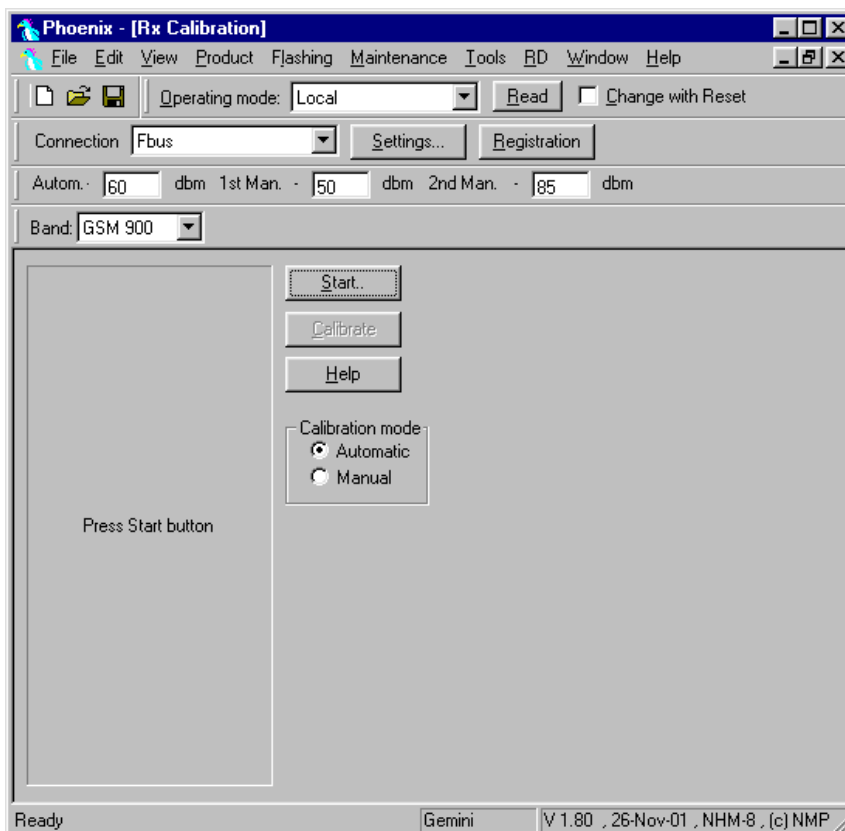
To vary a selected parameter you can use + and – key or in some cases directly type the new value. + and – steps the value for every press. Repeat function seems not to work. In I/Q you can use the side arrows.

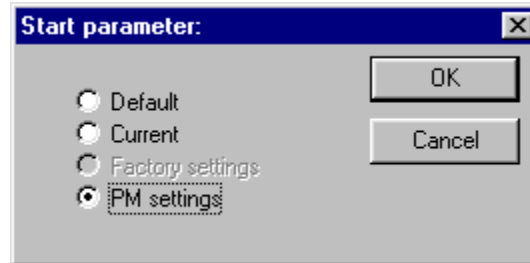
### RX calibration

Select **Maintenance, Tuning, RX Calibration**

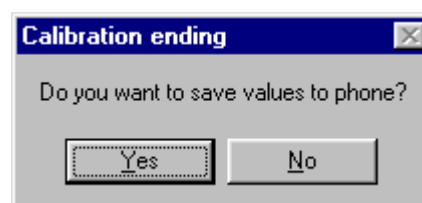
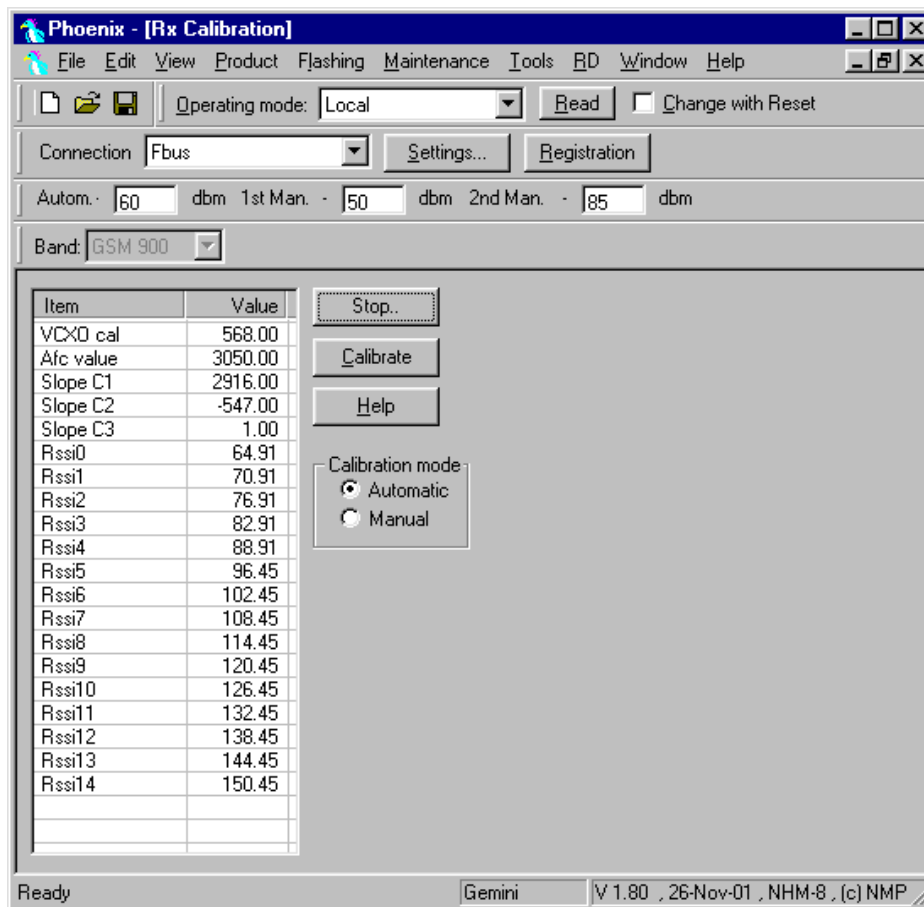
Select **Band: GSM 900**

The result should be like the shown:



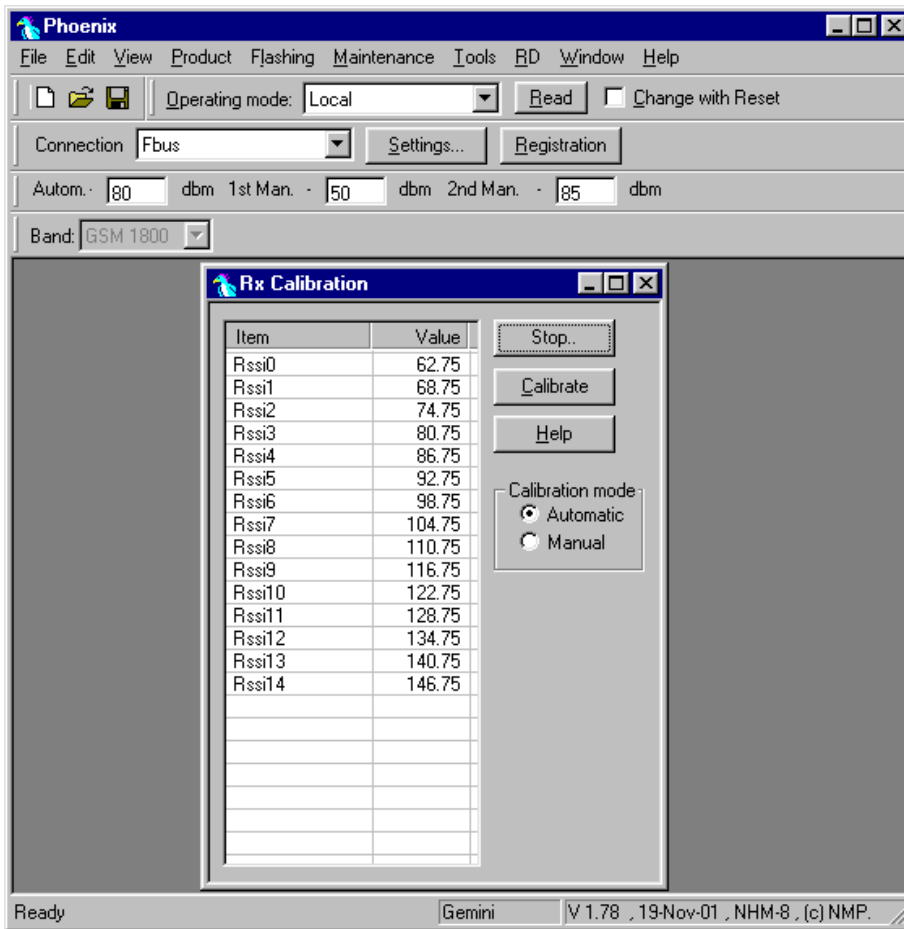


- 1 Select Automatic, set to 60dBm in small window in top bar
- 2 Start and select PM settings in the start parameters that pops up
- 3 OK





- 1 The existing data in the phone is shown
- 2 Calibrate, and the new data is shown
- 3 Stop, and the little window pops up where you can select to save or not
- 4 Select GSM1800 in the top bar and repeat at channel 700

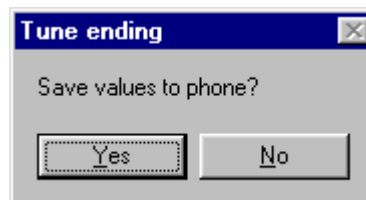
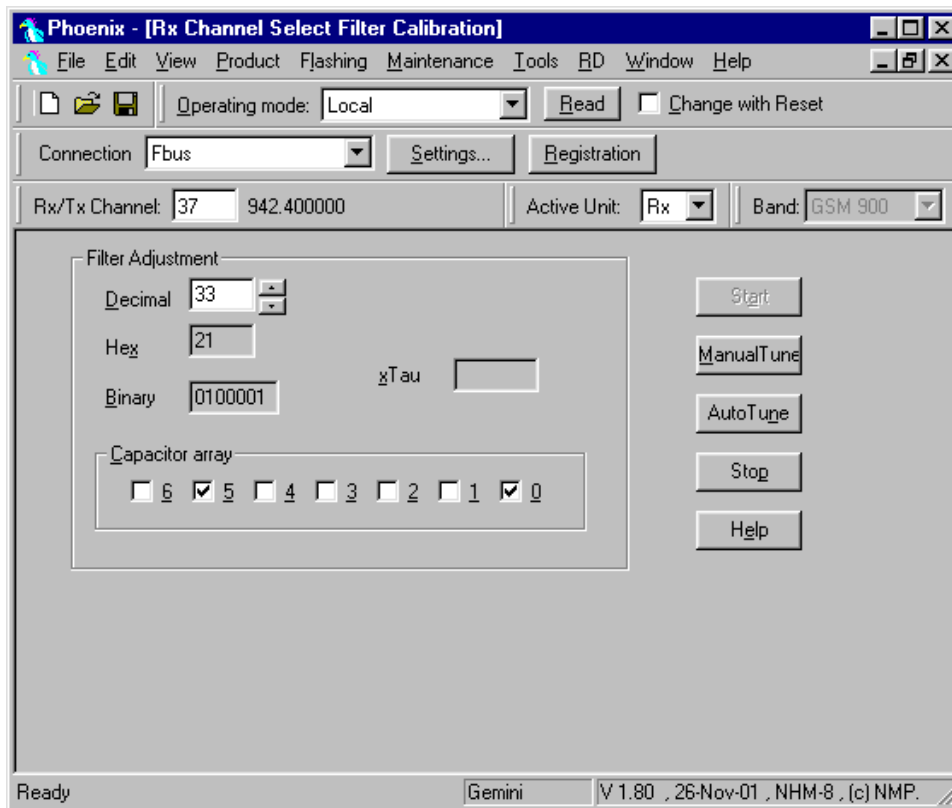


- 1 The existing data in the phone is shown
- 2 Calibrate, and the new data is shown
- 3 Stop, and the little window pops up where you can select to save or not

**RX channel select filter**

- 1 Select Maintenance, Tuning, Rx Channel Select Filter Calibration
- 2 Press Start and you can select to load values from the phone or not
- 3 Press AutoTune

- 4 Press Stop and you can select to save values to the phone or not

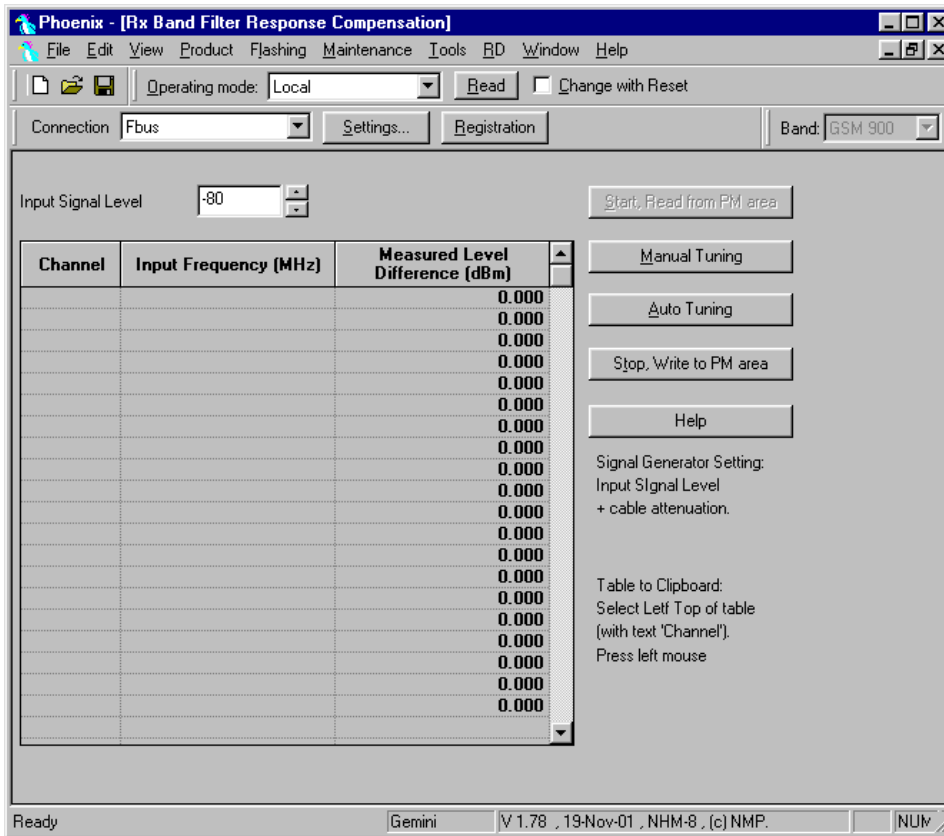


*Note: This calibration requires no input signal*

### **RX Band Filter Response**

- 1 Select Maintenance, Tuning, Rx Band Filter Response Compensation
- 2 Press Start, Read from PM area and you can select to load values from the phone or not
- 3 Press Manual Tuning
- 4 Set the Signal generator according to the pop-up windows
- 5 When finished press Stop, Write to PM area and you can select to save values to the phone or not

6 Repeat for GSM1800

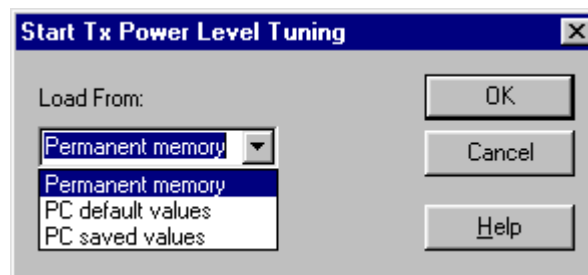
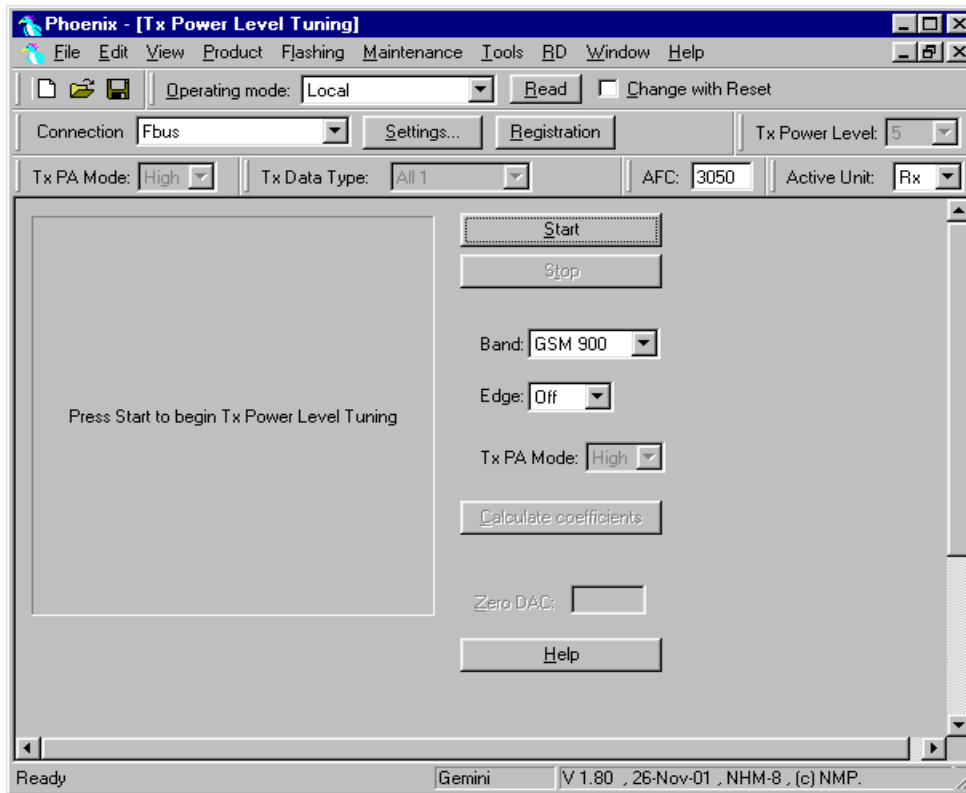


*Note: This calibration requires a lot of different frequencies from the generator. If you have a signal generator with a frequency list option you can with advantage use Auto Tuning (Dwell should be around 10ms).*

**Tx Power tuning**

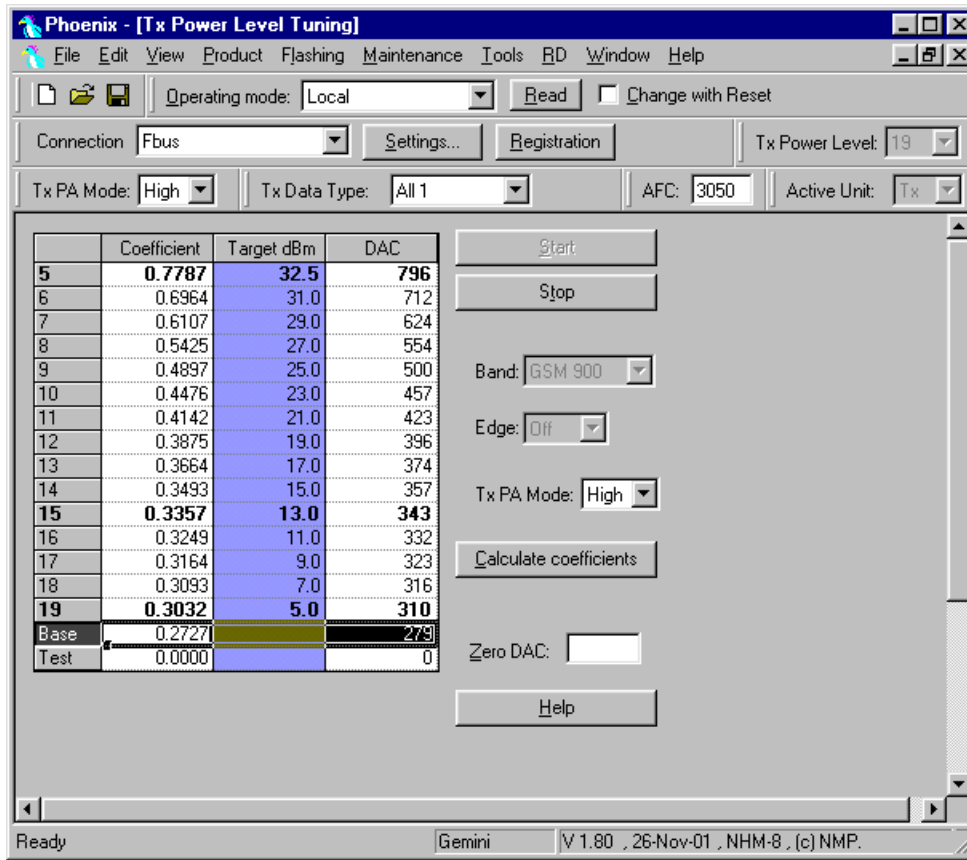
Select **Maintenance, Tuning, Tx Power Level Tuning**

## TX power tuning GSM



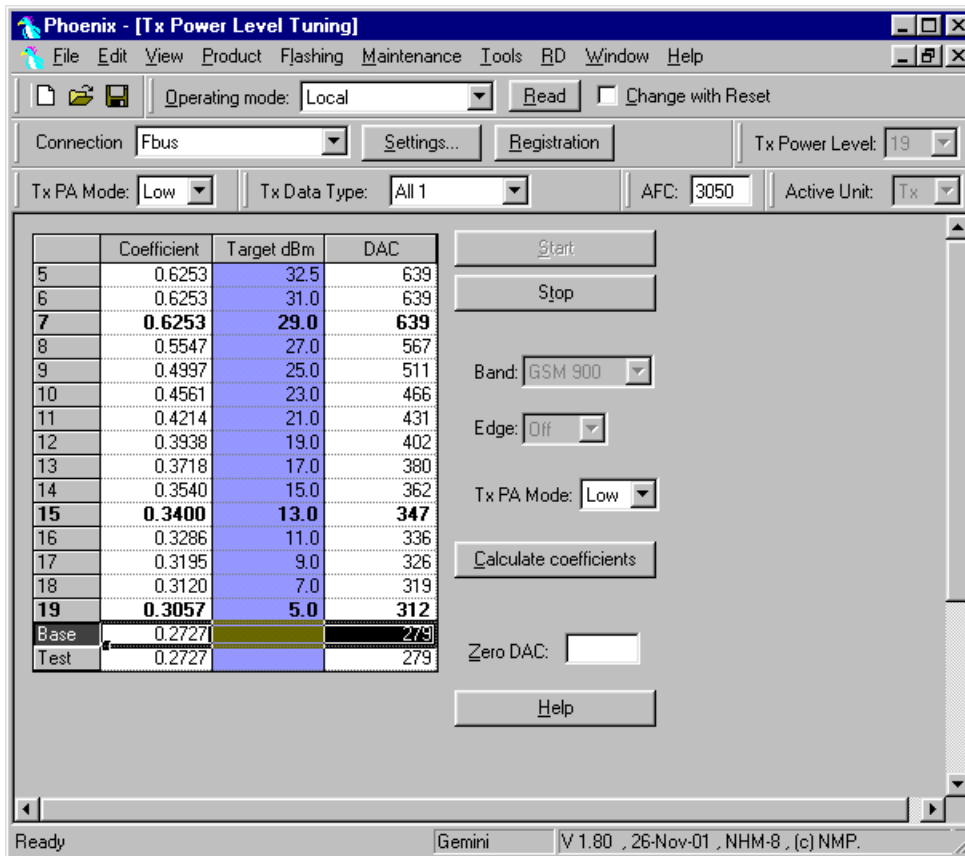
- 1 Select edge off, GSM 900
- 2 Press Start and select from where to load values. Best is to have PC saved data from a good phone. The data from a "good" phone can be saved to PC, for use

later.

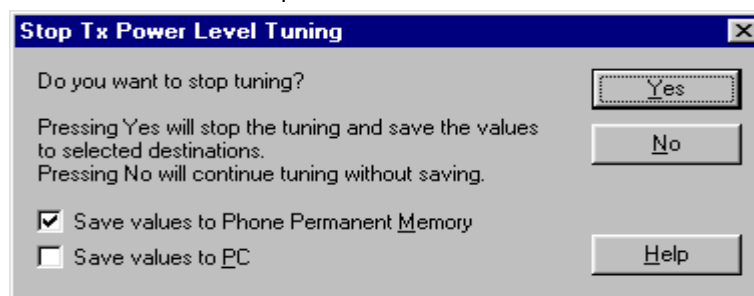


- 1 Select the modulation 1, 0 or random in Tx Data Type. Select random if a GSM tester is used. Then it can synchronise to the burst.
- 2 Select Tx PA Mode High
- 3 Tune the highlighted values to the wanted power (Use average burst power)
- 4 Tune base level to -28dBm (Close to lowest level CMD55 can keep synchronisation)

5 Calculate coefficients



- 1 Select Tx PA Mode low and tune the high highlighted values.
- 2 The base level coefficient is taken from the high mode. Do not change it.
- 3 Calculate and select Stop

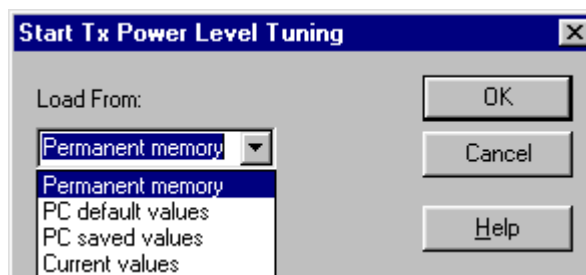
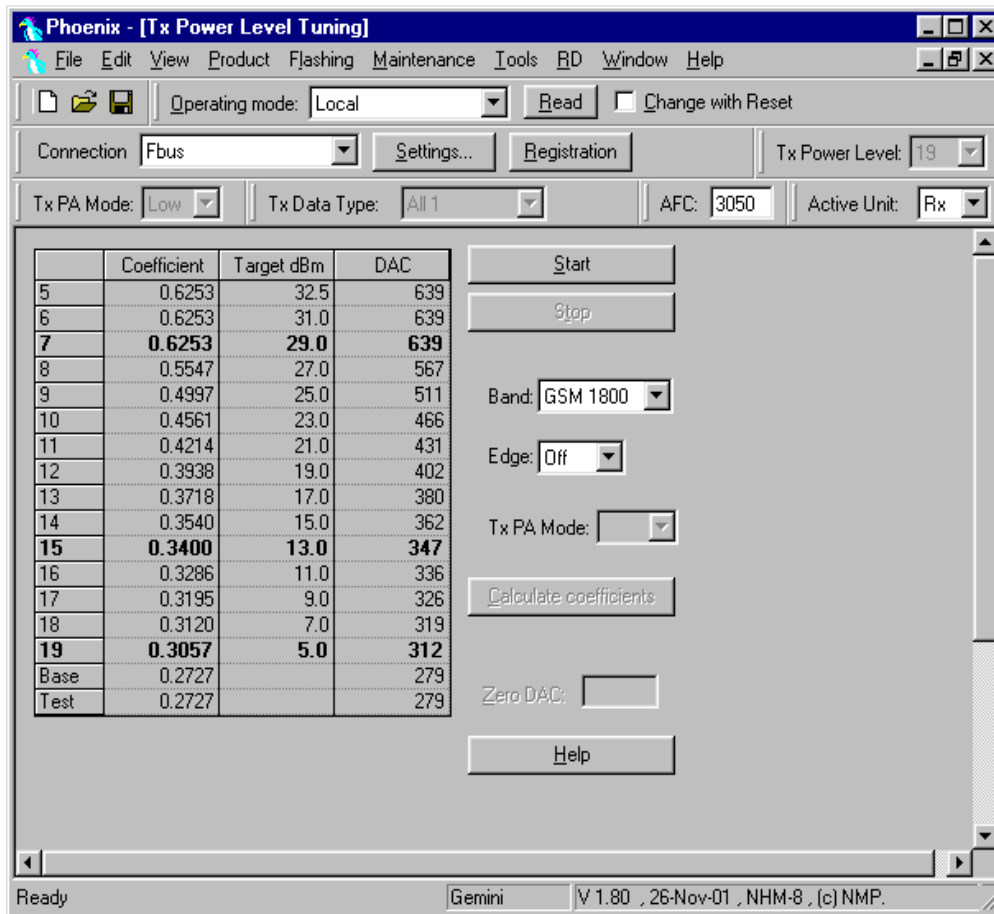


If you are satisfied with the coefficients and the power, then save to the Permanent memory.

You can also save the table to the PC, so that you can load it to an other phone. Or you can select not to do anything by removing both ticks.

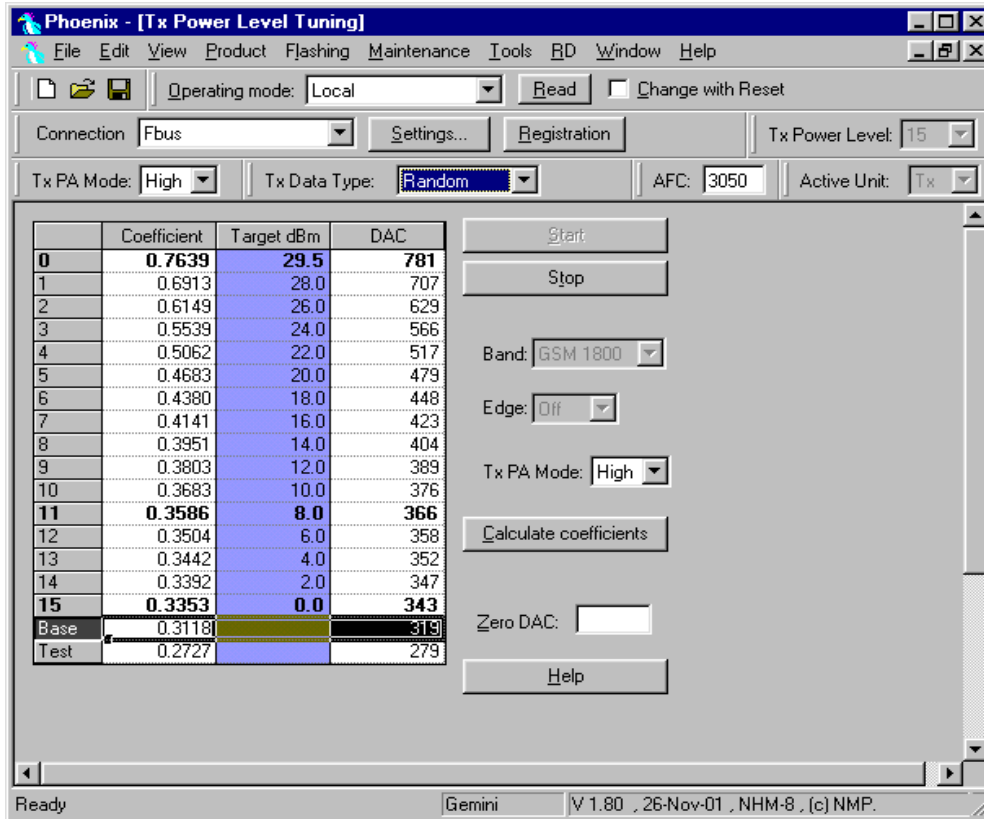
Only way to end the tuning session is with Yes

TX power tuning PCN

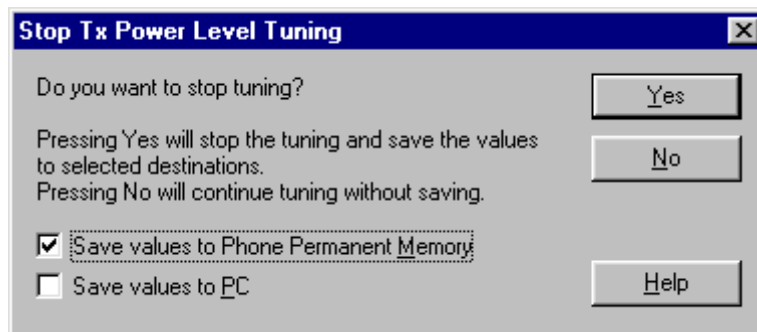


- 1 GSM 1800 band (PCN)
- 2 Start
- 3 Select where to get values from. Normally Permanent Memory

4 OK



- 1 Select the wanted modulation. Random if a GSM tester is used, so that you can synchronise the burst.
- 2 Only high mode is possible
- 3 Tune the highlighted values to the wanted power
- 4 Tune base level to -27dBm
- 5 Stop



- 6 Select where to save the values, one, both or no one can be selected.

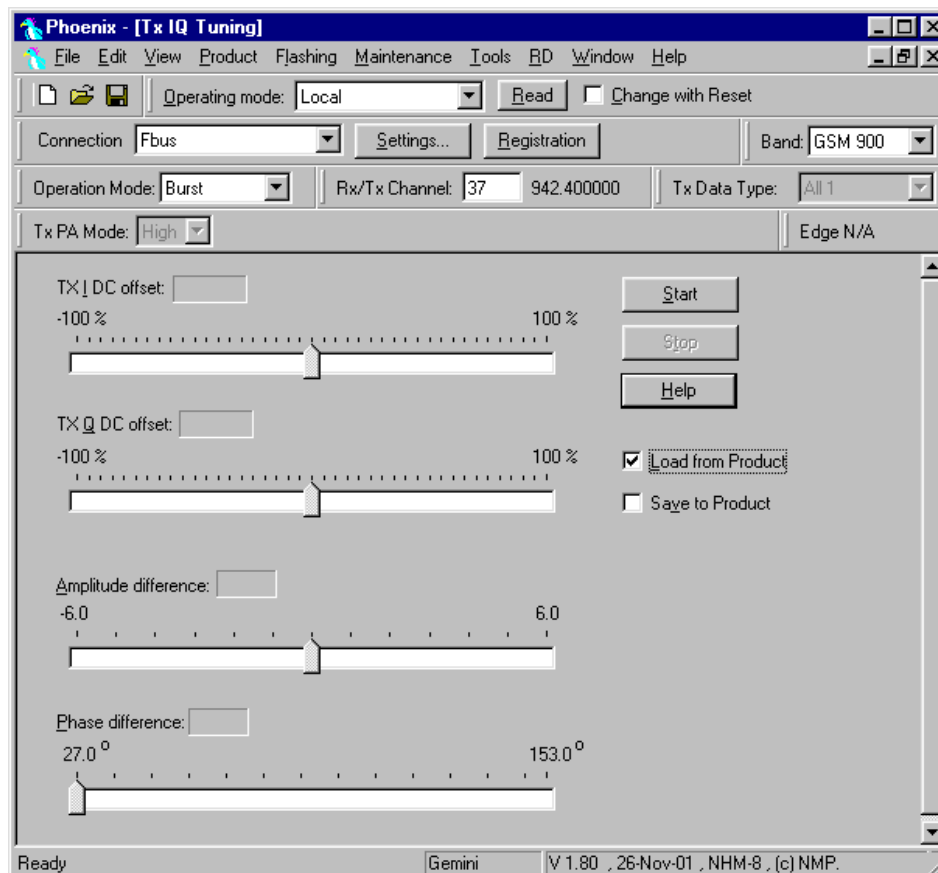


- 7 Yes. That's the only way to end tuning.

## I/Q tuning

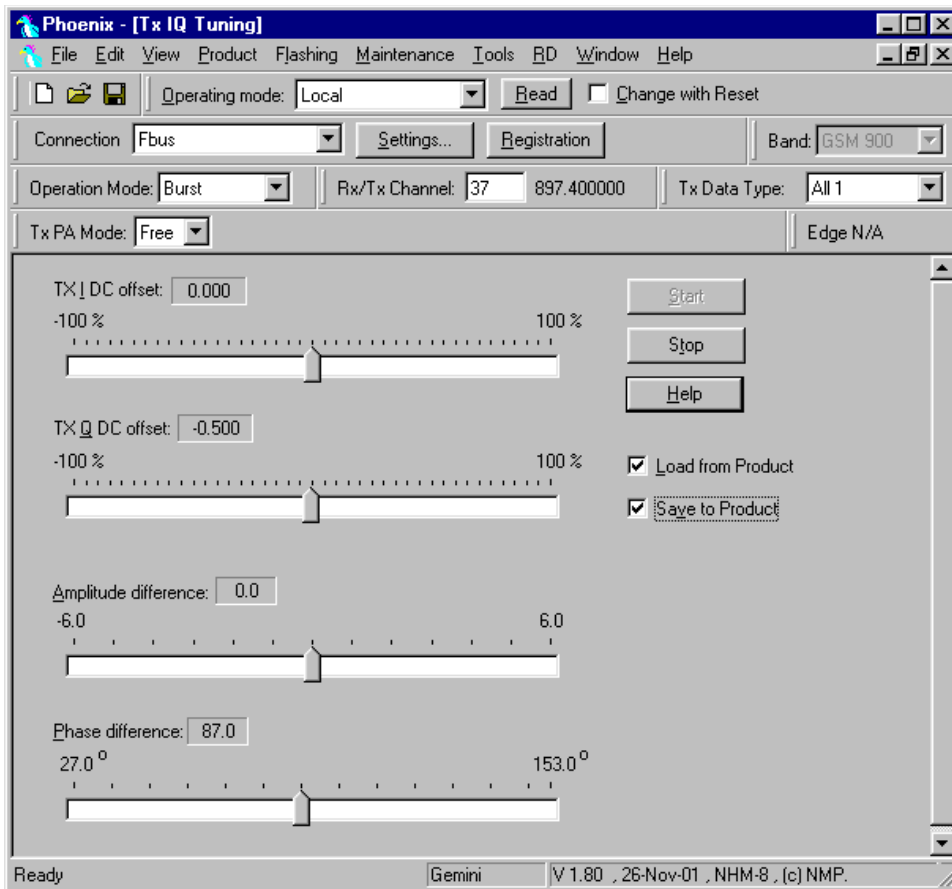
Select **Maintenance, Tuning, Tx IQ tuning**

Set CMD55 to Narrow Spectrum on the same band as the phone. Selected in the top menu.



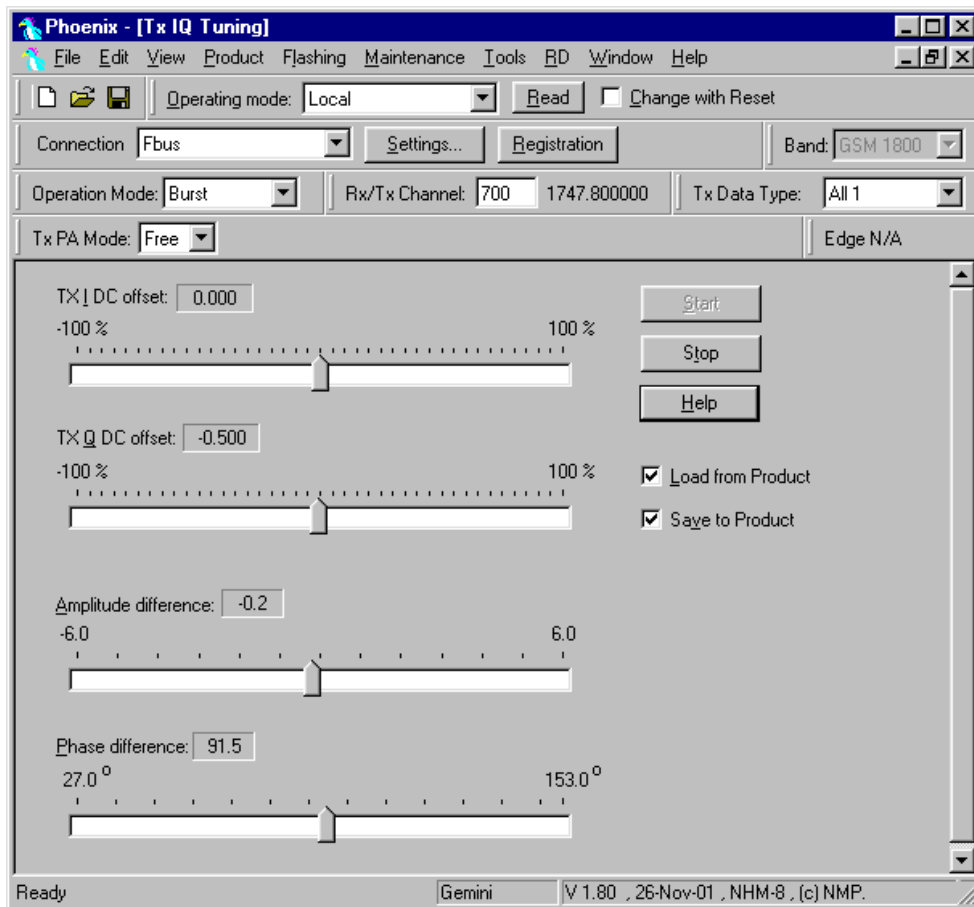
- 1 Select where to get values. Normally select Load From Product
- 2 Start
- 3 Tune offset values to lowest carrier. Use Side arrows or +, - .
- 4 Tune Amplitude and phase to lowest sideband.

5 Check eventually with other modulation (0).



Remember to tick **Save to Product** if you want to save to phone.

- 1 Stop to end the tuning with the selected save option



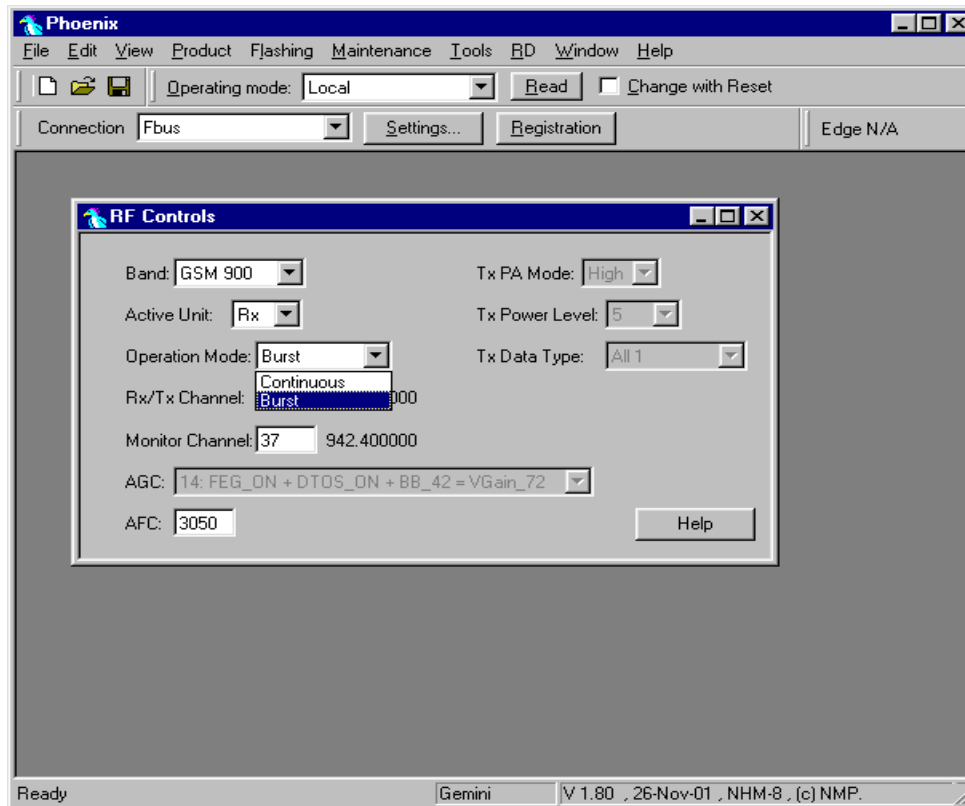
- 1 Same procedure for PCN as for GSM.
- 2 Remember to tick Save To Product.
- 3 Stop. Ends tuning and does what you have ticked.

## RF control

This menu can be placed in maintenance or in tuning dependent of Phoenix.

It is meant to check the receiver or transmitter without going in call. It works very much like a call, but you have control via the PC, and not via the tester. The TX mode GSM900 can select between Free, High and low mode. It changes the PA mode, but changes also the power level if a level is selected that is not supported in that mode.

If you want to tune at other channels than the default, then you must select it first in RF control and then start the tuning.



## Call testing

If all tunings are done, and the phone TX and RX is working a call is the ultimate test of the phone.

Set CMD55, or similar tester, to manual test and switch the phone to normal if it was in local. Remember to have a test simcard in the phone.

When the phone has made a registration a call can be made, and it is possible to let the phone answer via Phoenix. In the Autocaller (Maintenance Testing) you can answer by ticking Answer when button pushed and then push the button.