

# Programmes After Market Services NPE-3 Series Transceivers

## Troubleshooting

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## Baseband Trouble shooting

The following hints should make it easier to find the cause of the problem when the circuitry seems to be faulty. This trouble shooting instruction is divided into following sections:

1. Phone is totally dead
2. Flash programming doesn't work
3. Power doesn't stay on or the phone is jammed
4. Display information: "Contact Service"
5. Phone doesn't register to the network or phone doesn't make a call.
6. SIM card is out of order ("insert SIM card" or "SIM card rejected")
7. Audio fault
8. Charging fault

The first thing to do is carry out a through visual check of the module. Ensure in particular that:

There are not any mechanical damages

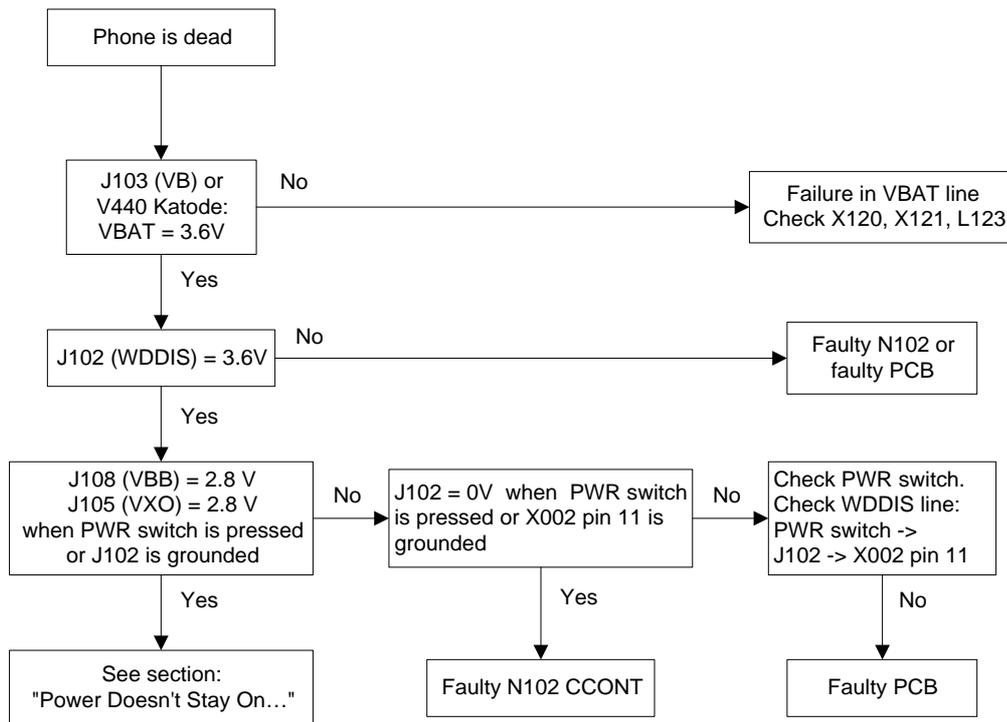
Soldered joints are OK

*Note: X002 is a panel connection only present in the production. Therefore it is not applicable for the PAMS repair.*

### Phone is dead

This mean that the phone doesn't take current at all when the power switch is pressed or when the watchdog disable pin WDDIS (J102 or X002 pin 11) is grounded.  
Nominal supply (VBAT voltage) to phone is 3.6V.

The hardware of CCONT (N102) prevents totally to switch power on if VBAT is below 3.1V.



## Flash programming doesn't work

The flash programming can be done via panel connector X002 or via system connector X001.

In production, the first programming is done via panel connector X002. After this, the panel connector is cut away, thus the flash programming must be done via system connector X001.

The main differences between these are:

- a) Flash programming voltage is produced different way.
- b) Signal routings are different.

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

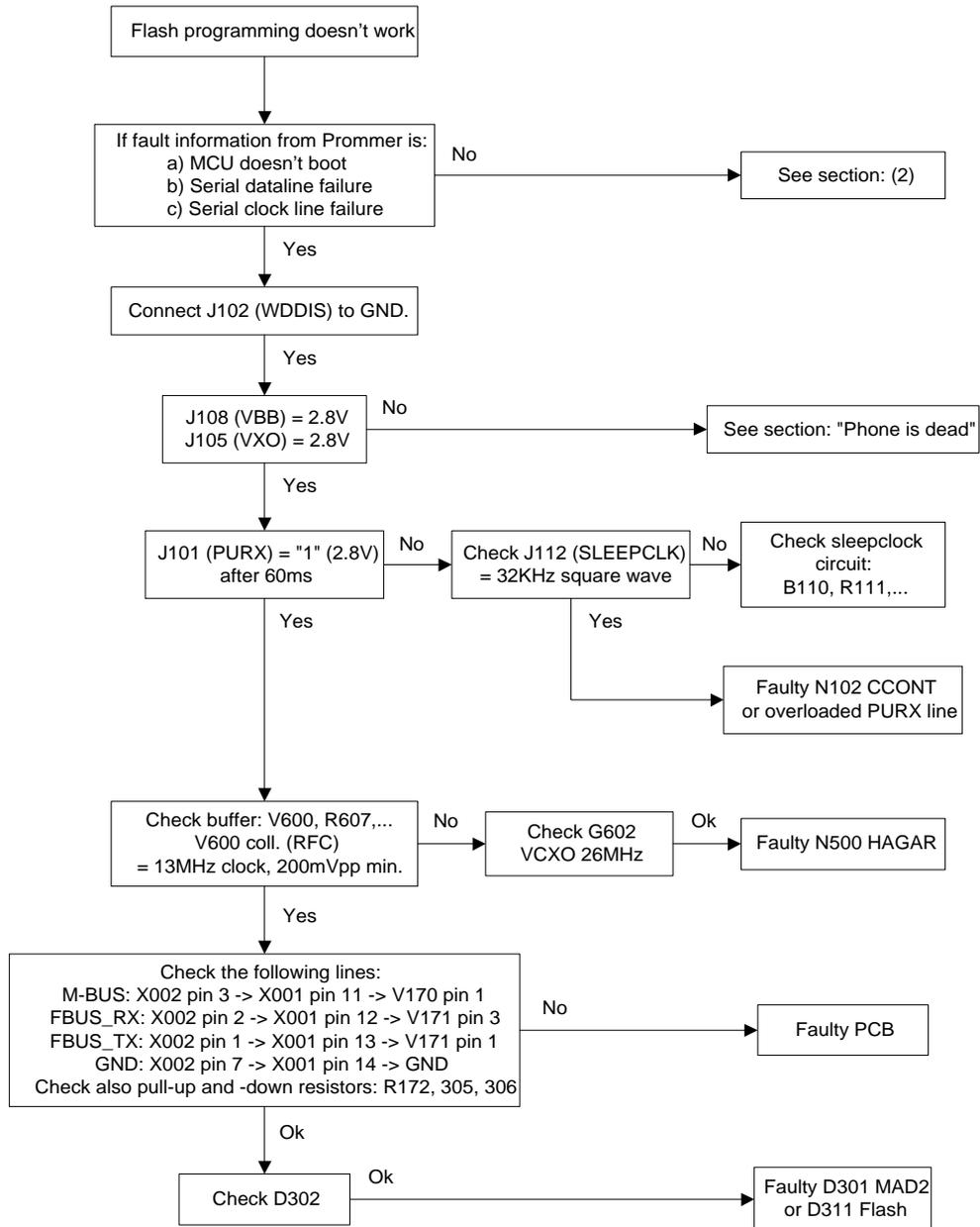
The fault information messages could be:

- MCU doesn't boot
- Serial clock line failure
- Serial data line failure
- External RAM fault
- Algorithm file or alias ID not found
- MCU flash Vpp error

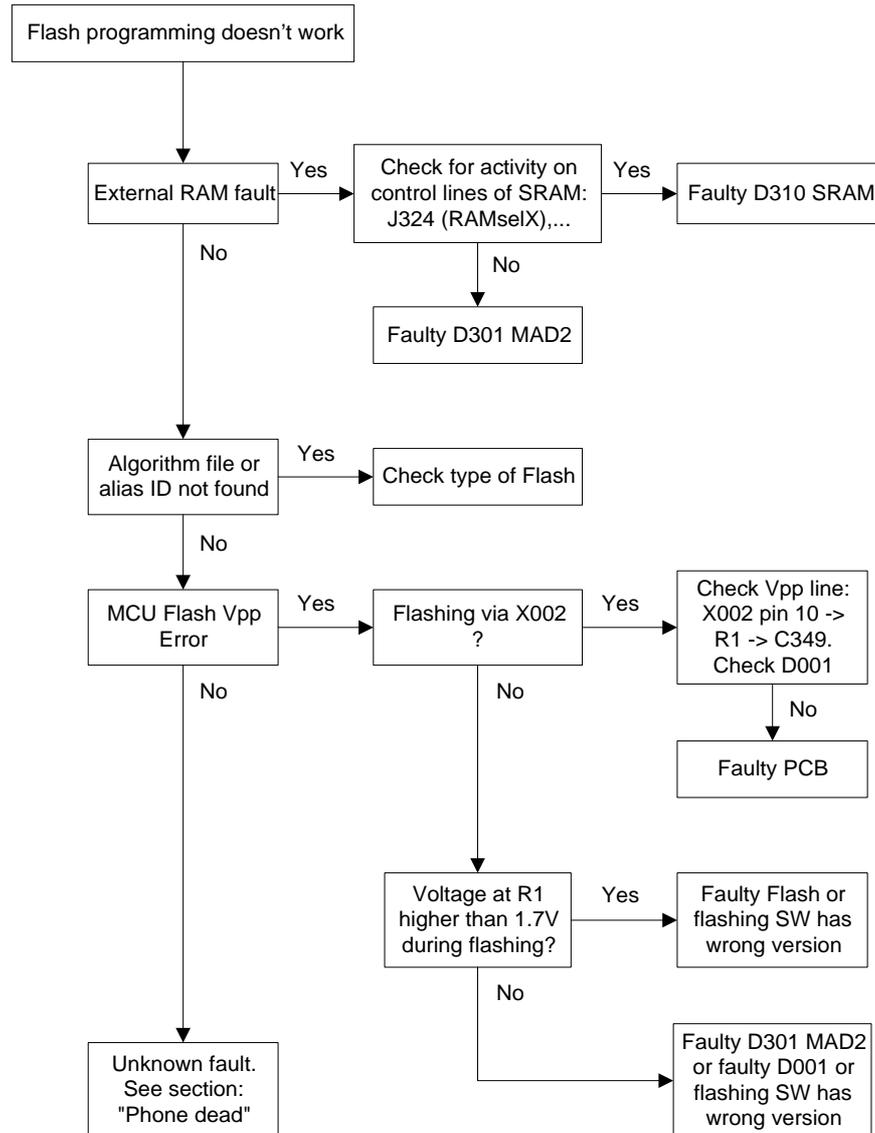
The fault-finding diagrams for flash programming are shown in the next two pages.

Because of the use of uBGA components it is not possible to verify if there is a shortcircuit in control- and adress lines of MCU (MAD2) and memory (SRAM and flash).

### Flash programming (1)



### Flash programming (2)



### Power doesn't stay on, or phone is jammed

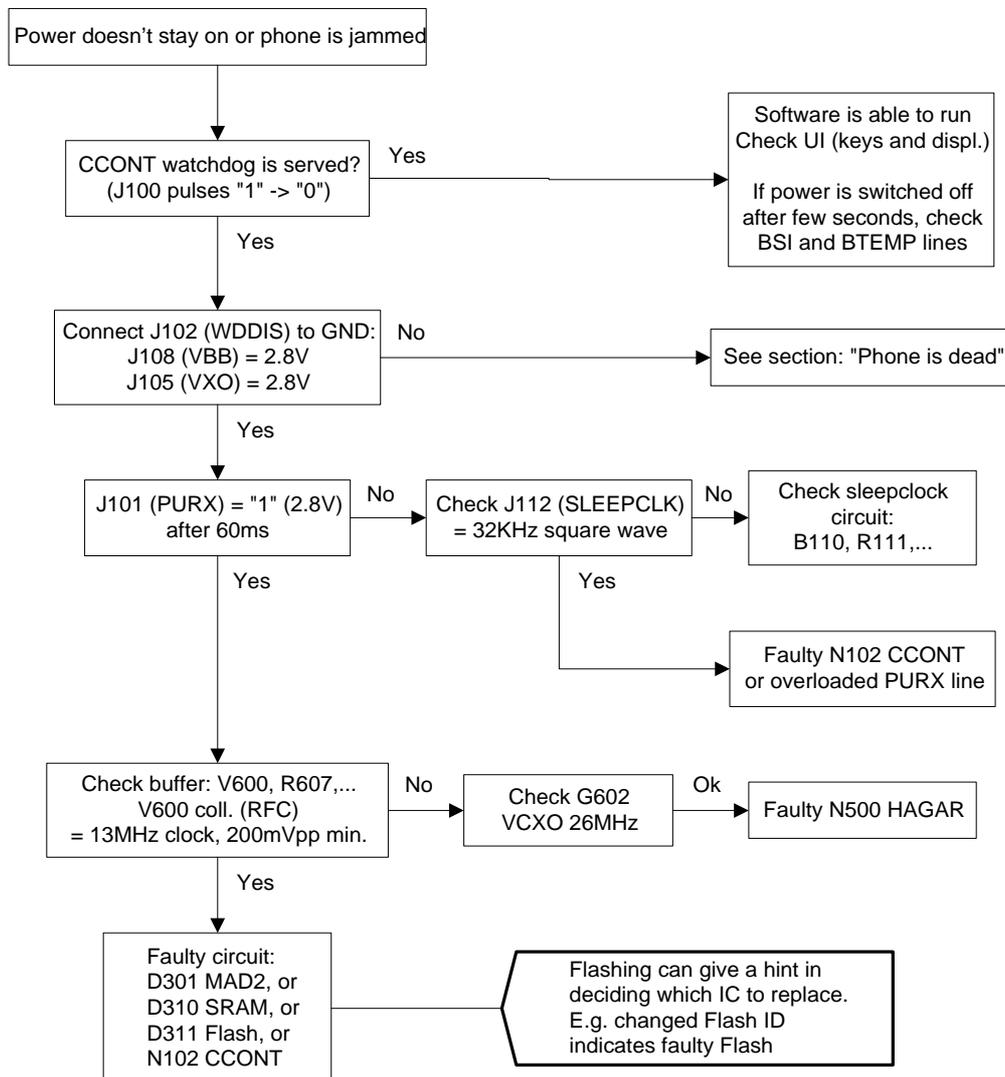
If this kind of fault has come after flash programming, there are most probably open pins in IC's.

Normally the power will be switched off by CCONT (N102) after 30 seconds, if the watchdog of the CCONT can not be served by SW.

The watchdog updating can be seen by oscilloscope at J100 (DataSelX from CCONT).

In normal case there is a short pulse from "1" -> "0" every 8 seconds.

The "power off" function of CCONT can be prevented by connecting a short circuit wire from J102 to ground.



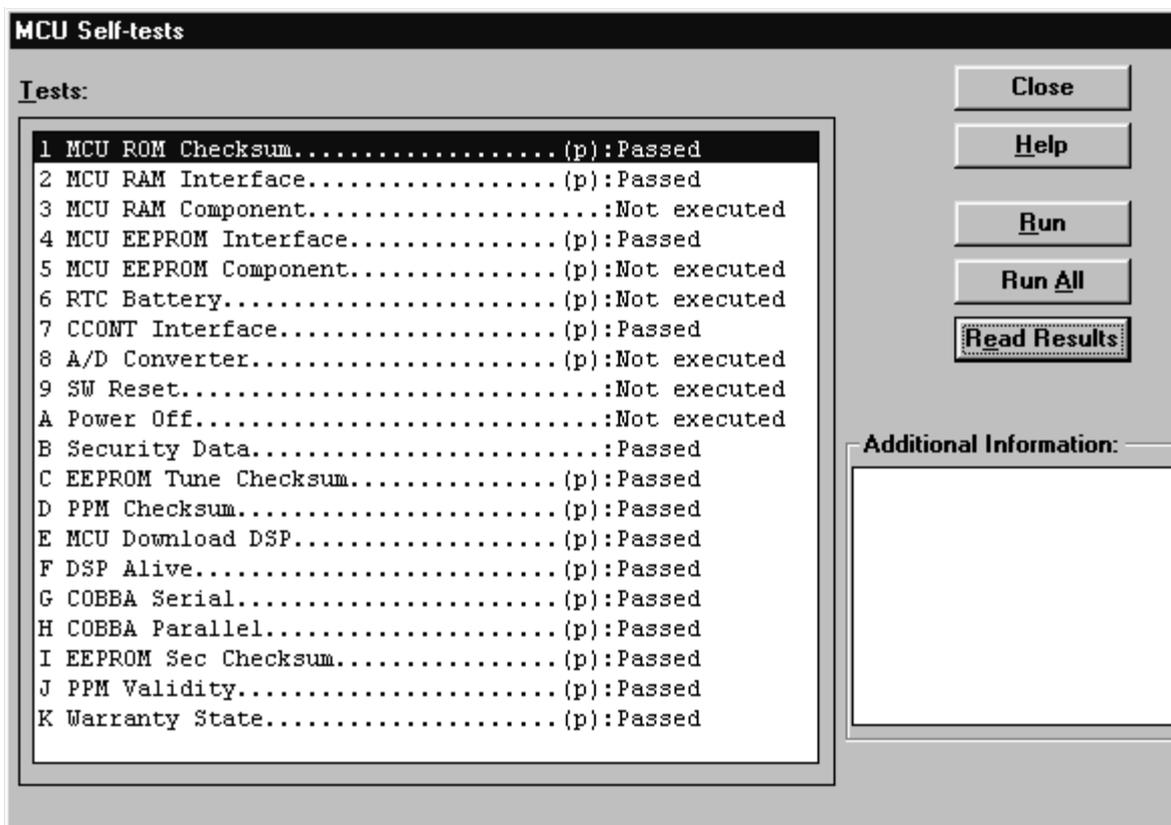
### Display Information: "Contact Service"

This fault means that software is able to run and thus the watchdog of CCONT (N102) can be served.

Selftest functions are executed when power is switched on and software is started to execute from flash.

If any one of the selftests fails, the text "Contact Service" is shown in the phone display.

MCU selftests are divided into those executed while power up (start up tests) and the ones that can be executed with connected PC. The tests and included items are as follows (screendump from WinTesla):



The information can be used for diagnosing.

Explanation for item no. 1; MCU ROM Checksum:

Calculates 16 bit checksum out of Flash code and compares it to the one found in Flash. Items being checked are: MAD2 <-> Flash data- and adress lines, CE0, CE1, WE, BYTE, Vcc, GND, and Flash internal functionality.

Explanation for item no. 4+5; MCU EEPROM:

This test is not valid thus the EEPROM is emulated in the Flash.

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

If the phone doesn't register to the network or if the phone doesn't make a call, the reason could be either the baseband or the RF part.

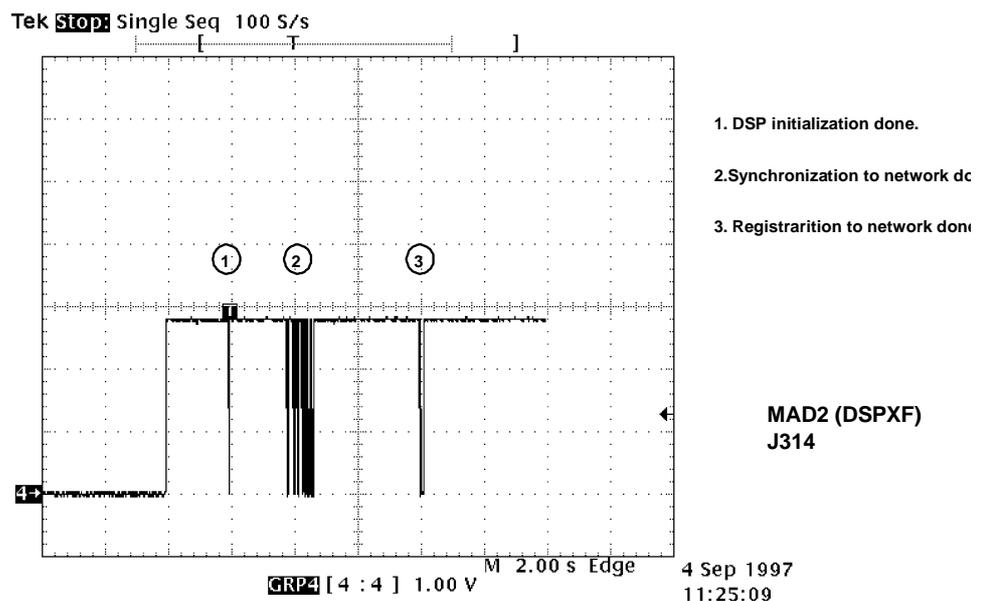
The phone can be set to required mode by WinTesla service software in order to determine if the fault is in RF or in baseband part (RF interface measurements).

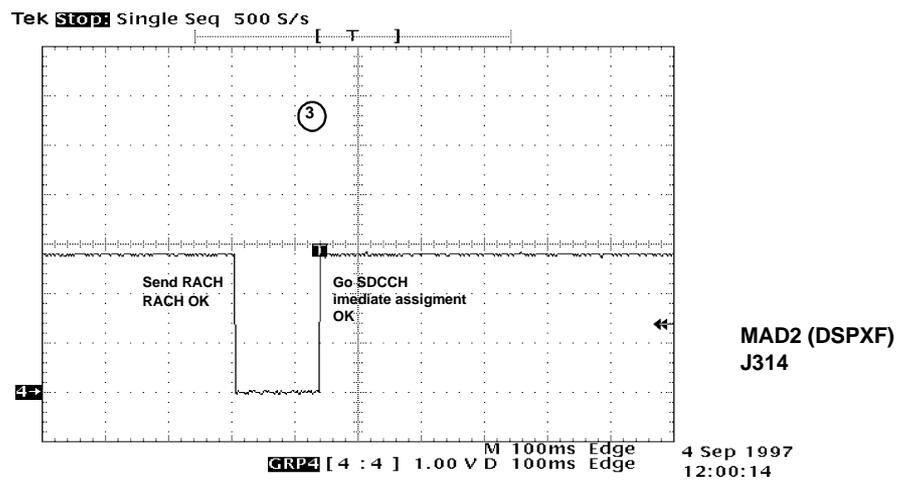
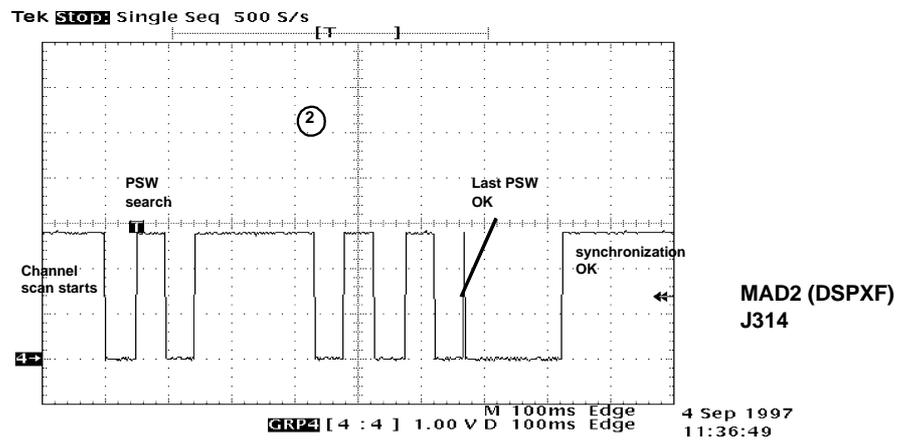
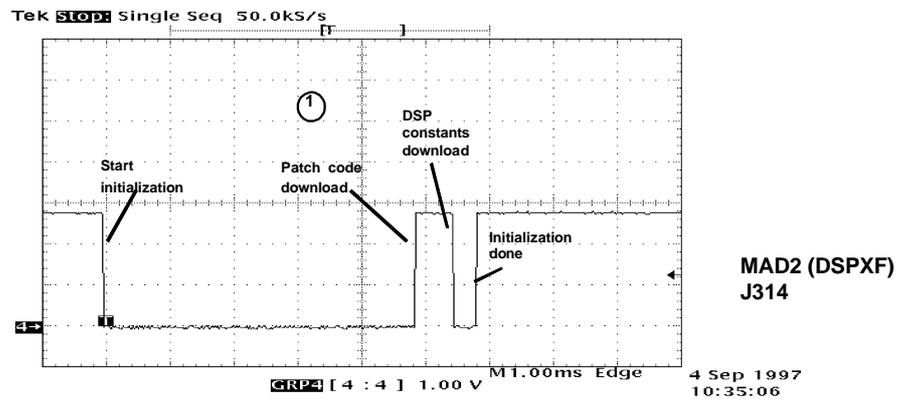
The control lines for RF part are supplied from both the System Asic (D301, MAD2) and the RFI (N240, Cobba). MAD2 handles digital control lines (SynthEna, TxP, etc.) and Cobba handles analog control lines (AFC, TxC, etc.).

The DSP software is constructed so that operation states of DSP (MAD2) can be seen in external flag DSPXF output pin, J314.

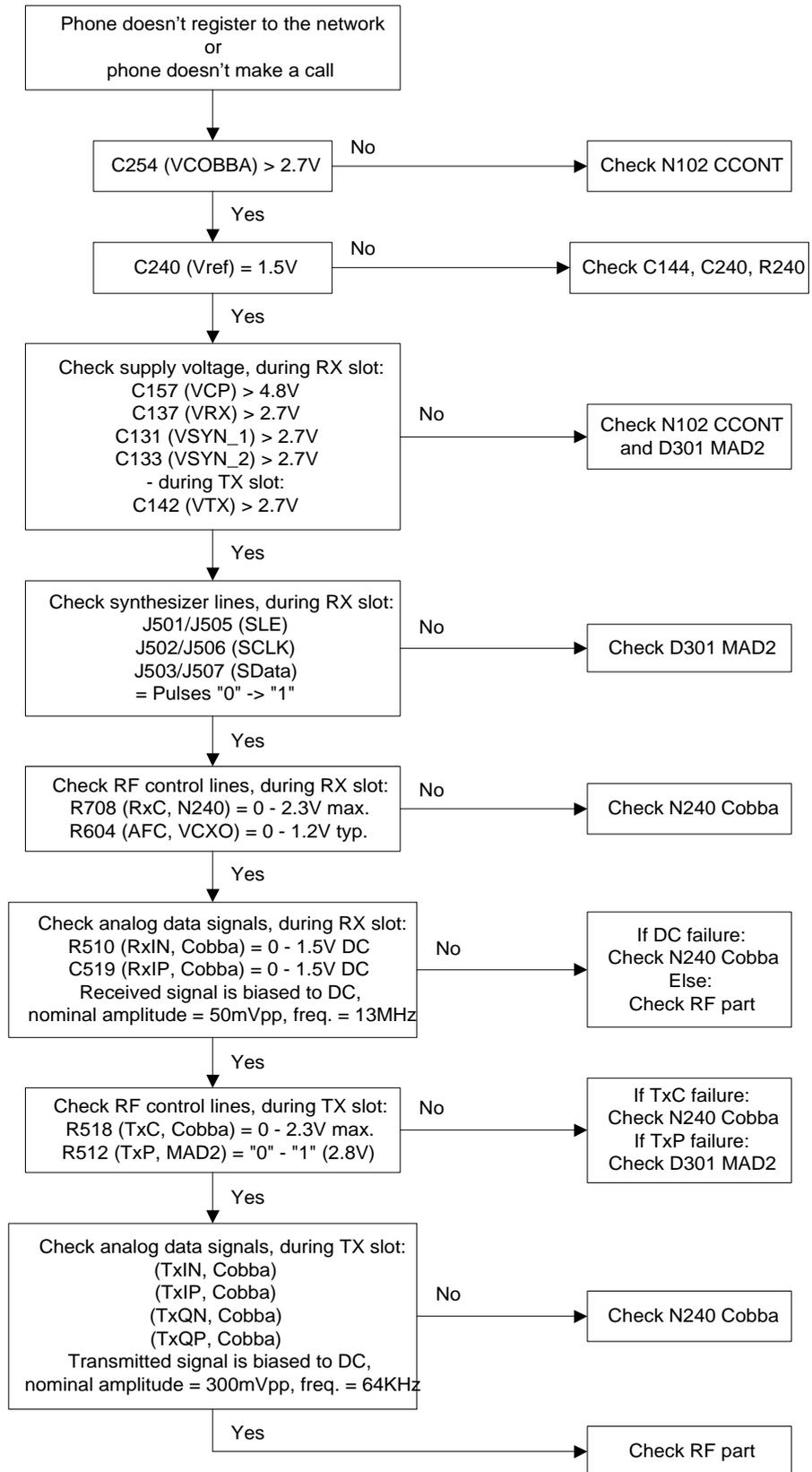
After power up, DSP indicates all the completed functions by changing the state of the XF pin as shown in figures below:

(Continued on the next page, and the fault finding diagram on the page after.)





## Phone doesn't register to the network...



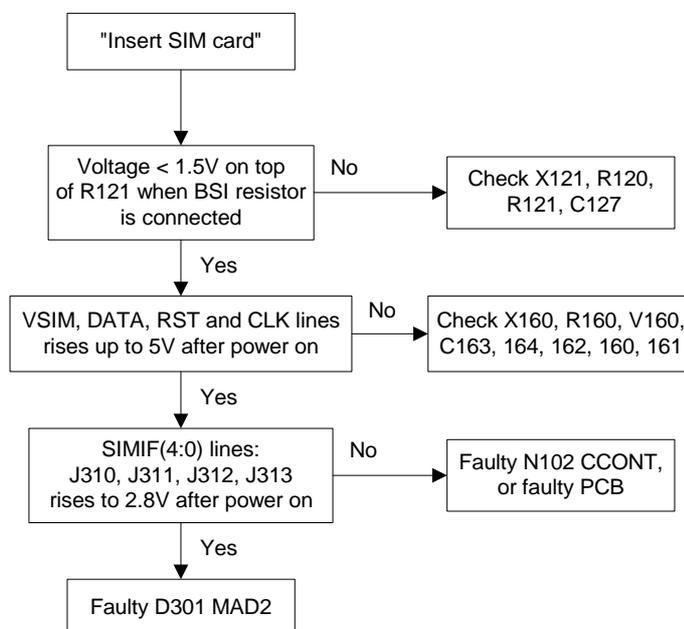
### SIM related faults

The hardware of the SIM interface from MAD2 (D301) to the SIM connector (X160) can be tested without a SIM card.

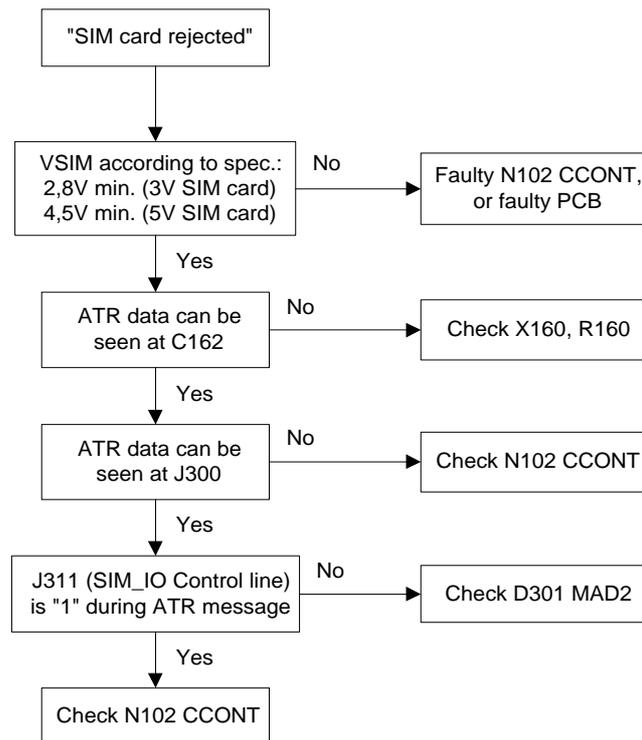
When the power is switched on and if the BSI line (X121;1) is grounded by a resistor, all the used lines (VSIM, DATA, RST, CLK) rises to 3V and then 5V (the phone will try this four times). Thus "Insert SIM card" faults can be found without SIM card.

The fault information "SIM card rejected" means that ATR message (the first message is always sent from card to phone) is sent from card to phone but the message is somehow corrupted, data signal levels are wrong etc. or factory set values (stored to the emulated EEPROM) are not correct.

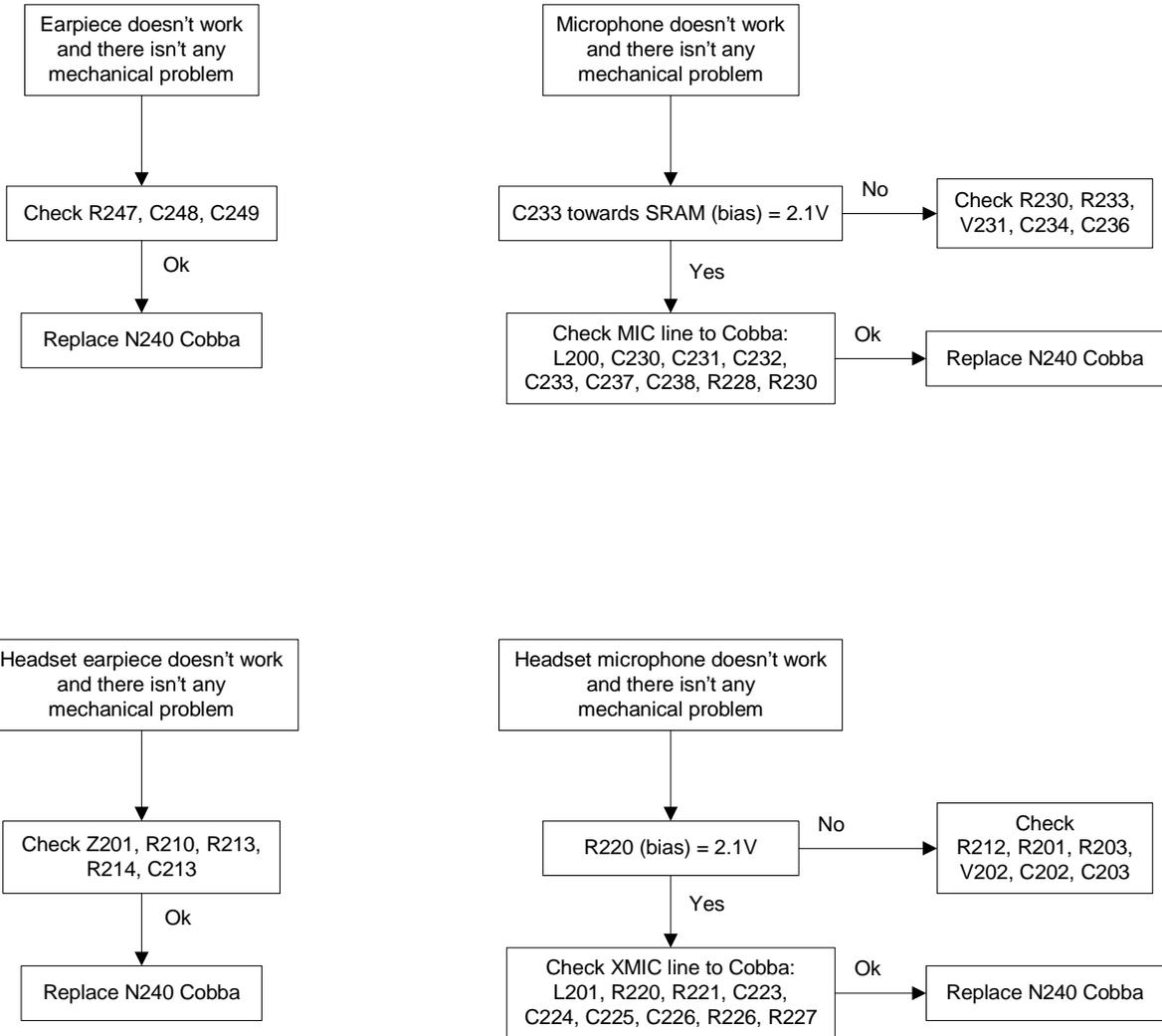
### Insert SIM card fault (1)



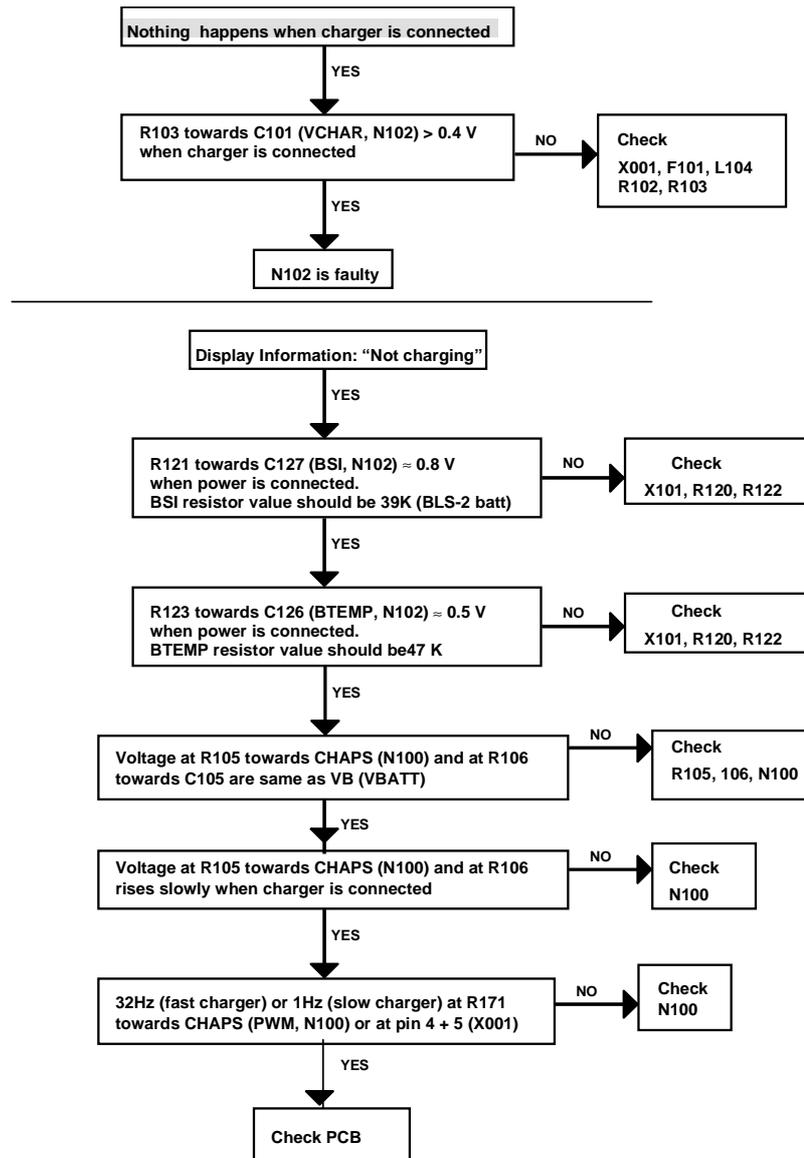
## SIM card rejected fault (2)



Audio Faults



## Charger Failure



# 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 (N500). 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.

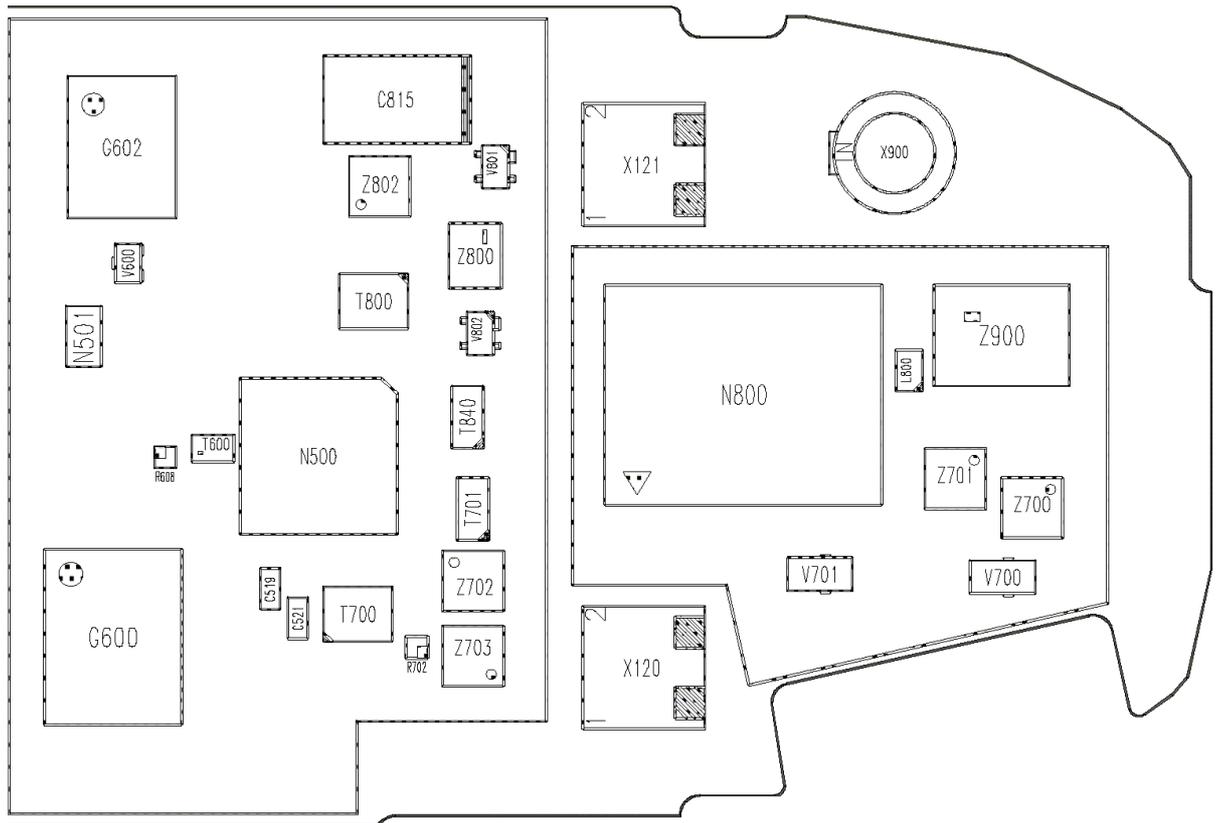
Please note that the grounding of the PA-module is directly below PA-module so it is difficult to check or change. **Most RF semiconductors are static discharge sensitive!** So ESD protection must be taken during repair (ground straps and ESD soldering irons). Hagar are moisture sensitive so parts must 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 Wintesla support DLL's version 271.05.00 or later (dated August 1st 2000 or later)

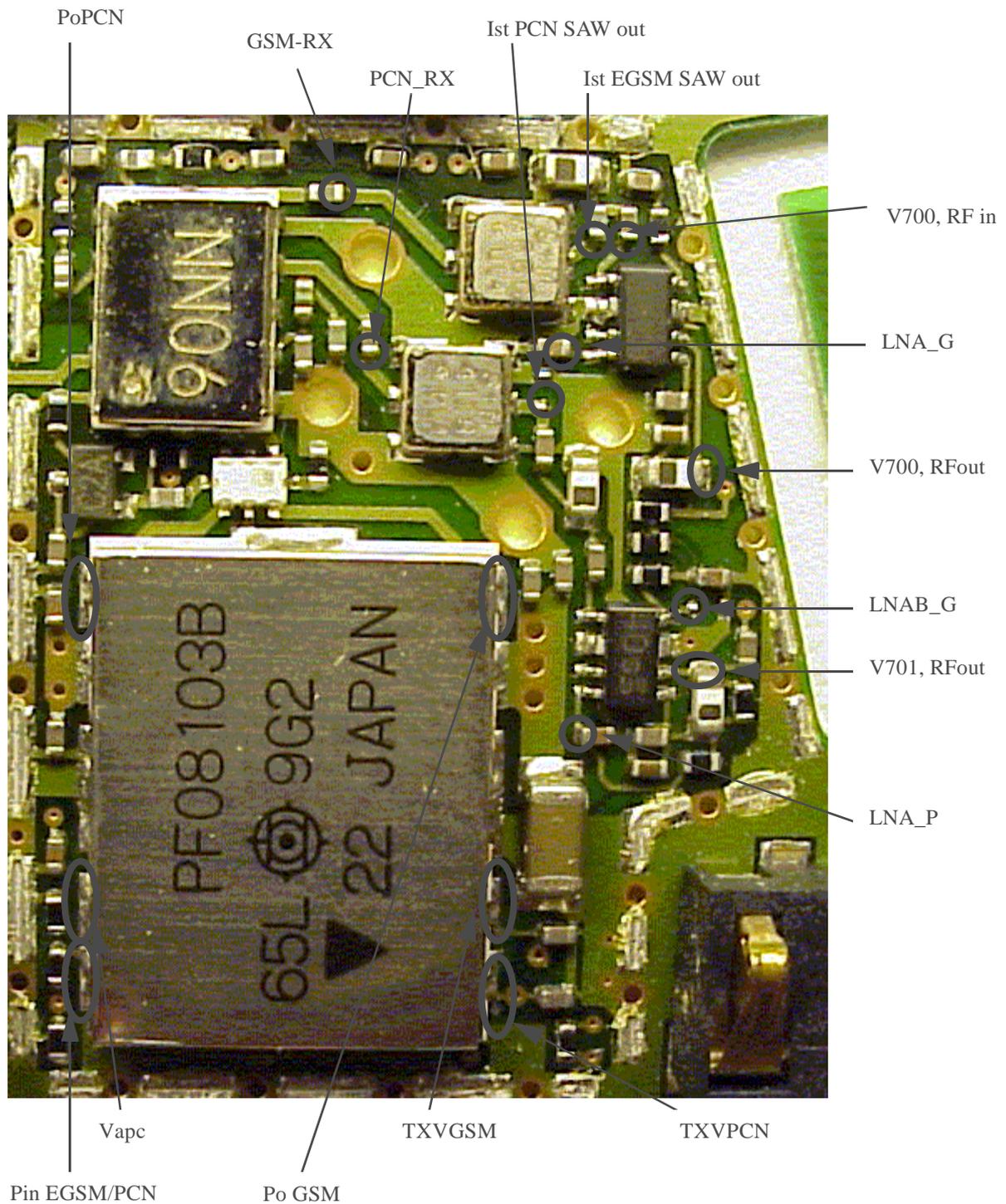
### RF Key component placement



### RF Measurement points

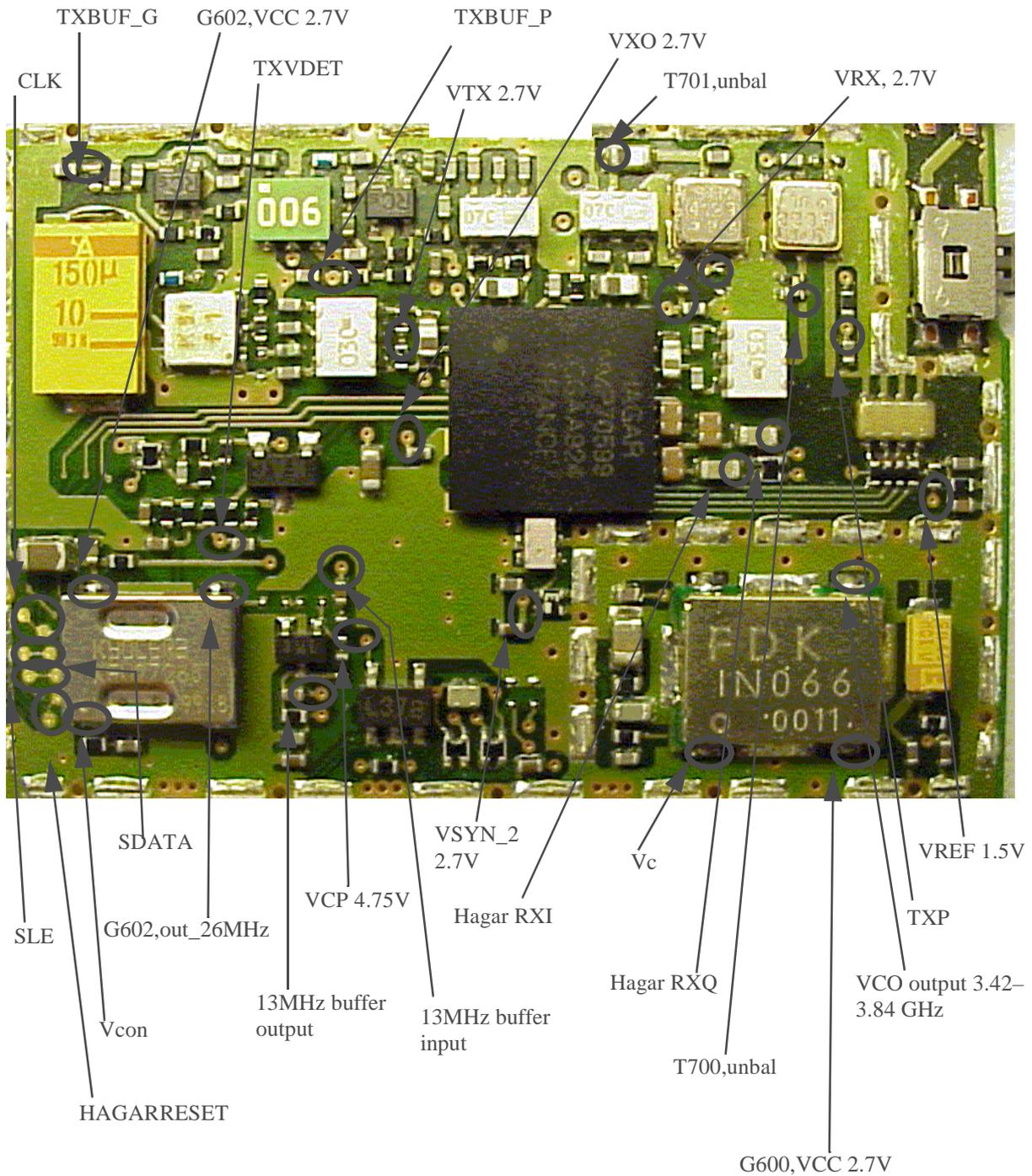
#### PA Can

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



**Hagar RF can**

Measurement points are shown on the picture below, circled in red.

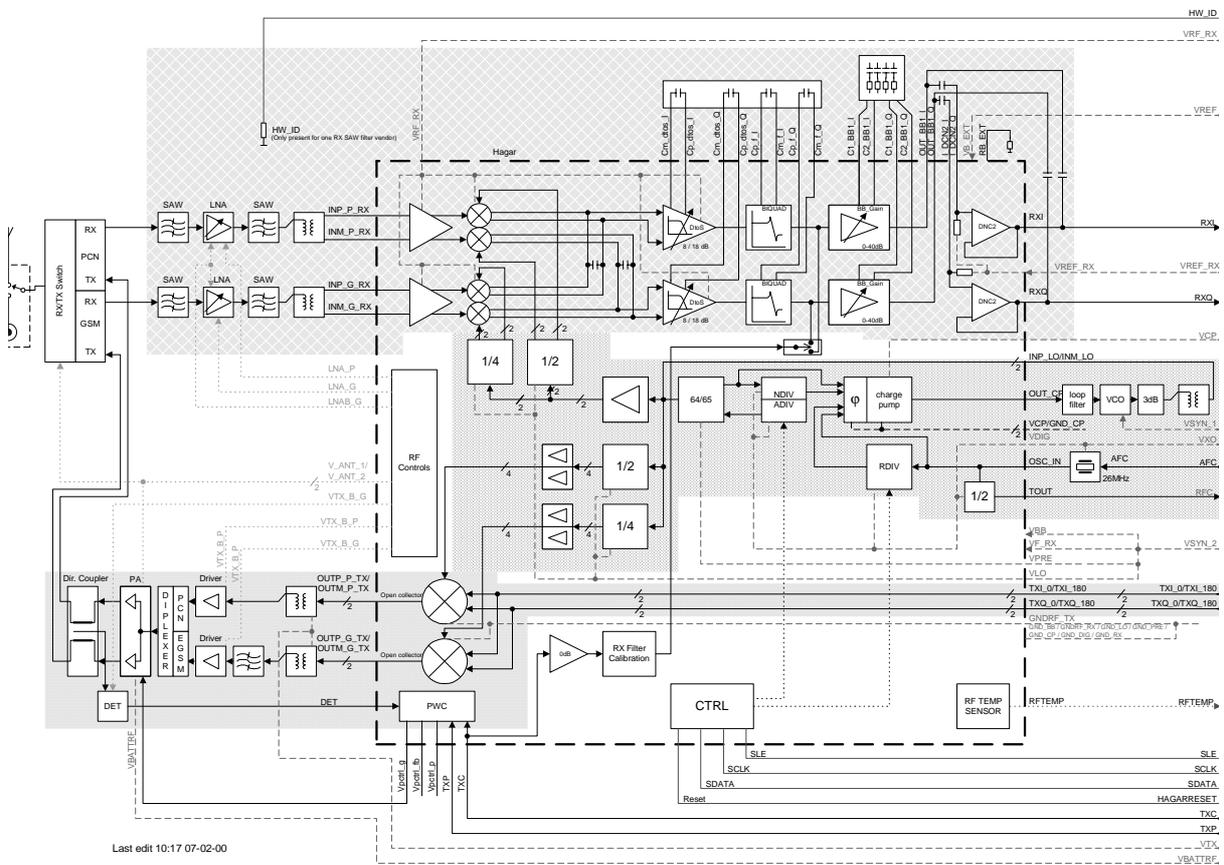


## Abbreviations in fault finding charts

|        |  |
|--------|--|
| BB     | Baseband   |
| DC     | Direct Current   |
| EGSM   | Extended GSM   |
| ESD    | Electro Static Discharge   |
| f:     | Frequency of signal (measured with Spectrum Analyzer)              |
| 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  |
| 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

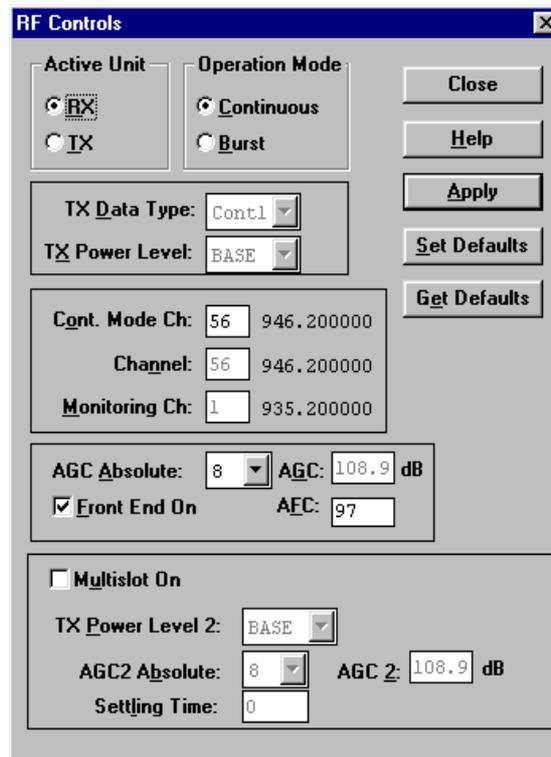
The RF part of this product is a Dualband Direct Conversion transceiver (Also used in 8210 and 8850). In Direct Conversion no intermediate frequencies are used for up- or downconversion. The VCO is set to either twice or four times (depending on the band used) the wanted RX or TX Frequency. The VCO frequency 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 (N500). 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), this will not require special equipment or procedures in repair situations.

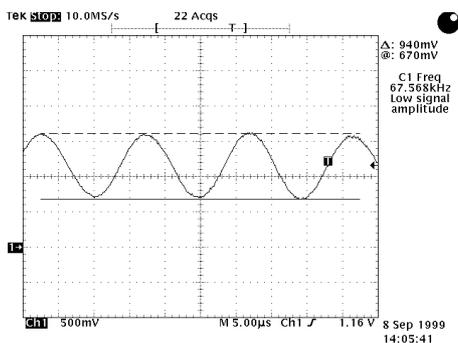


The set-up should now look like this:



Apply a 946.267 MHz (channel 56 + 67.710kHz offset) -80 dBm signal to the RF-con-  
nector (remember to compensate for cable attenuation).

Measuring with an oscilloscope on "Hagar RXI" or "Hagar RXQ" 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, continue to the next section



### **RX/TX Switch**

From the antenna-pad (X902) the RF signal is lead to the RX/TX switch (Z900) via a mechanical switch, the antenna connector (X900).

The RX/TX switch is normally open to the two RX outlets GSM\_Rx and DCS\_Rx. If no control voltage is present at VC1 or VC2 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 1<sup>st</sup> EGSM SAW filter via C912.

### **Front-end**

The EGSM front-end consists mainly of two SAW filters (Z700 and Z703) and one LNA (V700) in-between and finally one balun (T700). The SAW filters provides out-of-band blocking immunity, the LNA provides front-end gain and the balun provides a balanced signal for Hagar (N500)

The signal-path is through Z700 (In-band insertion-loss 3,5dB), through the matching circuit (C700, L700 and C701) and to the EGSM LNA (V700, RFin).

The LNA has about 20dB gain when it is on (LNA\_G = 2.8V and LNAB\_G=0V). If the signal applied to the antenna-connector is more than -45dBm the AGC will gainstep the LNA (LNA\_G = 0V and LNAB\_G=2.8V) which means the LNA Gain will now have negative gain (loss).

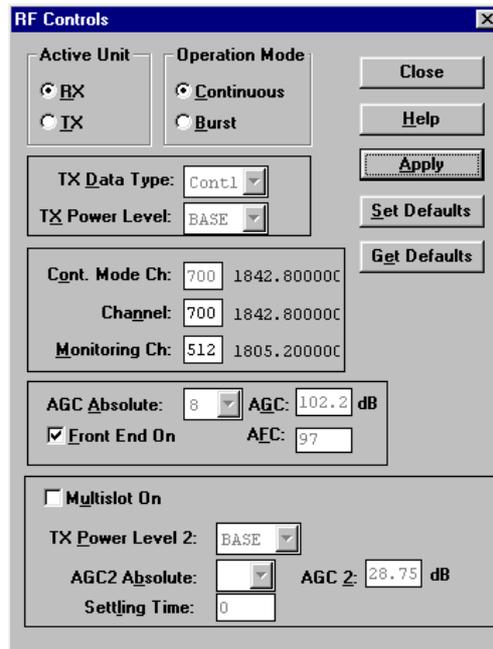
From the LNA (V700 RF out) the signal is lead through the LNA-output-matching-circuit (R705, L705 and C722), through the 2<sup>nd</sup> EGSM SAW Z703 (In-band insertion-loss 3,5dB) through a 3dB attenuator (R702) and to the EGSM balun T700. From the balun the signal is balanced and is lead to Hagar (N500 IMP\_GSM\_RX and INM\_GSM\_RX).

### **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 singleended signal in the DtoS (Differential to Singleended) amplifier. The signal is now filtered in a BIQUAD filter to provide channelseparation, amplified in the BB\_Gain amplifier and DC compensated in DCN2.

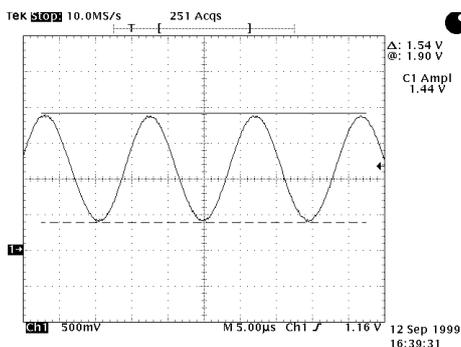


The set-up should now look like this:



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

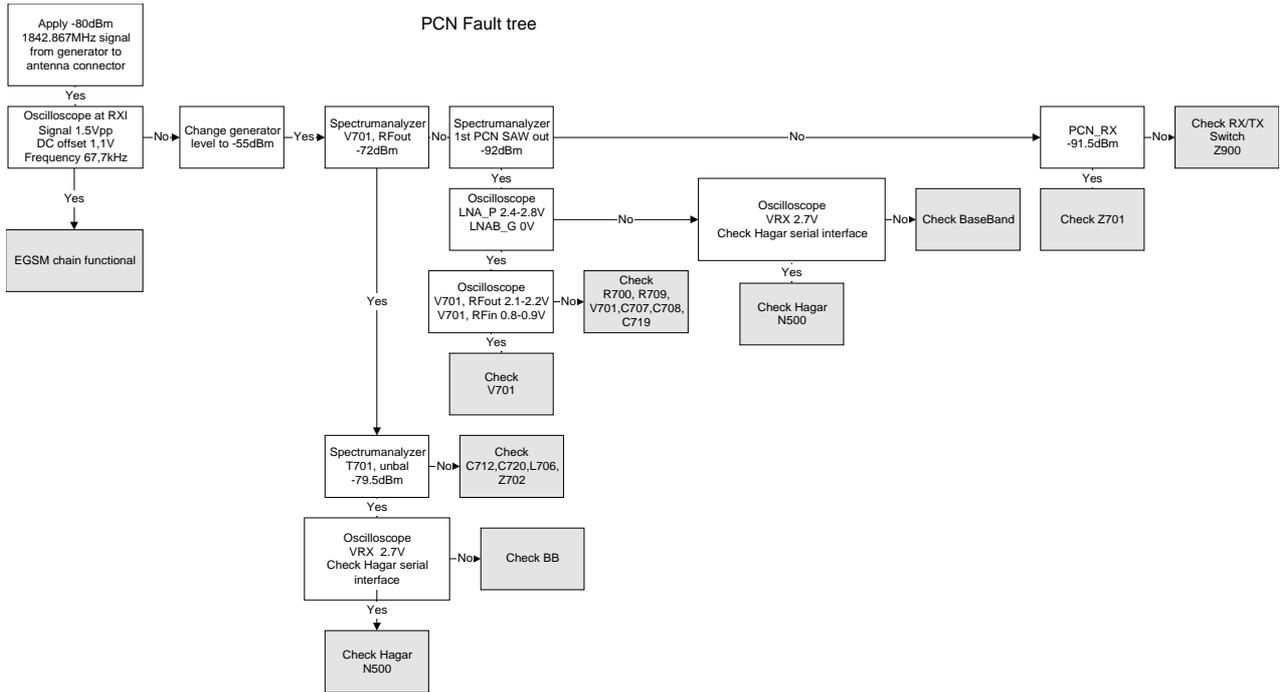
Measuring with an oscilloscope on "Hagar RXI" or "Hagar RXQ" this picture should be  
seen on a working PCN receiver:



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

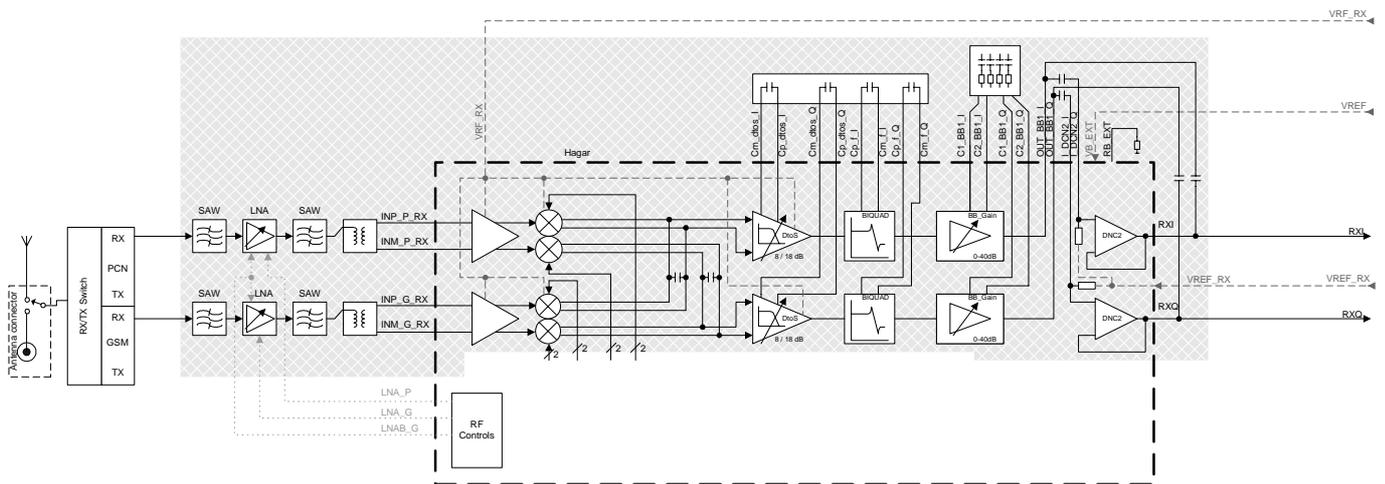
If this picture is not seen, continue to the next section

### 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.



### **RX/TX Switch**

From the antennapad (X902) the RF signal is lead to the RX/TX switch (Z900) via a mechanical switch, the antenna connector (X900).

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

From DCS\_Rx the PCN signal is feed to the 1<sup>st</sup> PCN SAW filter via C913.

### **Front-end**

The PCN front-end consists mainly of two SAW filters (Z701 and Z702) and one LNA (V701) in-between and finally one balun (T701). The SAW filters provides out-of-band blocking immunity, the LNA provides front-end gain and the balun provides a balanced signal for Hagar (N500)

The signal-path is Through Z701 (In-band insertion-loss max 4dB), through the matching circuit (C702, L701 and C703) and to the PCN LNA (V701, RFin).

The LNA has about 18 dB gain when it is on (LNA\_P = 2.8V and LNAB\_G=0V). If the signal applied to the antenna-connector is more than -45dBm the AGC will gainstep the LNA (LNA\_P = 0V and LNAB\_G=2.8V) which means the LNA Gain will now have negative gain (loss).

From the LNA (V701 RF out) the signal is lead through the LNA-output-matching-circuit (R701, L702 and C712), through the 2<sup>nd</sup> PCN SAW Z702 (In-band insertion-loss max 4dB) through a matching-network (C720 and L706) and to the PCN balun T701. From the balun the signal is balanced and is lead to Hagar (N500 IMP\_PCN\_RX and INM\_PCN\_RX).

### **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 singleended signal in the DtoS (Differential to Singleended) amplifier. The signal is now filtered in a BIQUAD filter to provide channelseparation, amplified in the BB\_Gain amplifier and DC compensated in DCN2.

## EGSM Transmitter

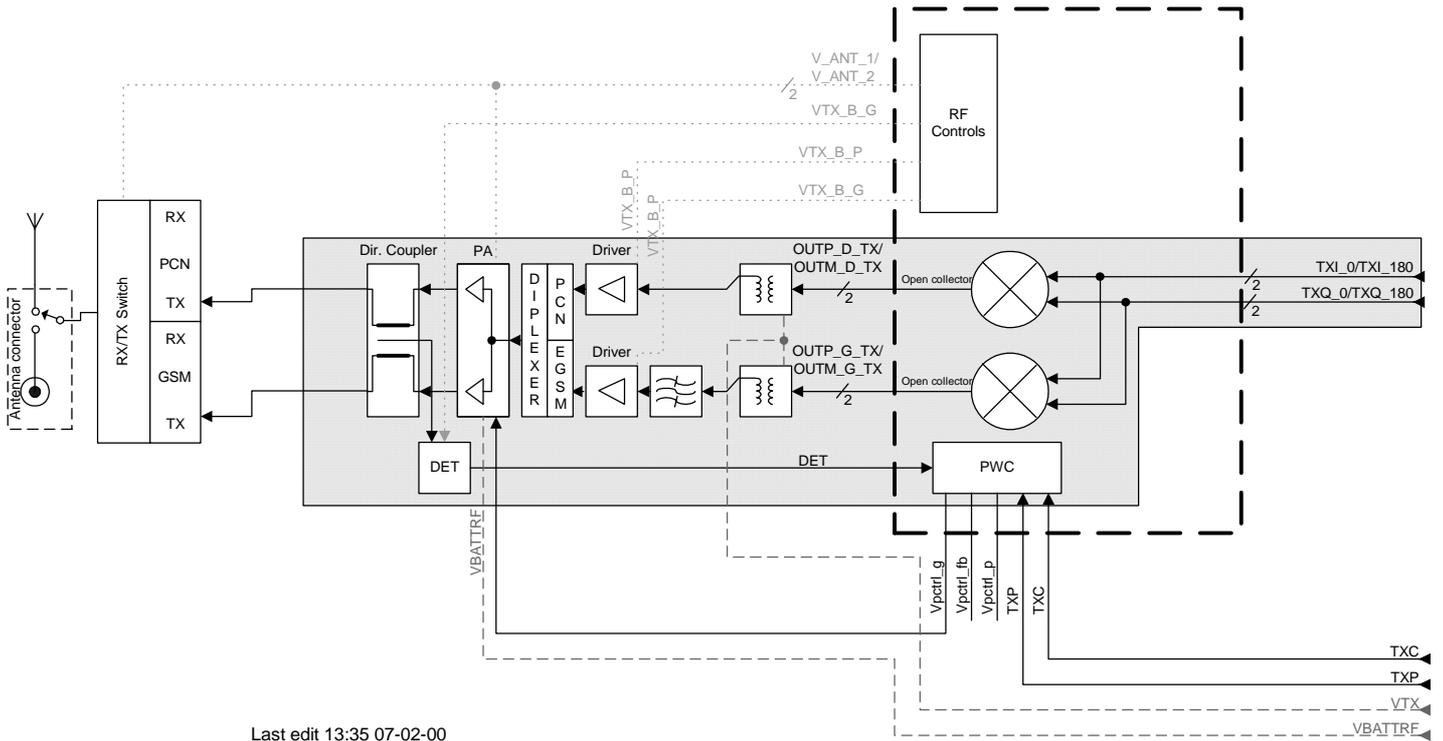
### General instructions for EGSM TX troubleshooting

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 or to at least a 10-dB attenuator, otherwise the PA may be damaged.

Start Wintessa-Service-Software and

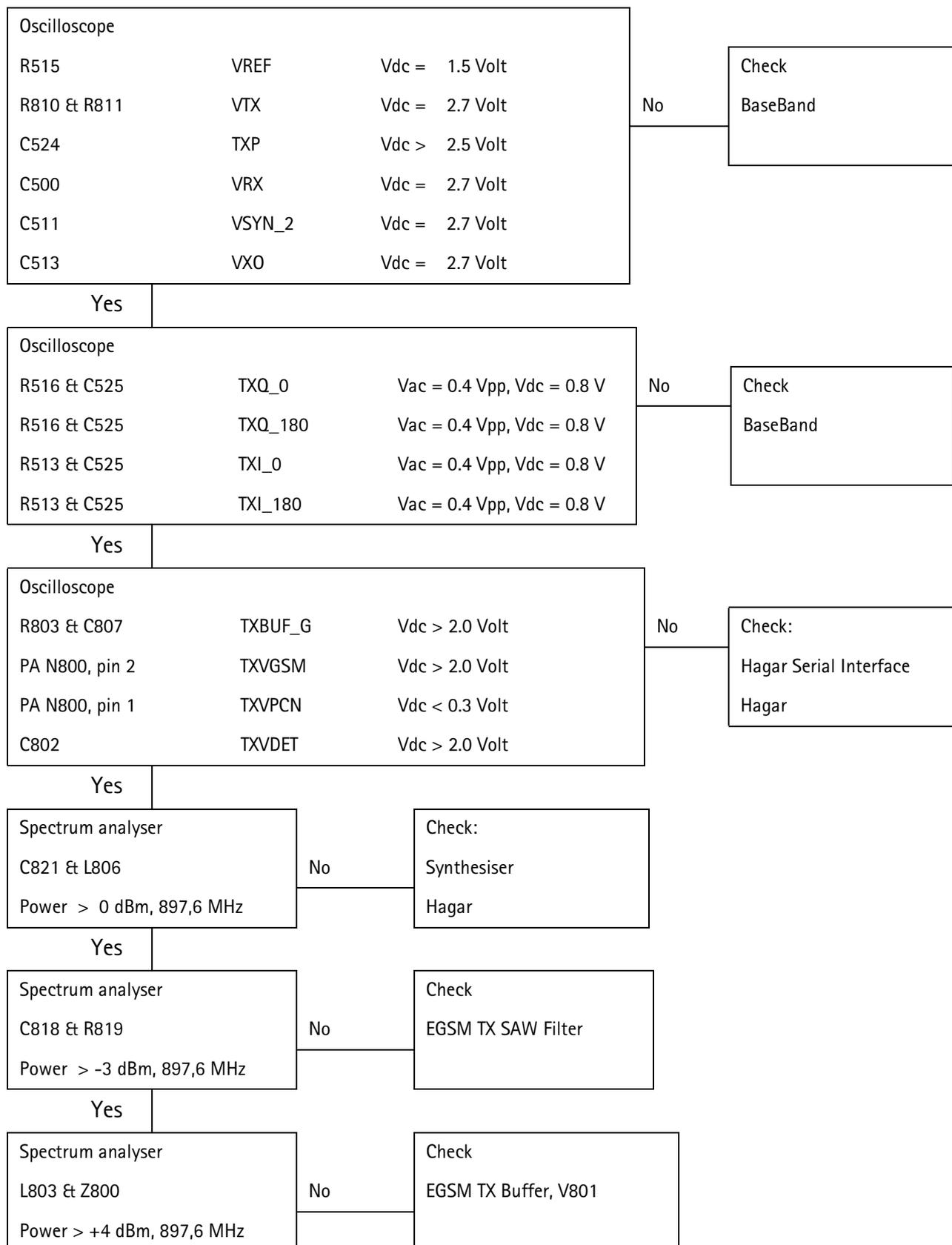
|                               |           |
|-------------------------------|-----------|
| Select: <u>P</u> roduct       | Alt+p     |
| <u>B</u> and                  | b         |
| <u>G</u> SM                   | g         |
| Select: <u>T</u> esting       | Alt+e     |
| <u>R</u> F Controls           | r         |
| <u>T</u> X Power Level : BASE | Alt+x, b  |
| TX <u>C</u> ontinuos          | Alt+c     |
| TX <u>D</u> ata Type: Random  | Alt+d, r  |
| Ch <u>a</u> nnel: 38          | Alt+n, 38 |
| <u>A</u> pply                 | Alt+a     |

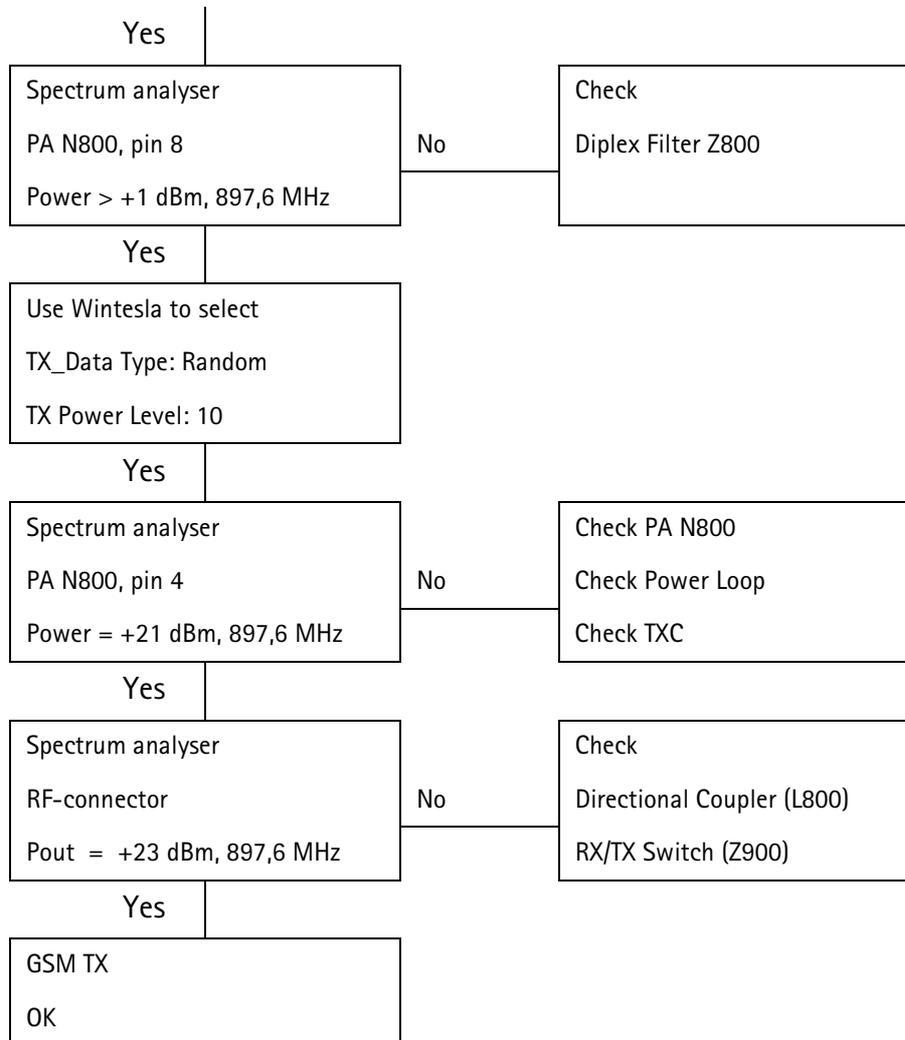
### Path of the transmitted EGSM signal



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**Fault finding chart for EGSM transmitter**





## PCN Transmitter

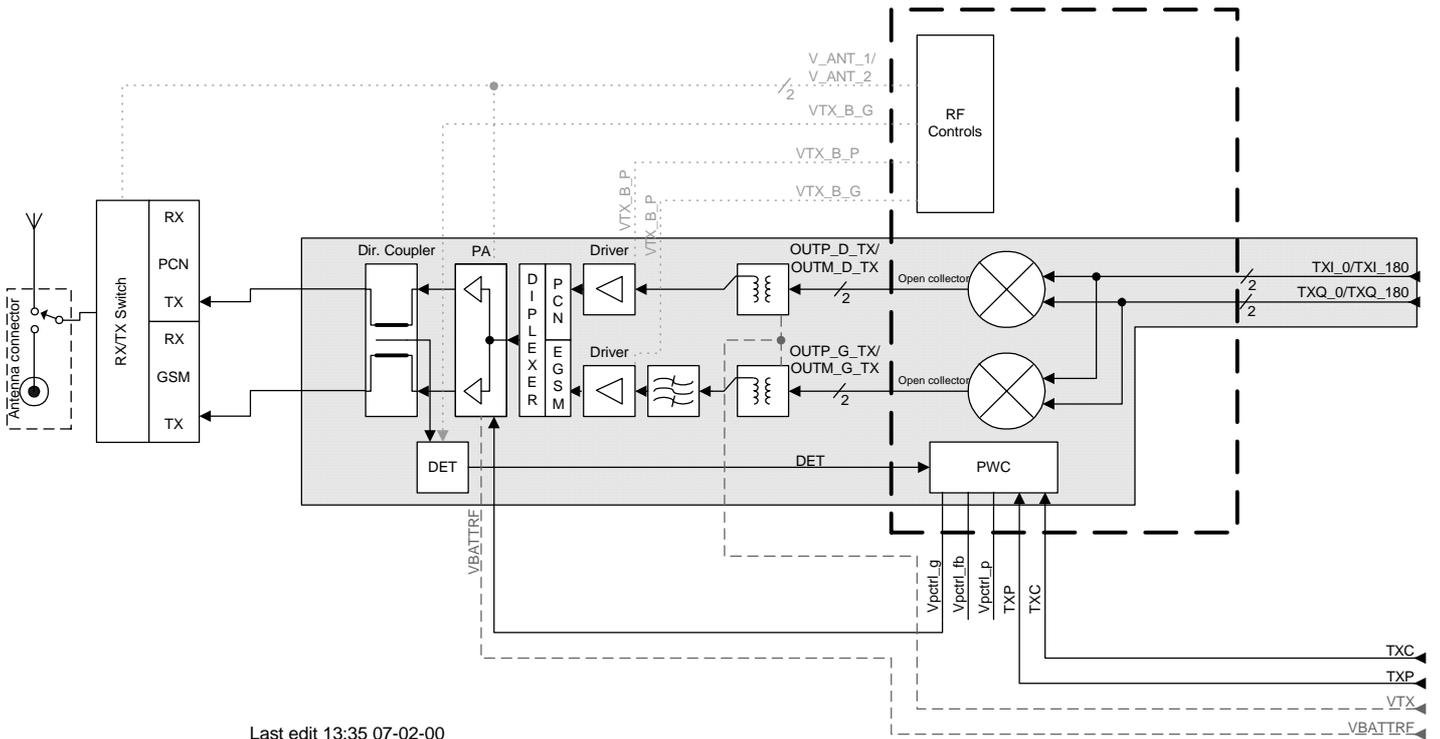
### General instructions for PCN TX troubleshooting

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 or to at least a 10-dB attenuator, otherwise the PA may be damaged.

Start Wintesla-Service-Software and

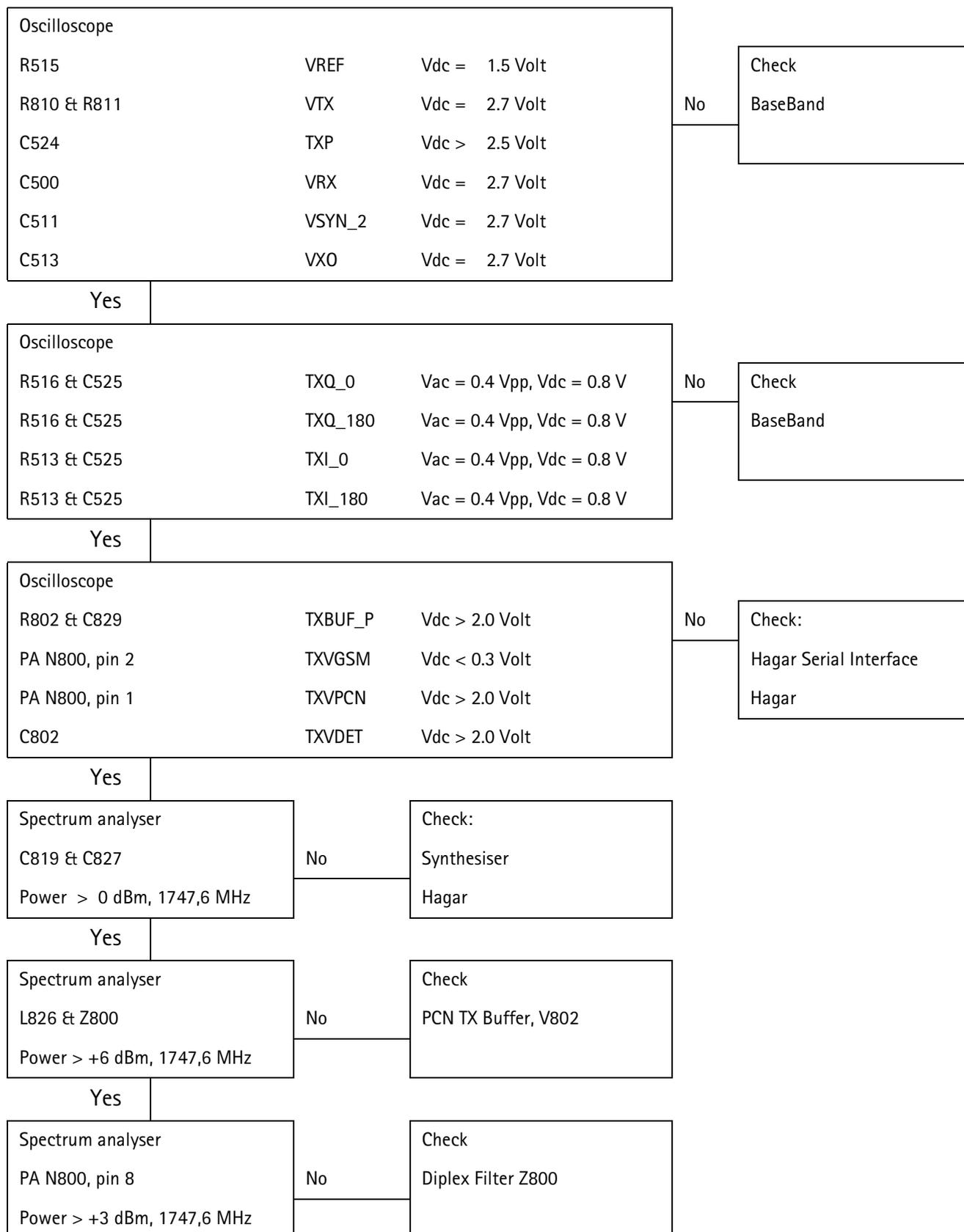
|                         |                              |            |
|-------------------------|------------------------------|------------|
| Select: <u>P</u> roduct |                              | Alt+p      |
|                         | <u>B</u> and                 | b          |
|                         | <u>P</u> CN                  | p          |
| Select: <u>T</u> esting |                              | Alt+e      |
|                         | <u>R</u> F Controls          | r          |
|                         | <u>T</u> X Power Level: BASE | Alt+x, b   |
| TX <u>C</u> ontinuos    |                              | Alt+c      |
|                         | TX <u>D</u> ata Type: Random | Alt+d, r   |
|                         | Ch <u>a</u> nnel: 700        | Alt+n, 700 |
|                         | <u>A</u> pply                | Alt+a      |

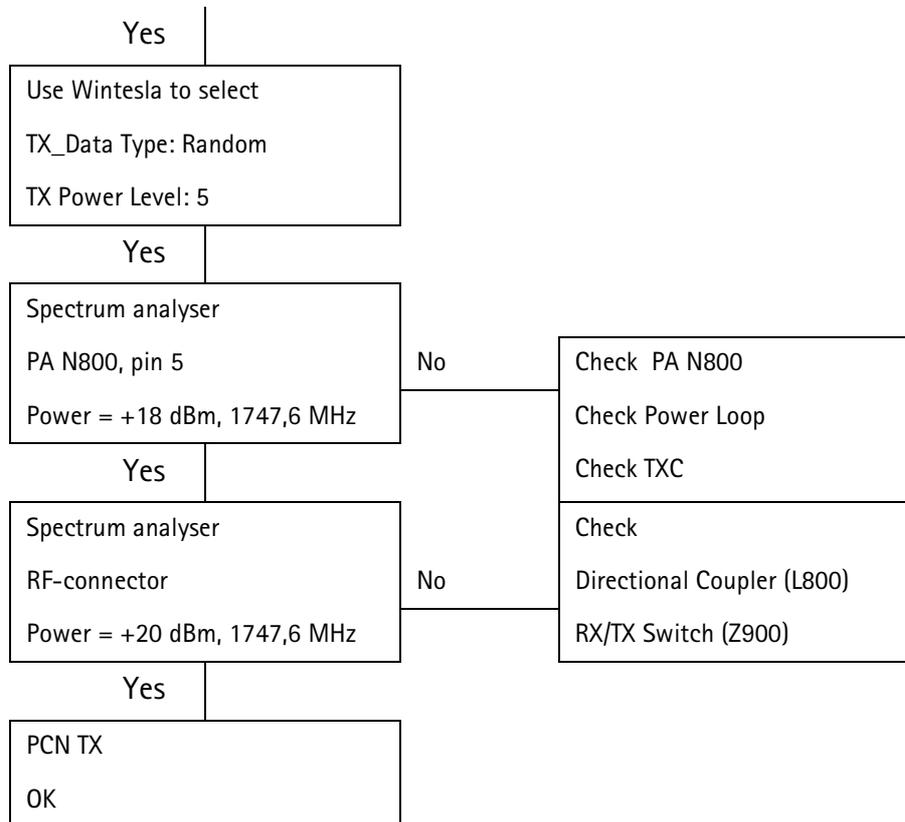
### Path of the transmitted PCN signal



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**Fault finding chart for PCN transmitter**





## Synthesiser

There is only one PLL synthesiser generating frequencies for both Rx and Tx in both bands ( PCN and GSM). VCO frequency is divided by 2 or by 4 in HAGAR depending on which band is active.

### General instructions for Synthesiser troubleshooting

Start Wintesla-Service-Software and

|                           |           |
|---------------------------|-----------|
| Select: <u>P</u> roduct   | Alt+p     |
| <u>B</u> and              | b         |
| <u>E</u> GSM              | e         |
| Select: <u>T</u> esting   | Alt+e     |
| <u>R</u> F Controls       | r         |
| <u>R</u> X Continuous     | Alt+r     |
| <u>C</u> ont. Mode Ch: 60 | Alt+o, 60 |

In this situation there is possible to measure frequency of 3788 MHz at the output of the VCO ( G600) using a spectrum analyzer.

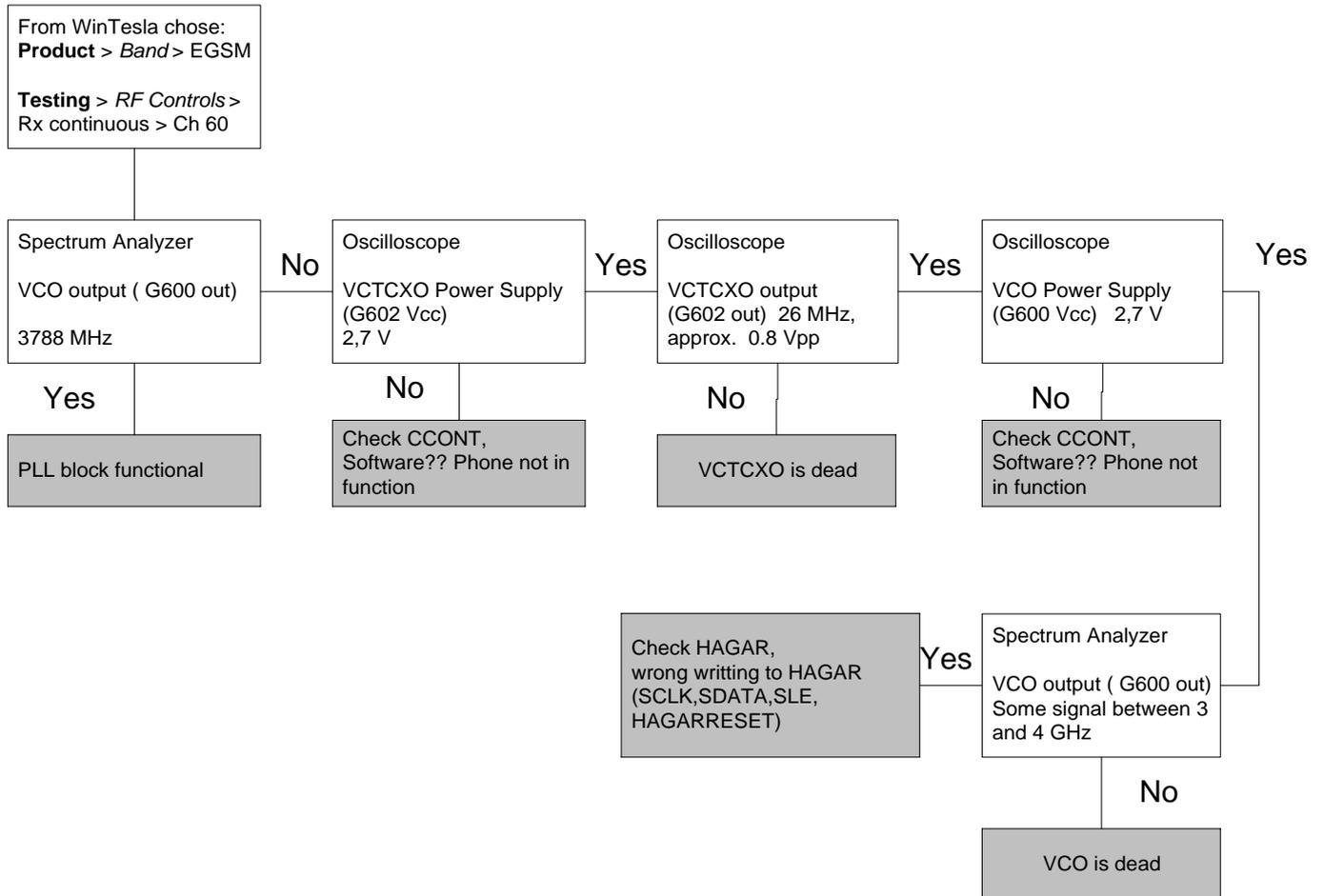
### 26 MHz reference oscillator ( VCTCXO )

The 26 MHz oscillator (G602) is used as a reference frequency for the PLL synthesiser and as the system clock for BB ( 13 MHz) after it is divided by 2 in HAGAR. 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 COBBA. Range of Vcon is 0.3 – 2.3 V.

### VCO

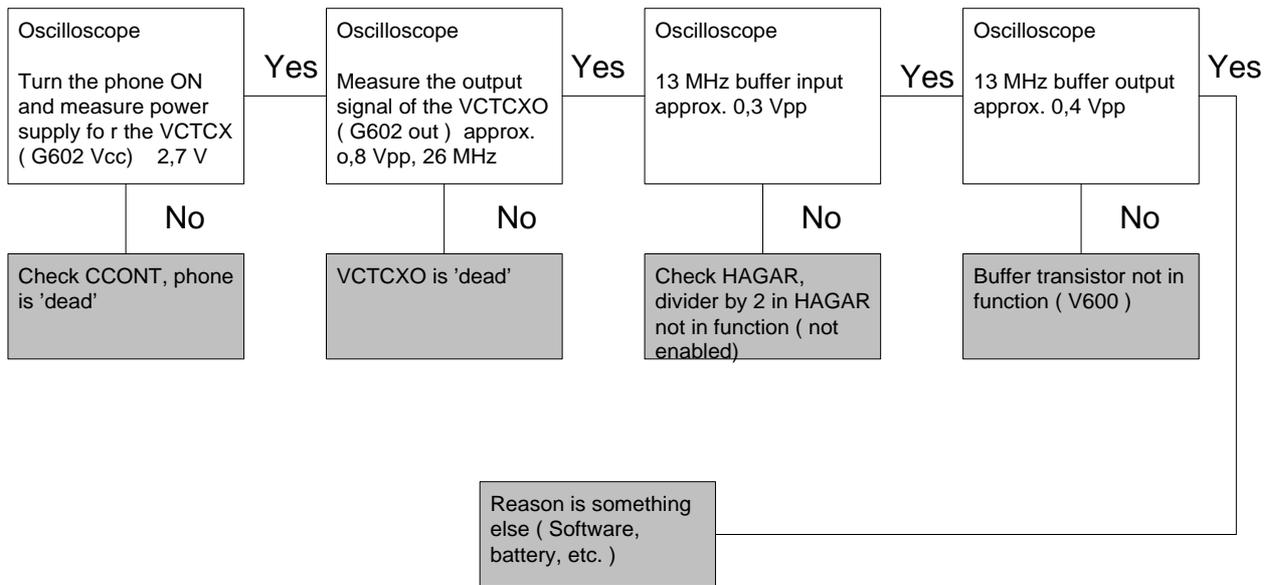
The VCO is generating frequencies in the range of 3420 – 3840 MHz when PLL is in function. These are divided by 2 or by 4 in HAGAR so that they can generate all channels in GSM and PCN. Frequency of the VCO is controlled by dc voltage ( Vc ) coming from the loop filter. Range of the Vc when PLL is in 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 ( G600) which is between 3 and 4 GHz, ofcourse if the VCO is working.

### Fault finding chart for PLL Synthesiser

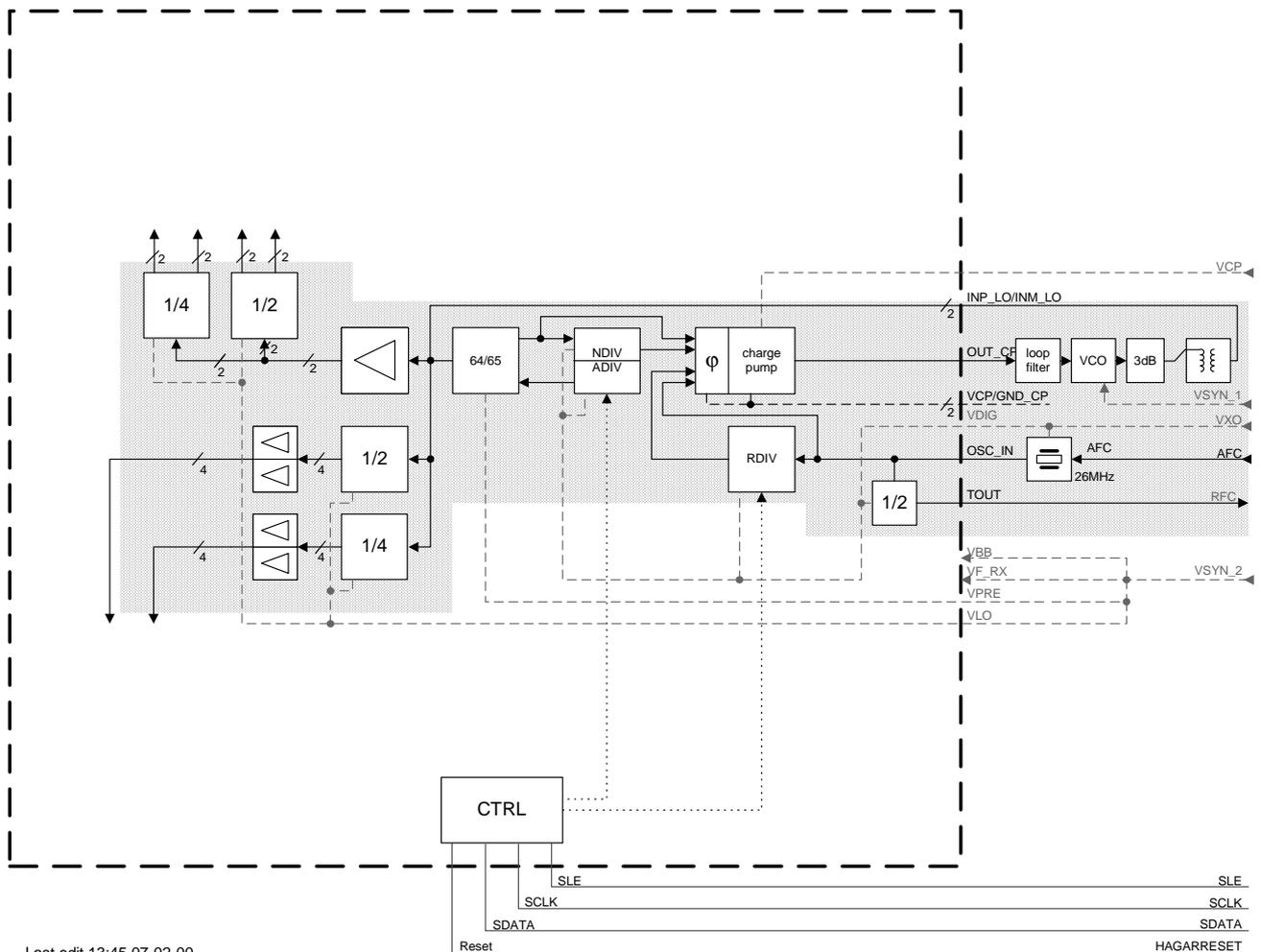


It is important to say that power supply for VCTCXO ( VXO) is OFF only in 'Deep Sleep Mode' and power supply for VCO ( G600 Vcc) is OFF in 'Sleep Mode'.

If the phone gets 'dead' very short time after the power is turned ON, possible reason for this might be that 13 MHz system clock signal is not coming to the BB. Use the following chart to find the problem.



**PLL Blockdiagram**



Last edit 13:45 07-02-00  
Drawing12

## 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

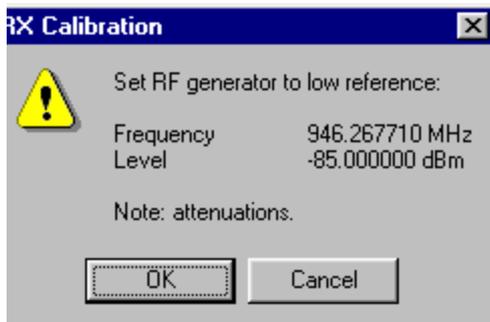
| H   | TX     | RX     | VCO TX | VCO RX | CH  | TX     | RX     | VCO TX | VCO RX | CH  | TX     | RX     | VCO TX | VCO RX | CH  | TX     | RX     | VCO TX | VCO RX |
|-----|--------|--------|--------|--------|-----|--------|--------|--------|--------|-----|--------|--------|--------|--------|-----|--------|--------|--------|--------|
| 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 |        |        |        |        |





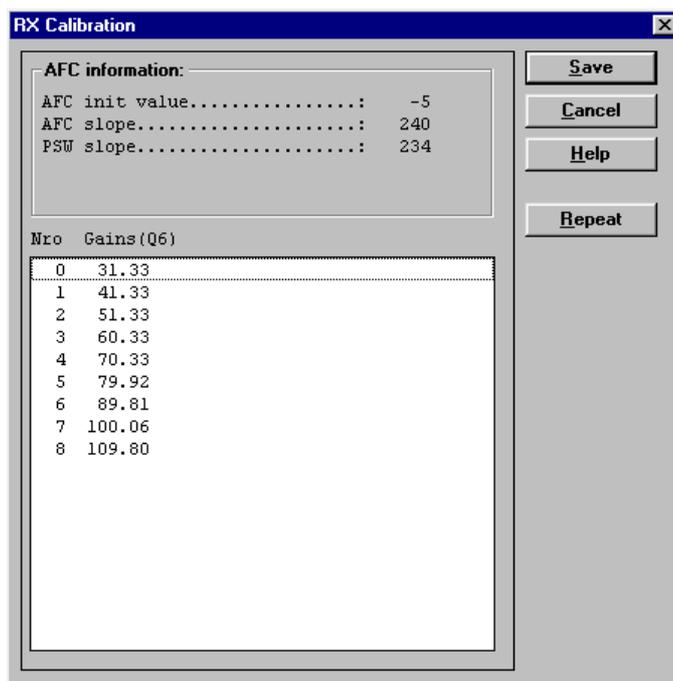
Connect an external generator to the phones RF connector and set the generator as the window tells you.

Click OK in the Wintesla window, now a new window pops up:

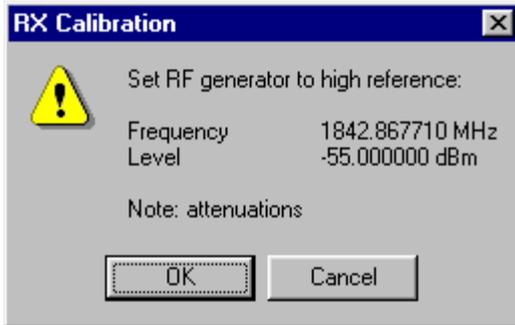


Change the level on the generator as the window tells you.

Click OK in the Wintesla window, now a new window pops up:

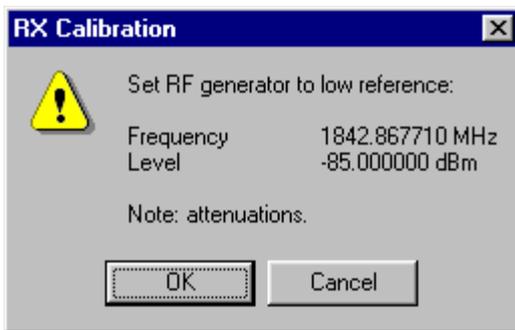


Click Save in the Wintesla window, now a new window pops up:



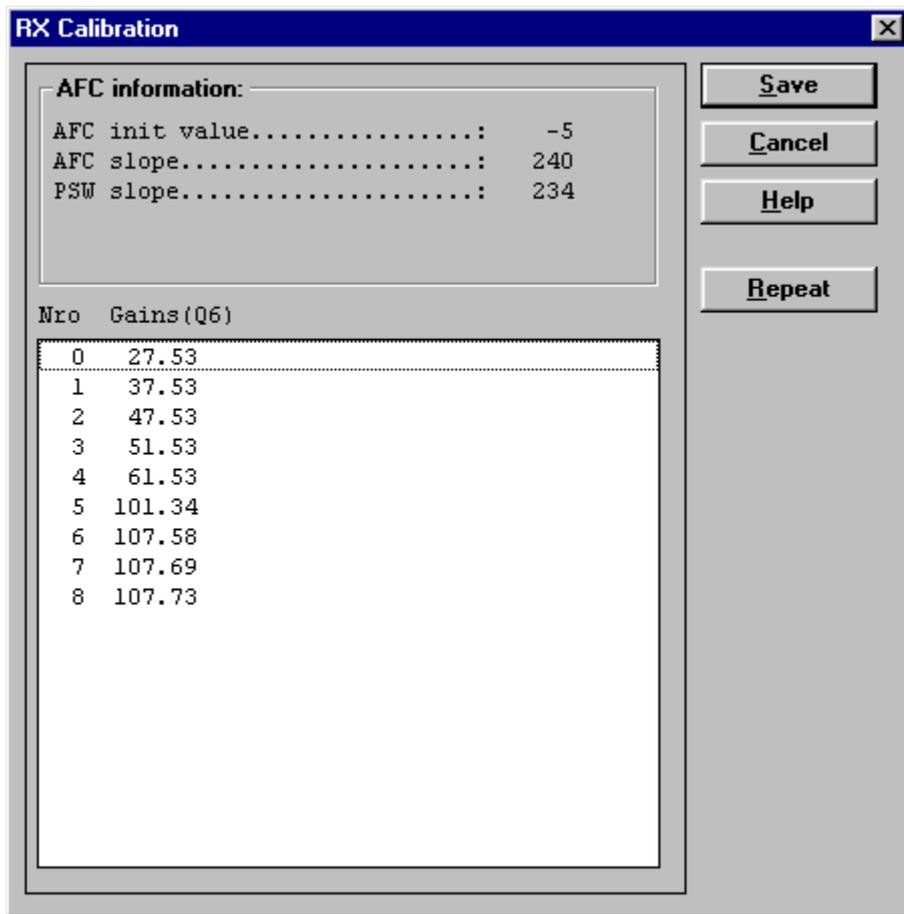
Change the level and frequency on the generator as the window tells you.

Click OK in the Wintesla window, now a new window pops up:



Change the level and frequency on the generator as the window tells you.

Click OK in the Wintesla window, now a new window pops up:



Click Save in the Wintesla window,

RX Calibration is now completed.

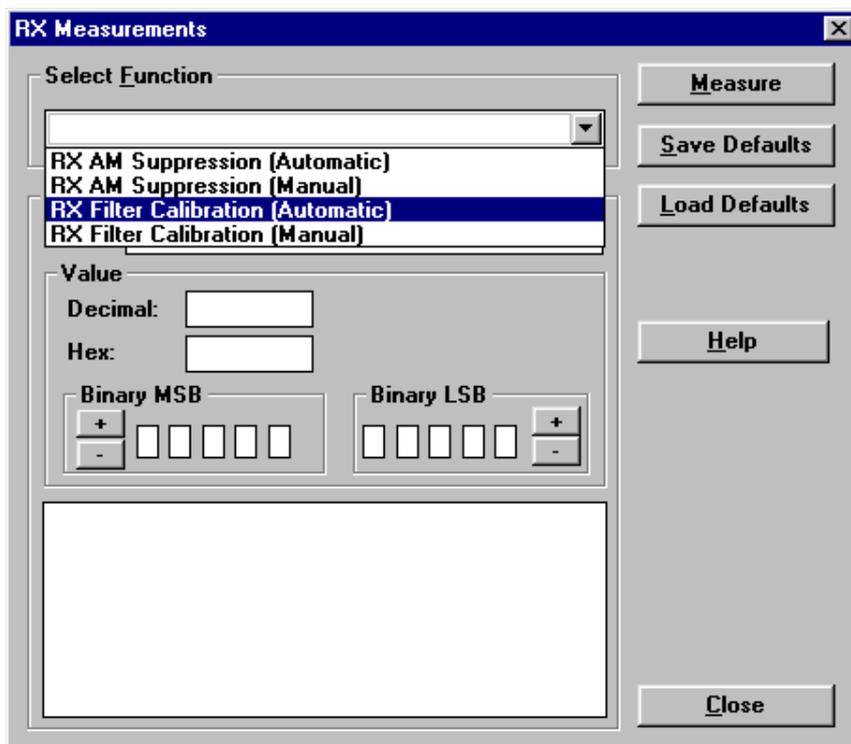
### **RX Filter Calibration (Automatic)**

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

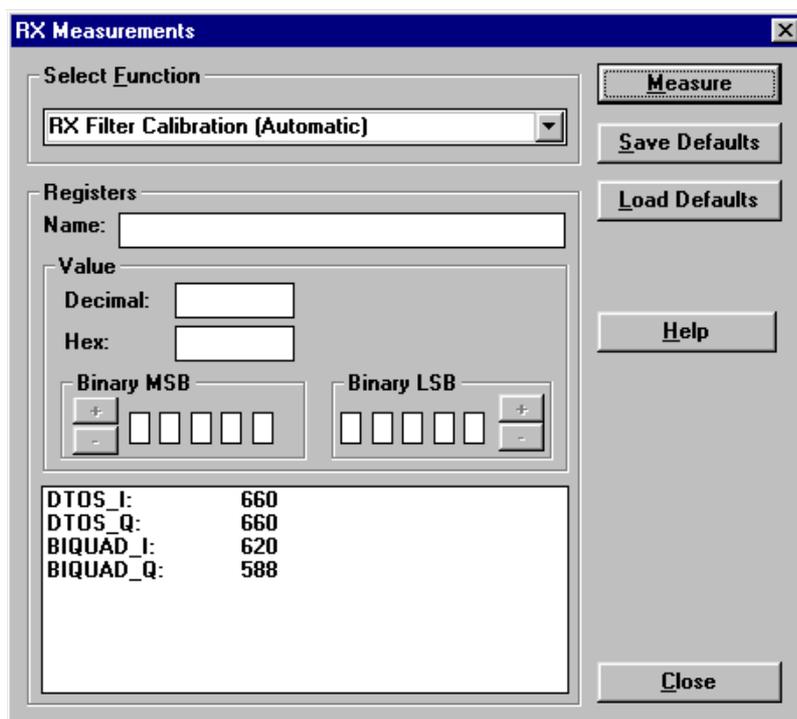
Select: Tuning      Alt+t

RX Measurements

A window now pops-up:

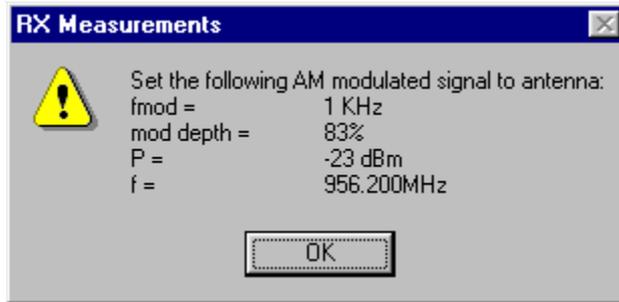


In the "Select Function" frame select RX "Filter calibration (Automatic)". No external signal is needed for this, just click "Measure", wait a few seconds and then click "Save Defaults"



RX filter calibration is now completed and the "RX Measurements" window can be closed by clicking "Close"

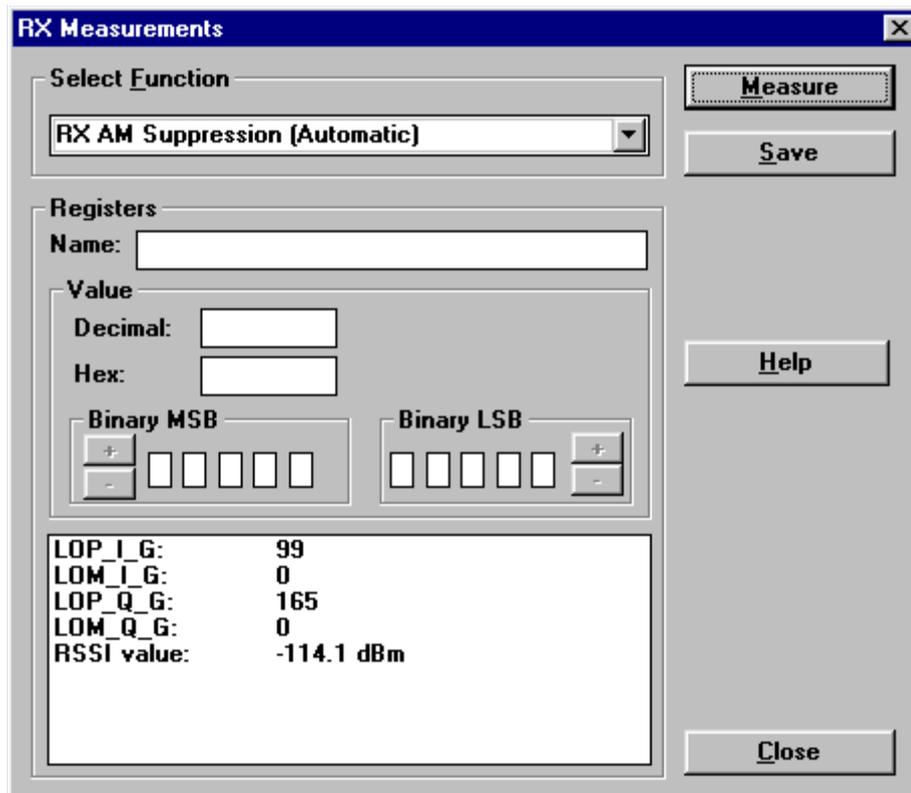




*Note: Wintesla support DLLs must be 271.05.00 Or later*

Connect an external generator to the antenna connector of the phone and set-up the generator.

Click OK in the Wintesla window, the RSSI value is updated in the RX Measurements window.



Click "Save ". The "RX AM suppression tuning" is now completed in EGSM.

PCN

Select: Product                      Alt+p

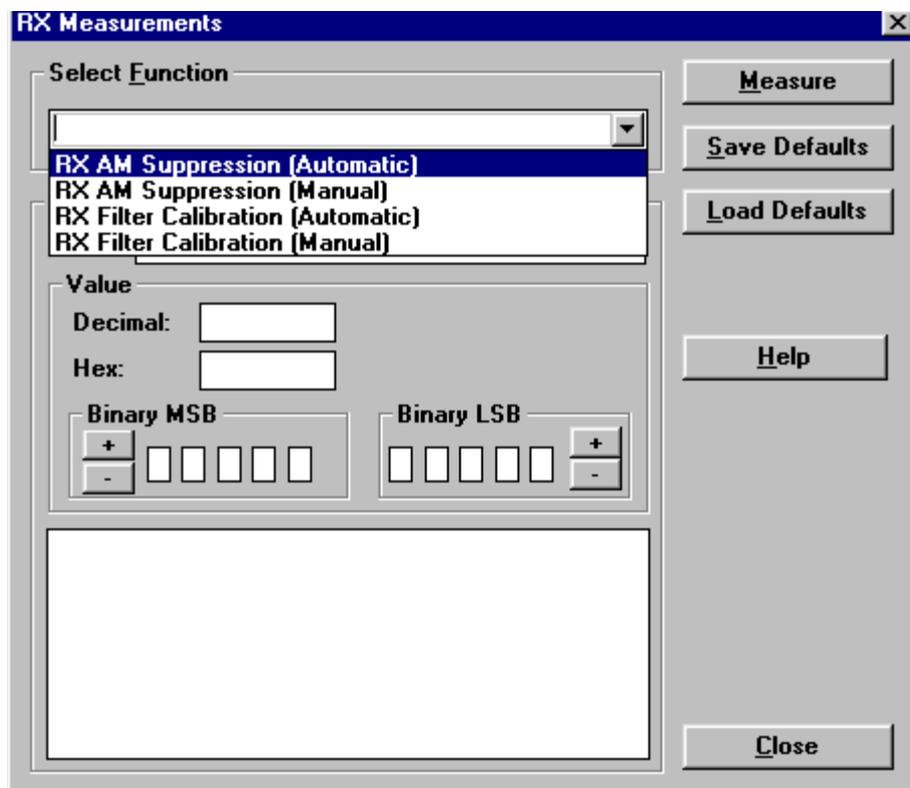
Band                      b

PCN                      p

Select: Tuning                      Alt+t

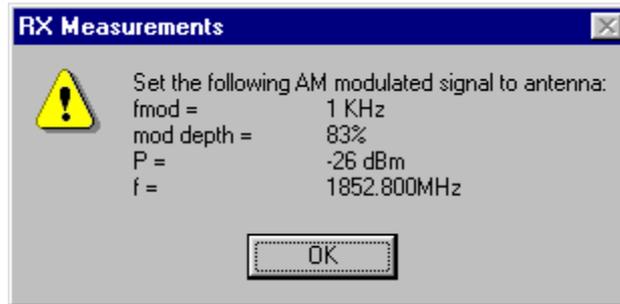
RX Measurements

A window now pops-up:



In the "Select Function" frame select RX "RX AM Suppression (Automatic)".

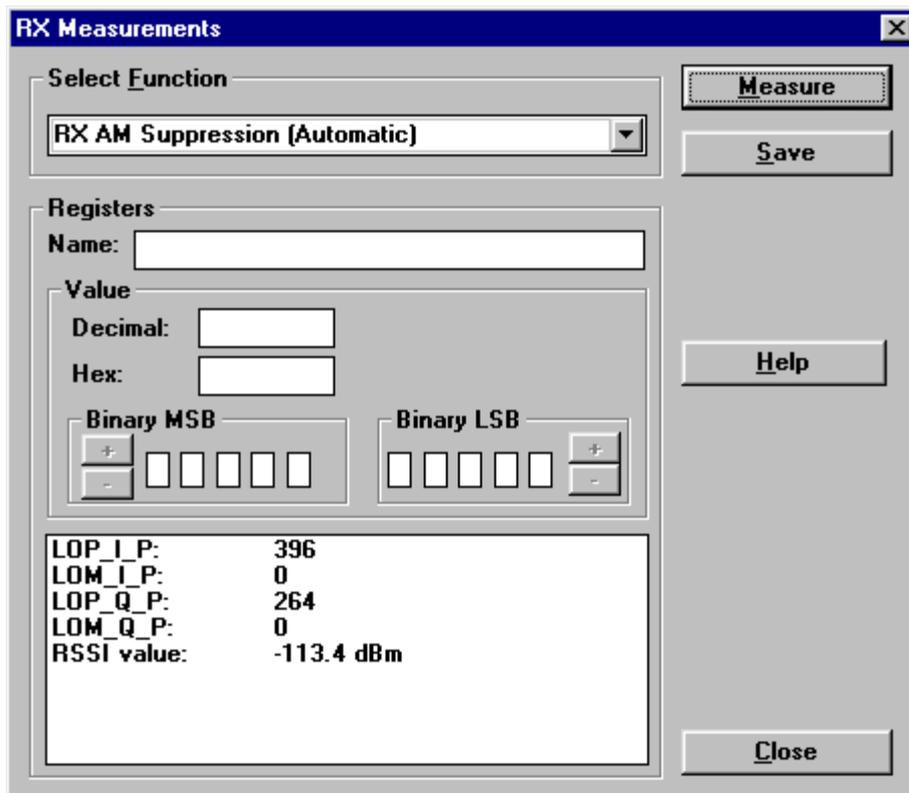
Click Measure, A window now pops-up:



*Note: Wintesla support DLLs must be 271.05.00 or later.*

Connect an external generator to the antenna connector of the phone and set-up the generator.

Click OK in the Wintesla window, the RSSI value is updated in the RX Measurements window.



Click "Save ". The "RX AM suppression tuning" is now completed in PCN.

## 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

|                         |       |
|-------------------------|-------|
| Select: <u>P</u> roduct | Alt+p |
| <u>B</u> and            | b     |
| <u>E</u> GSM            | e     |
| Select: <u>T</u> esting | Alt+e |
| <u>R</u> F Controls     | r     |

A window now pops-up:

Set Active unit to TX

Set TX Data Type: to Rand

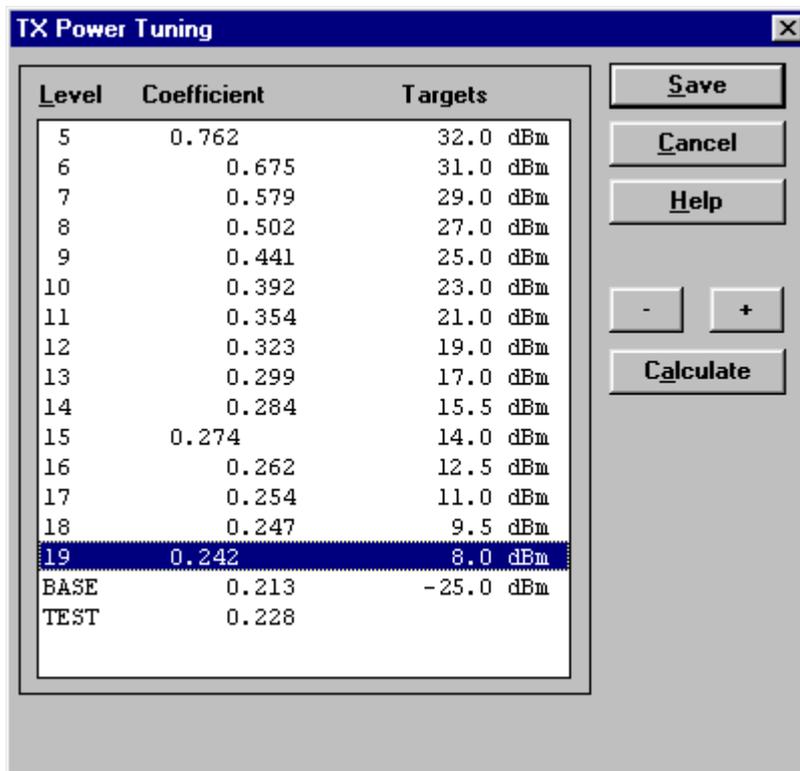
Click Apply

Click Close

Select: Tuning Alt+t

TX Power... Alt+P

A window now pops-up:



Tune level 19, 15, 5 and Base in accordance with the target values.

Click calculate, check if the other levels match the targets, correct if necessary.

Click Save when all values matches the targets.



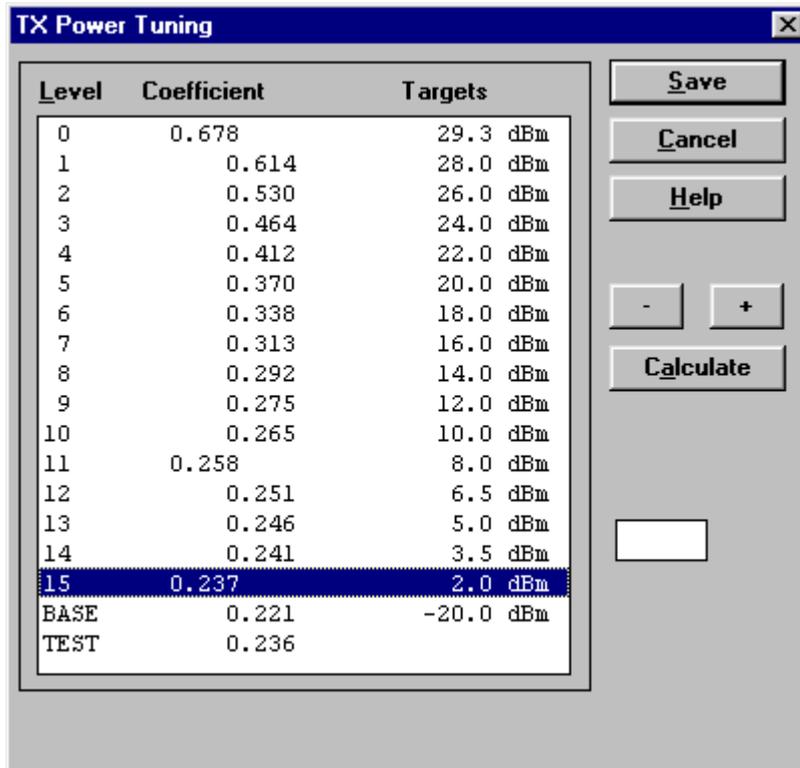
Select: Tuning

Alt+t

TX Power...

Alt+P

A window now pops-up:



Tune level 15, 11, 0 and Base in accordance with the target values.

Click calculate, check if the other levels match the targets, correct if necessary.

Click Save when all values matches the targets.





**Initial set up PCN**

Select: Product                      Alt+p

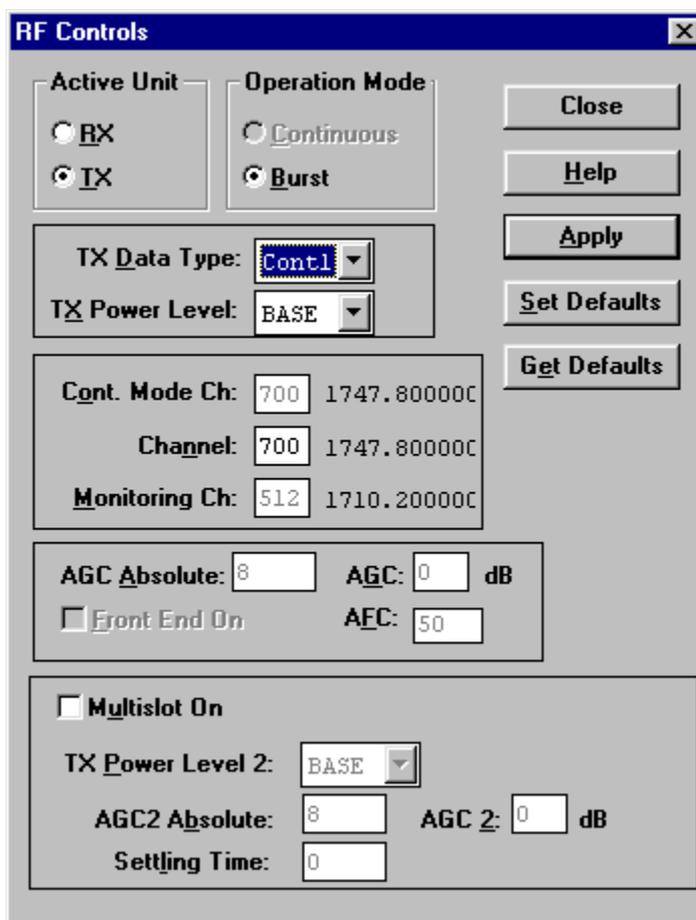
Band                      b

PCN                      p

Select: Testing                      Alt+e

RF Controls                      r

A window now pops-up:



Set Active unit to TX

Set TX Data Type: to Cont1

Click Apply

Click Close and continue to next section

## IQ Tuning using Spectrum Analyzer

### EGSM:

#### Spectrum Analyzer Settings

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.

Set the Spectrum Analyzer according to the following settings.

|                      |               |
|----------------------|---------------|
|                      | EGSM          |
| Center Frequency     | 897.6 MHz     |
| Frequency Span       | 300 kHz       |
| Resolution Bandwidth | 3kHz          |
| Video Bandwidth      | 3kHz          |
| Sweep Time           | 3 sek.        |
| Detector Type        | Max Peak      |
| Reference level      | 35 dBm        |
| Marker 1             | 897.53229 MHz |
| Marker 2             | 897.6 MHz     |
| Marker 3             | 897.66771 MHz |

#### Phone Settings

Connect the phone to the computer and to the Spectrum Analyzer.

Using WinTesla to select the following:

Product

Band

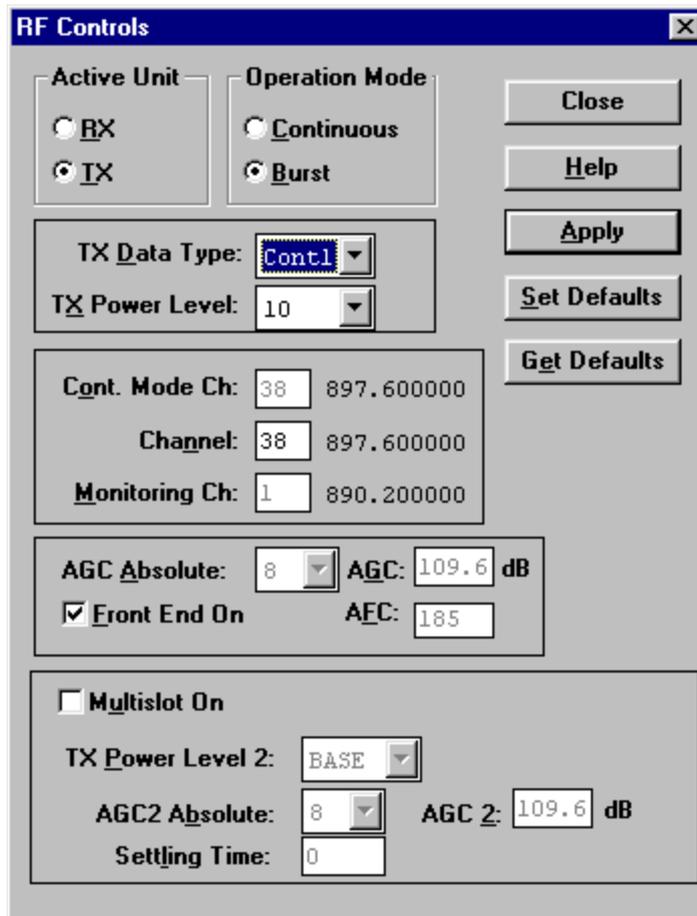
EGSM

This selects the EGSM band. Then select the following:

Testing

RF Controls...

A window pops up:



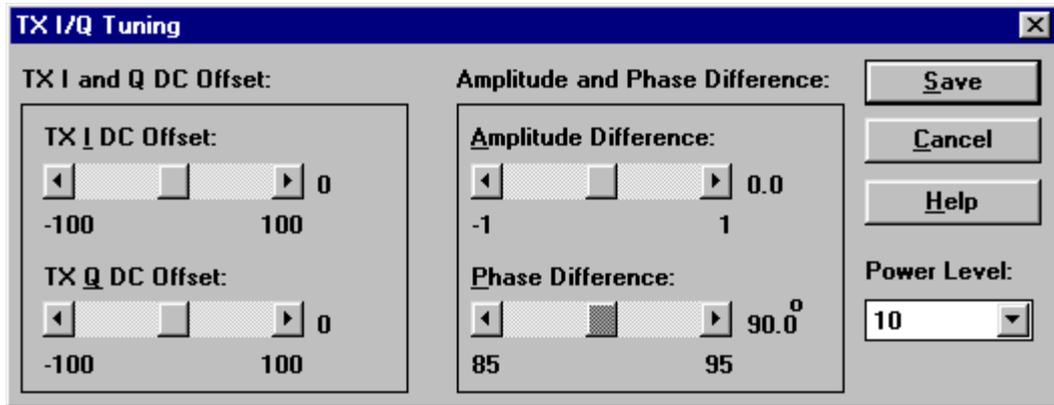
Set "TX Data Type" to "Cont1", press "Apply", then press "Close". The window closes.

Select the following:

Tuning

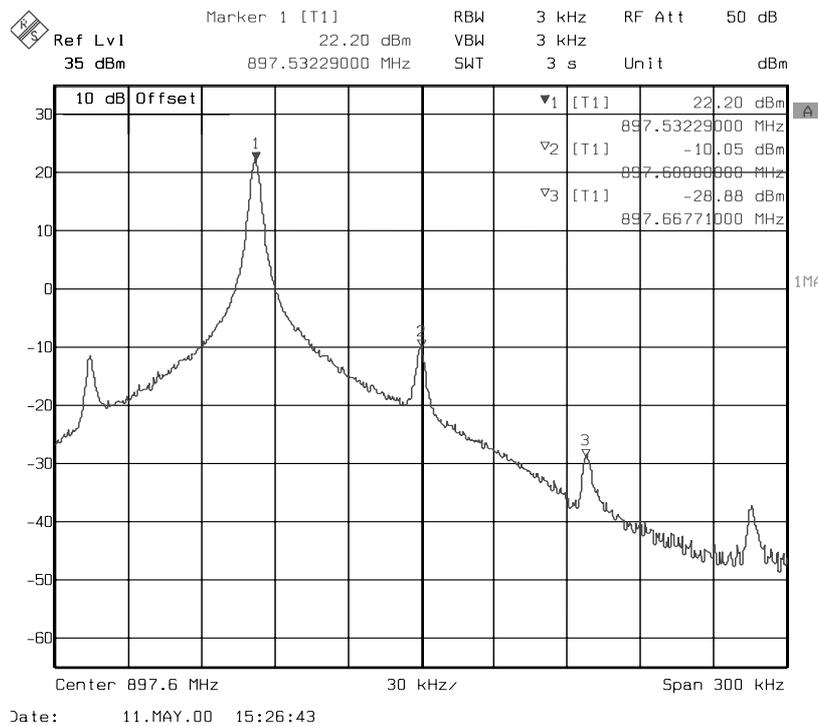
Tx I/Q...

A window pops up:



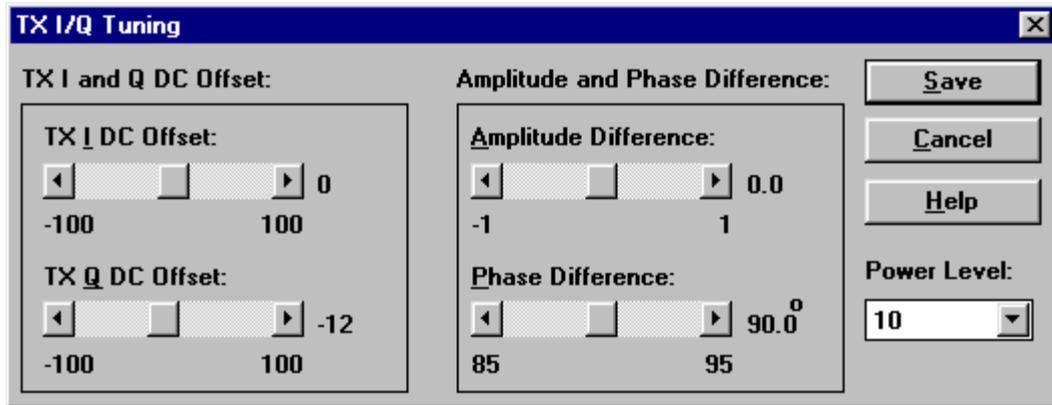
This is the "Tx I/Q Tuning" window.

Set the Power Level to "10". Then the Spectrum Analyzer shows a plot like this:

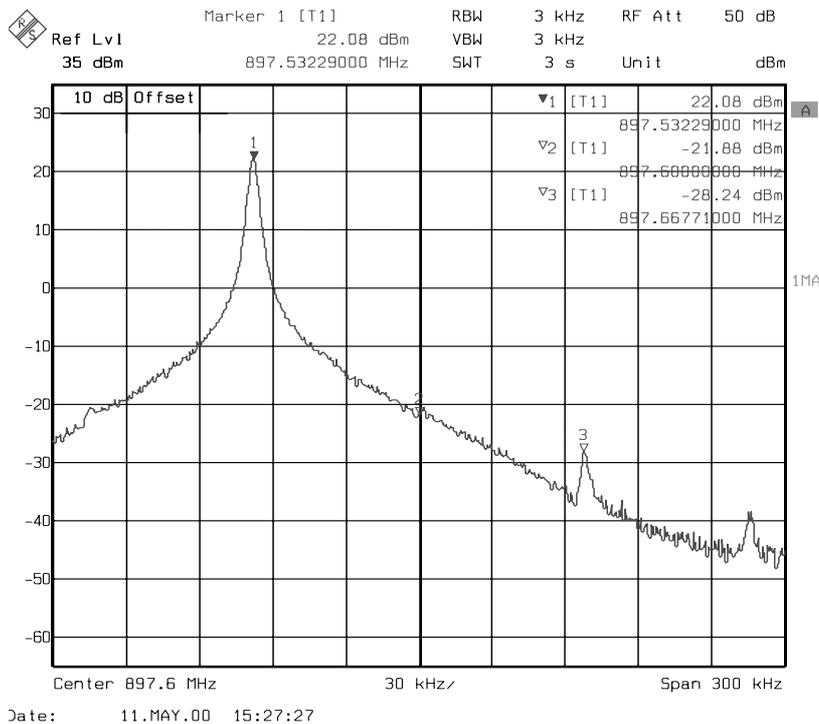


Marker 1 shows the wanted signal. Marker 2 and marker 3 show the unwanted signals.

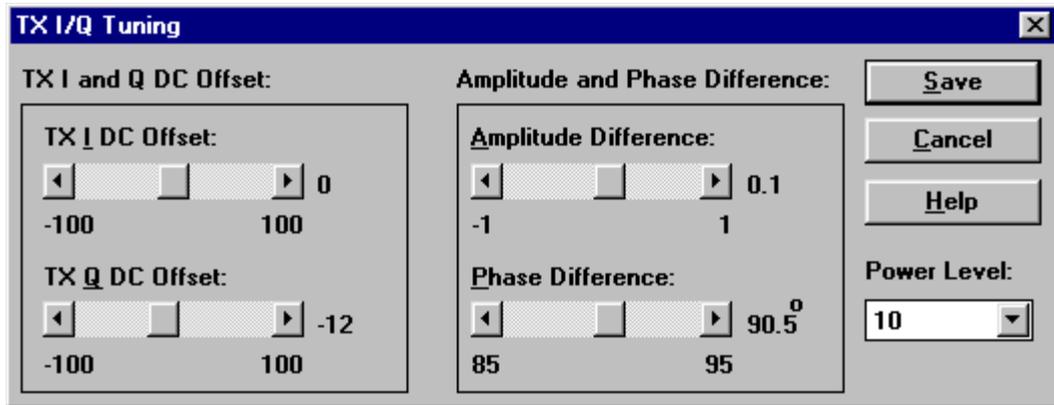
In the "Tx I/Q Tuning" window use "TX I DC Offset" and "TX Q DC Offset" to adjust the spurious at 897.6MHz (Marker 2) to the minimum level.



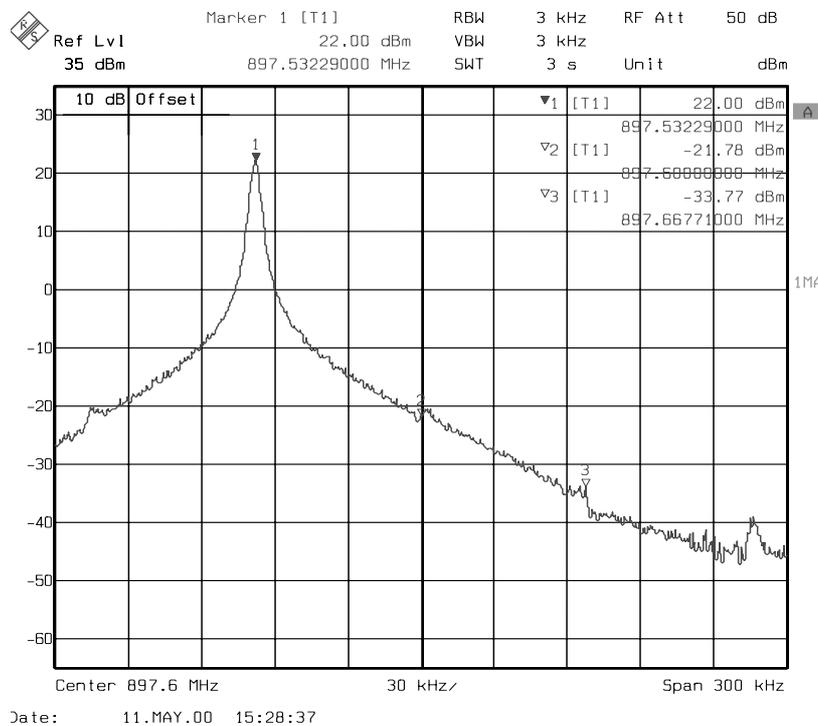
Then the Spectrum Analyzer shows a plot like this:



In the "Tx I/Q Tuning" window use "Amplitude Difference" and "Phase Difference" to adjust the spurious at 897.66771MHz (Marker 3) to the minimum level.



Then the Spectrum Analyzer shows a plot like this:



In the "Tx I/Q Tuning" window press "Save" and the optimal values are stored in the phone. The window closes.

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

**PCN:**

Spectrum Analyzer Settings

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.

Set the Spectrum Analyzer according to the following settings.

|                      | PCN            |
|----------------------|----------------|
| Center Frequency     | 1747.8MHz      |
| Frequency Span       | 300 kHz        |
| Resolution Bandwidth | 3 kHz          |
| Video Bandwidth      | 3 kHz          |
| Sweep Time           | 3 sek.         |
| Detector Type        | Max Peak       |
| Reference level      | 35 dBm         |
| Marker 1             | 1747.73229 MHz |
| Marker 2             | 1747.8 MHz     |
| Marker 3             | 1747.86771 MHz |

Phone Settings

Connect the phone to the computer and to the Spectrum Analyzer.

Using WinTesla to select the following:

Product

Band

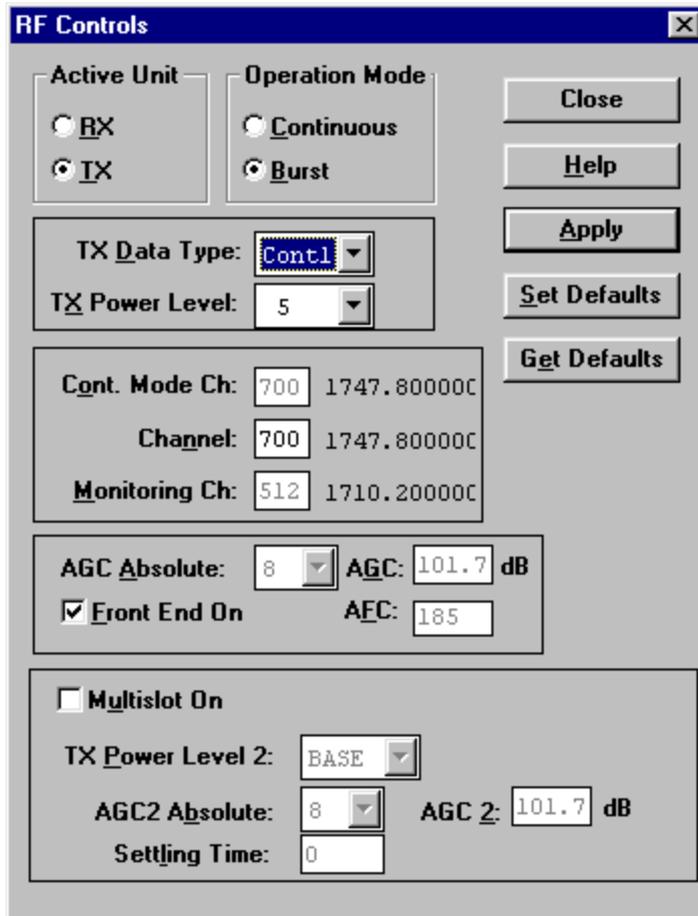
PCN

This activates the PCN band. Then select the following:

Testing

RF Controls...

A window pops up:



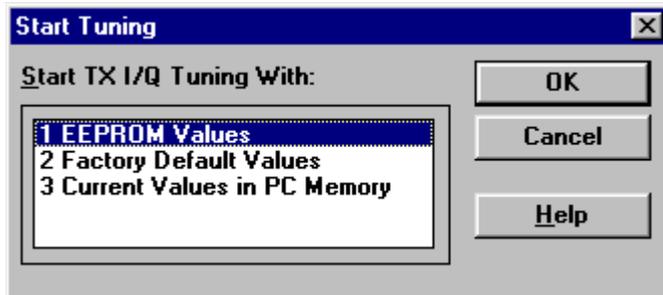
Set "TX Data Type" to "Cont1", press "Apply", then press "Close". The window closes.

Select the following:

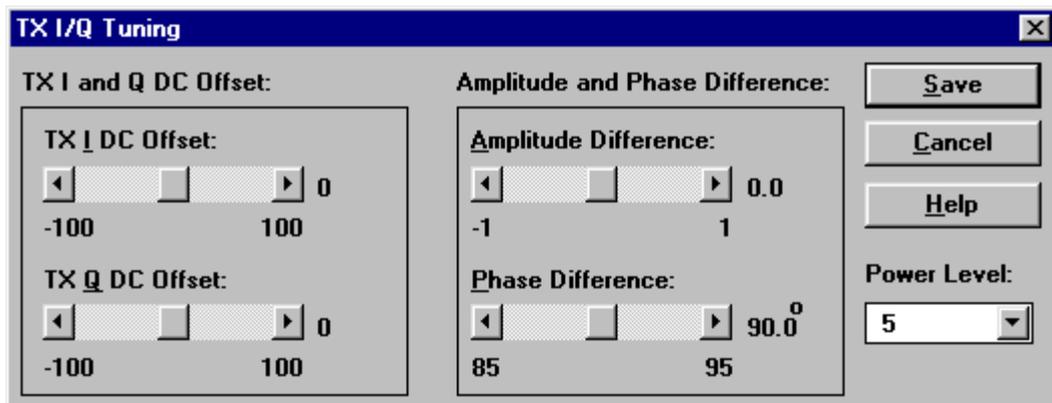
Tuning

Tx I/Q...

A window pops up:

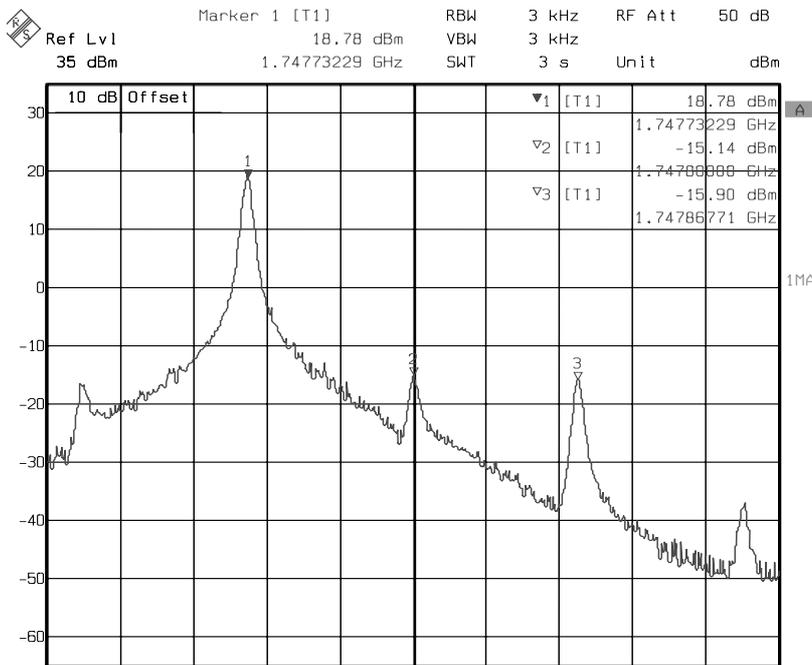


Select "EEPROM Values" and a new window pops up:



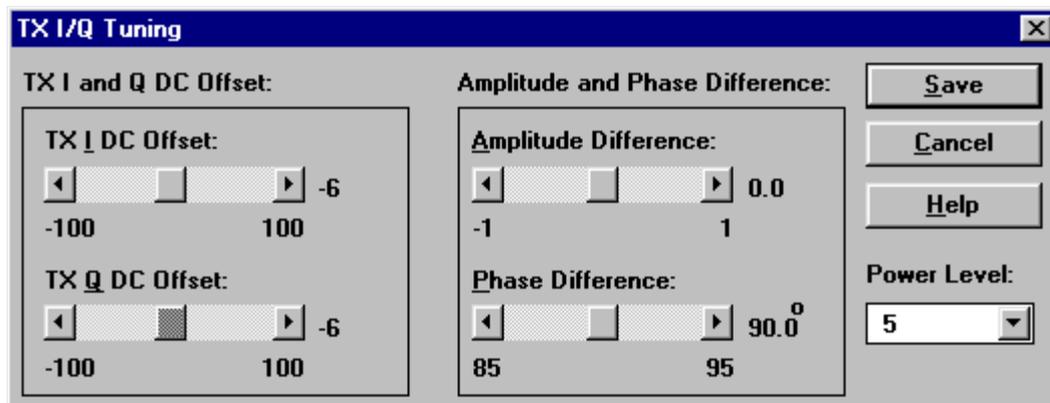
This is the "Tx I/Q Tuning" window.

Set the Power Level to "5". Then the Spectrum Analyzer shows a plot like this:

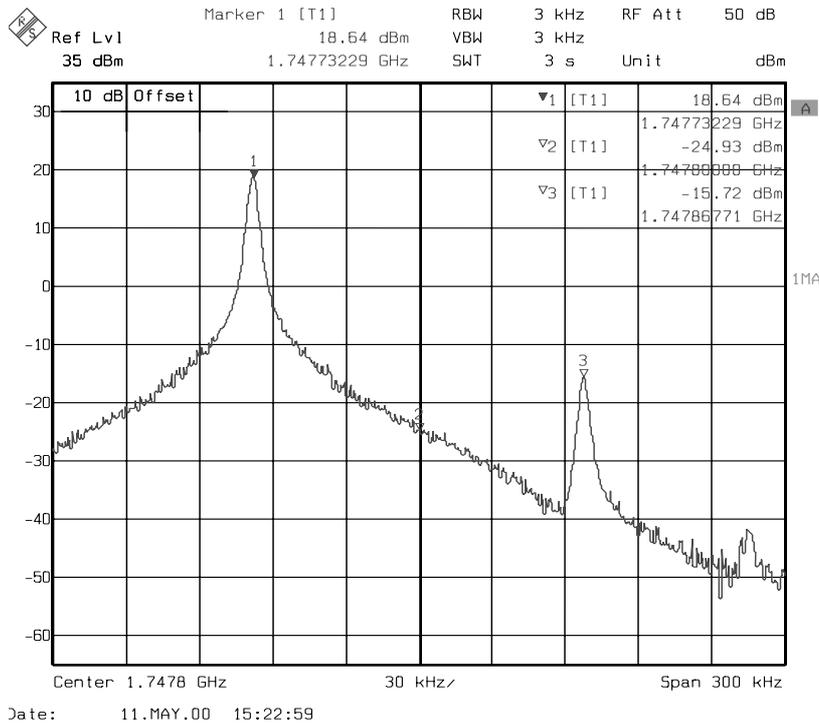


Marker 1 shows the wanted signal. Marker 2 and marker 3 show the unwanted signals.

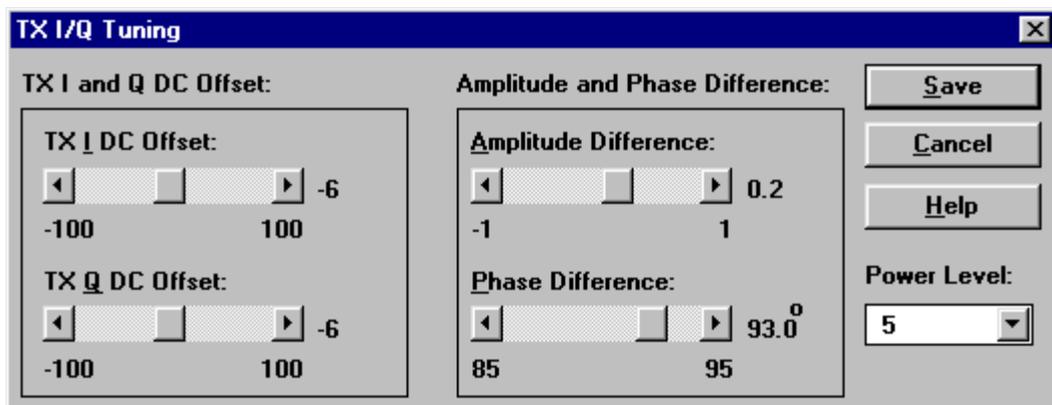
In the "Tx I/Q Tuning" window use "TX I DC Offset" and "TX Q DC Offset" to adjust the spurious at 1747.8MHz (Marker 2) to the minimum level.



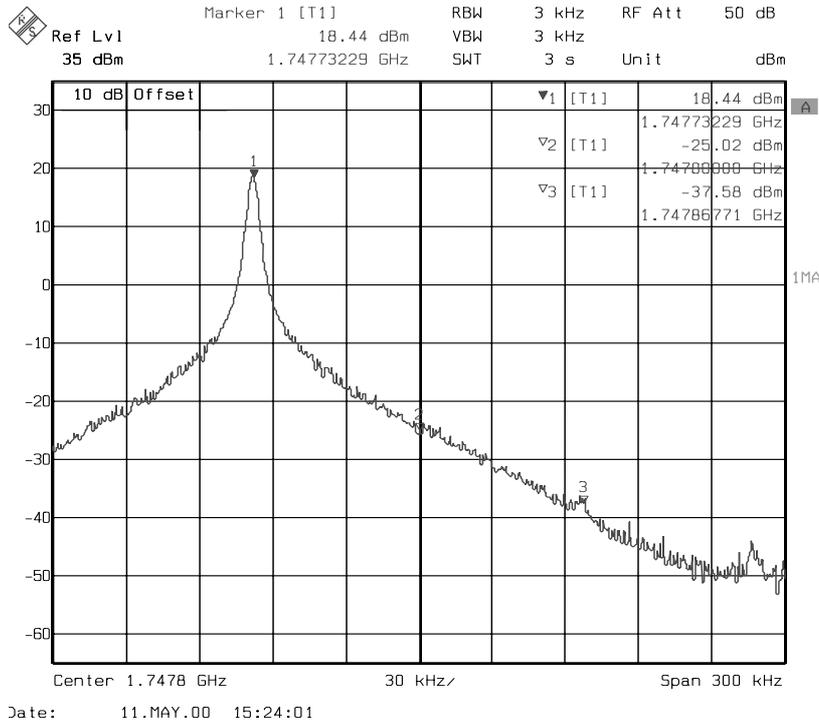
Then the Spectrum Analyzer shows a plot like this:



In the "Tx I/Q Tuning" window use "Amplitude Difference" and "Phase Difference" to adjust the spurious at 1747.86771MHz (Marker 3) to the minimum level.



Then the Spectrum Analyzer shows a plot like this:



In the "Tx I/Q Tuning" window press "Save" and the optimal values are stored in the phone. The window closes.

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

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