Programmes After Market Services
NHM-5NX Series Transceivers

Troubleshooting

Issue 1 09/00
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Component Identification:

NMH -5 utilises different component brands.

None of the components must be substituted by other brands, as it will cause misalignment in the phone.

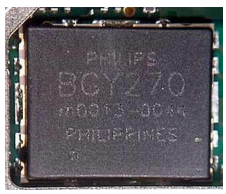
The fFollowing key components will be sourced by up to three different vendors.

Below is a list with photos that will help identify what brand of component has been used in the phone.

Component	Reference	Vendor 1	Vendor 2	Vendor 3
PA	Ref: N502	HITACHI	PHILIPS	RFMD
VCTCXO	Ref: G502	NDK	TOYOCOM	
SRAM	Ref: D302	SAMSUNG	AMIC/UMC	
DUAL SAW	Ref: Z500, Z501	EPCOS	PANASONIC	
TX SAW	Ref: Z503	EPCOS	PANASONIC	
FLASH	Ref: D301	ST	INTEL	
LIGHT-GUIDE	Ref:	SEIKO EPSON	PHILIPS	

REF: N502 Hitachi, PA

Ref: N502 Philips, PA

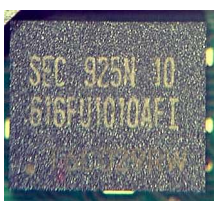


Ref: N502 RFMD, PA

Ref: G502 VCTCXO, NDK

Ref: G502 VCTCXO, TOYOCOM

Ref: D302 S-RAM, SAMSUNG



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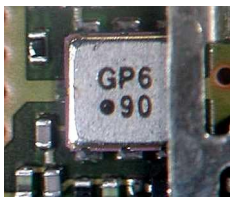
Ref: D302 S-Ram, AMIC

Ref: Z500, Z501 Dual SAW, EPCOS

Ref: Z500, Z501 Dual Saw, Panasonic



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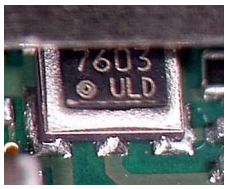
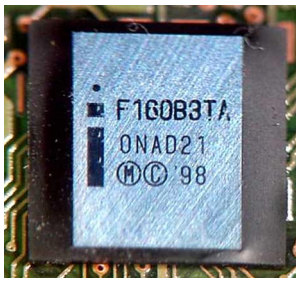
Ref: Z503 TX SAW, EPCOS



Ref: D301 FLASH, INTEL



Ref: D301 FLASH, ST

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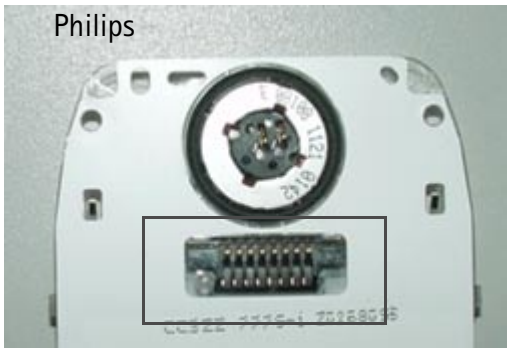
Display Module Suppliers

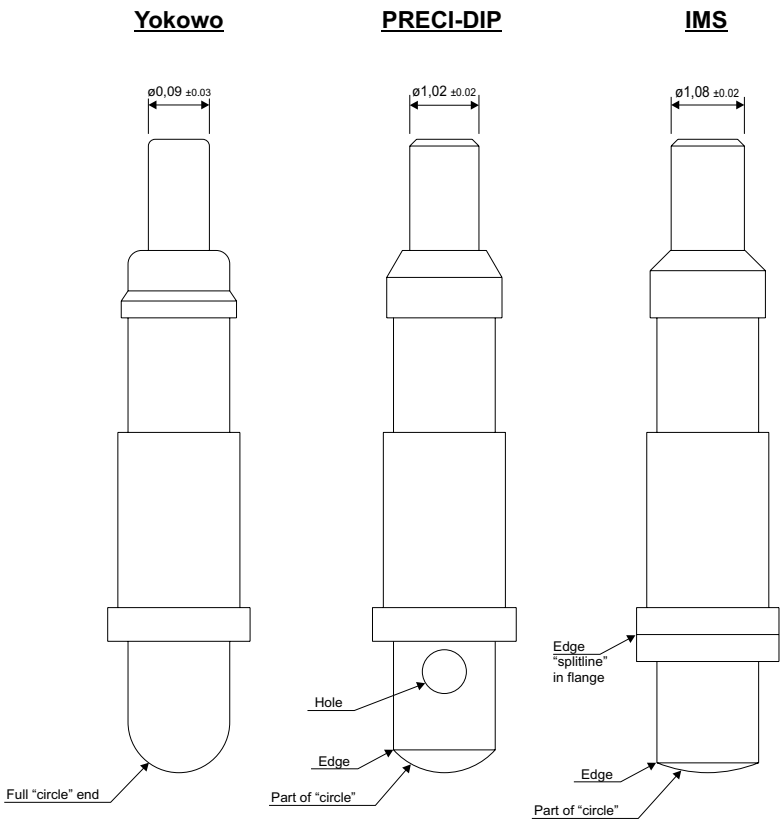
The easiest way to determine the supplier of the display module is by looking at the connector and connector cavity from the backside of the module.

Philips display module has **large** "T" shaped connector and **large** connector cavity



Seiko Epson display modules has **small**, square connector and **small**, square connector cavity.

Antenna Suppliers



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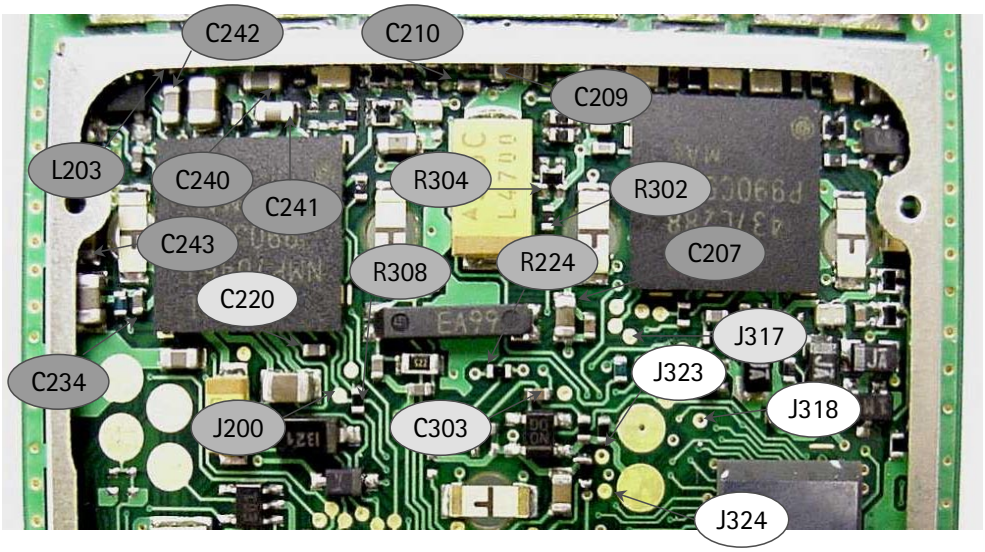
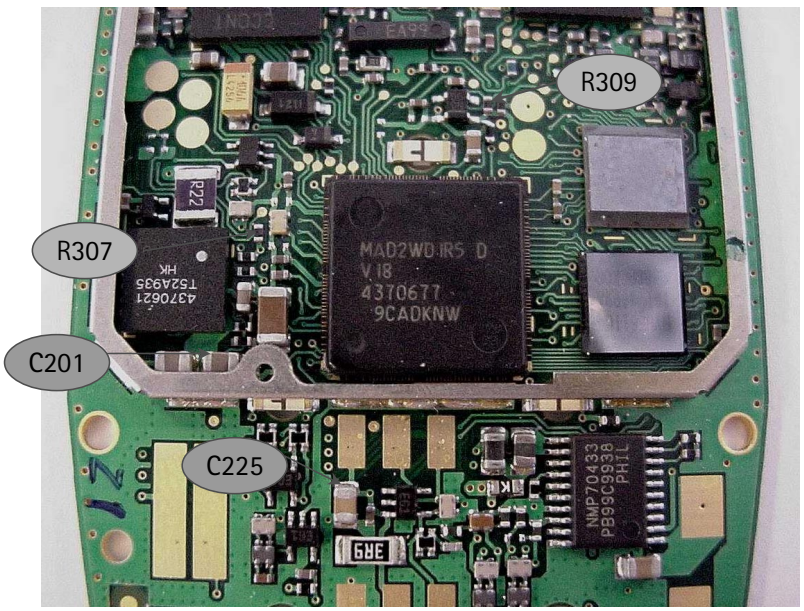
Baseband Troubleshooting

Baseband Testpoints

Topside Components



Bottom Side Components



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Testpoint	*Net*	*Name*	*Condition*	*DC-level*	*AC-level*
General					
R309	VPP		Flash or mulated EEPROM write	Nominal 2.8 V Min 1.7V, max 2.85 V	
J200	CCONTCSX		Active State	Pulsed active 0V Normal state 2.8 V	
R308	PURX		Power up/down	Reset state 0V Normal state 2.8 V	
R224	PWRON	PWRONX / WDDISX	Power on	Reset state 0V Normal state 2.8 V	
R304	FBUS_TX	FBUS(1)	Power on	Pulsed DC (0V to 2.8V)	
R302	FBUS_RX	FBUS(0)	Power on	Pulsed DC (0V to 2.8V)	
R307	MBUS		Power on	Pulsed DC (0V to 2.8V)	
Power supplies					
C201	VB (baseband)		Active state	Nominal 3.6V Min 3.0V, max 4.2V	
C240	VRX		Active state	2.8V Min 2.7V, max 2.85V	
R564	VXO		Active state	2.8V Min 2.7V, max 2.85V	
L203	VSYN_1	VCOS (RF)	Active state	2.8V Min 2.7V, max 2.85V	
C241	VSYN_2	Vsynte (RF)	Active state	2.8V Min 2.7V, max 2.85V	
C242	VTX	Vmod (RF)	Active state	2.8V Min 2.7V, max 2.85V	
C209	VBB		Power on	2.8V Min 2.7V, max 2.85V	
C207	VCOBBA		Active state	2.8V Min 2.7V, max 2.85V	
C234	VCP	V5V	Active state	Nominal 5.0V Min 4.8V, max 5.0V	
C225	VSIM		Active state	Nominal 2.8V (3V SIMcard) or 5.0V (5V SIM card)	
C210	VREF_2	VREF	Power on	1.5 V ± 1.5 %	

Testpoint	*Net*	*Name*	*Condition*	*DC-level*	*AC-level*
Clock					
C220	SLEEPCLK	SLCLK	Power on	Pulsed DC (0V to 2.8V)	
C303	RFC	RFCLK	Active state		Typ. 0.8 Vpp (Min 0.5Vpp, Max 2.0Vpp)
J317	COBBACLK	COBBAIF(2)	Active state	Pulsed DC (0V to 2.8V)	
MCU					
J323	MEMC(7)	RAMSelX	Active state	Pulsed, active 0V Non-active 2.8V	
J324	MEMC(0)	ROM1SelX	Active state	Pulsed, active 0V Non-active 2.8V	
J318	MEMC(4)	EsysResetX	Power on	Reset state 0V, normal state 2.8V	

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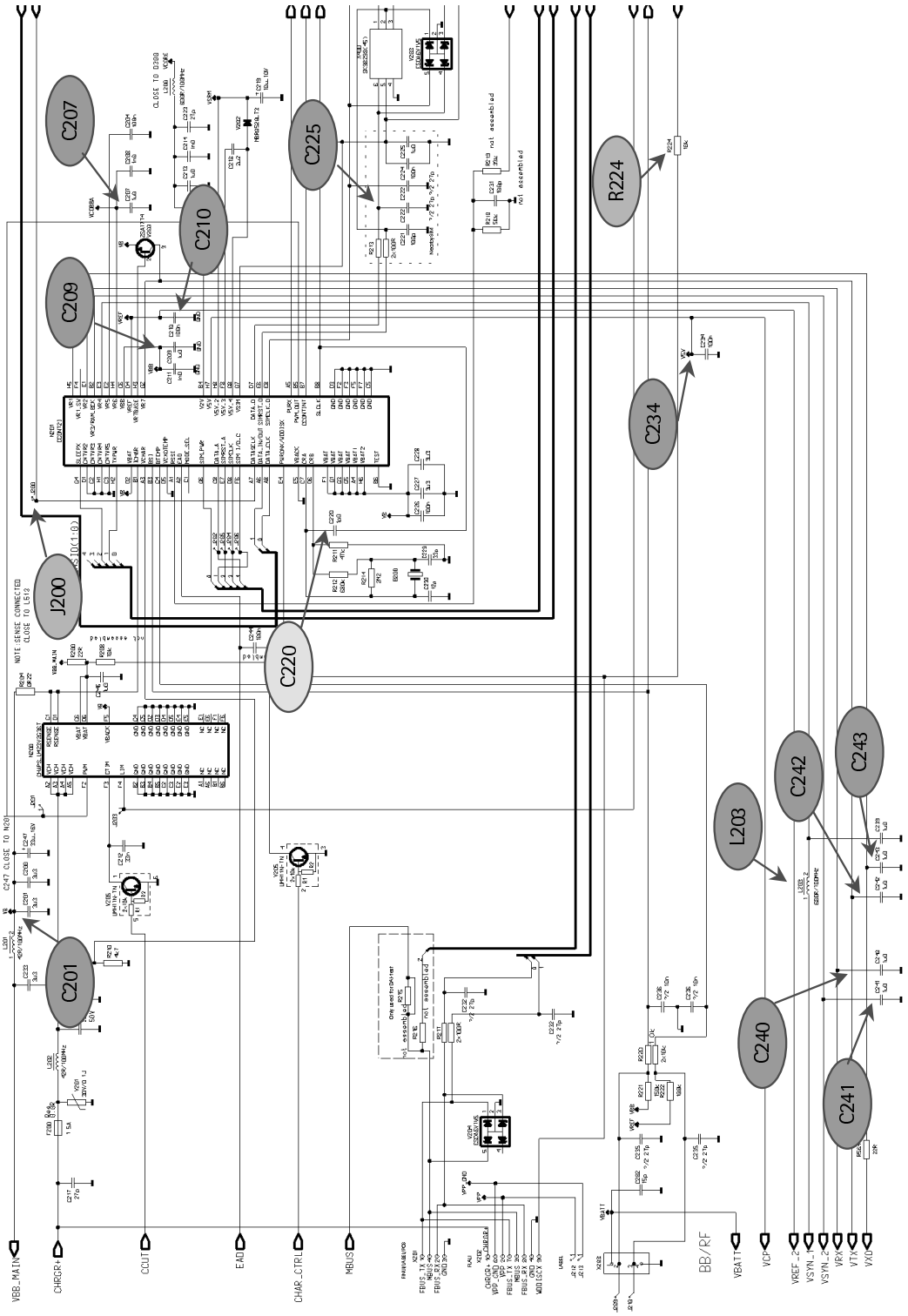
Power Schematic -Testpoints



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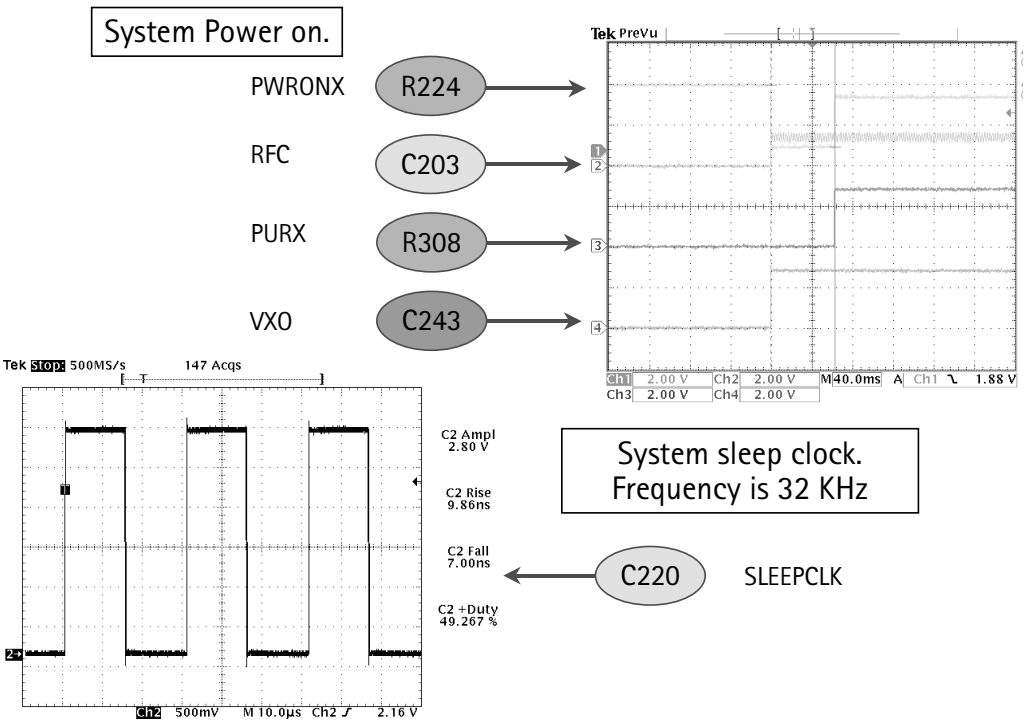
Power Schematic - Plots



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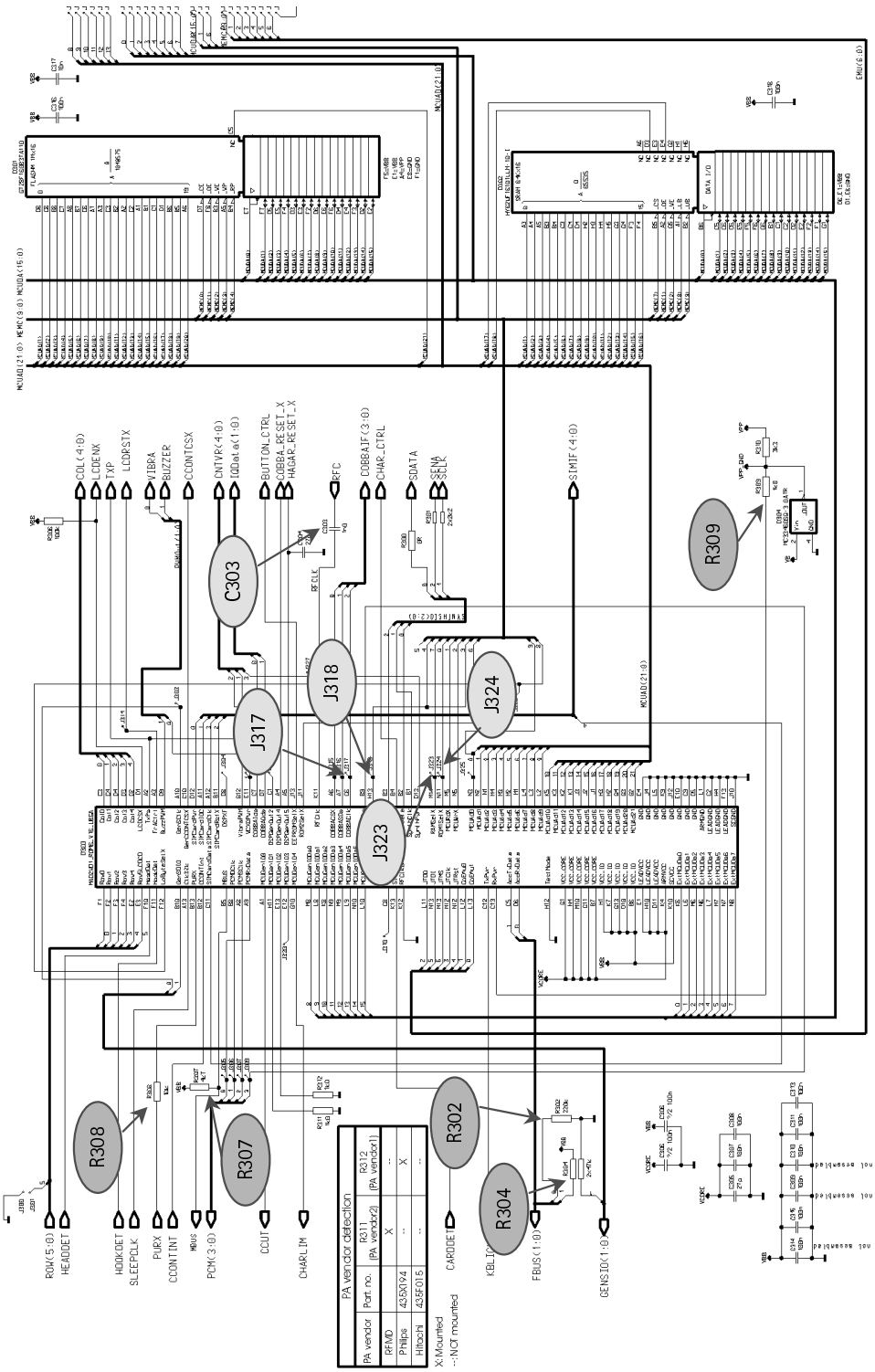
Cpu Schematic - Testpoints



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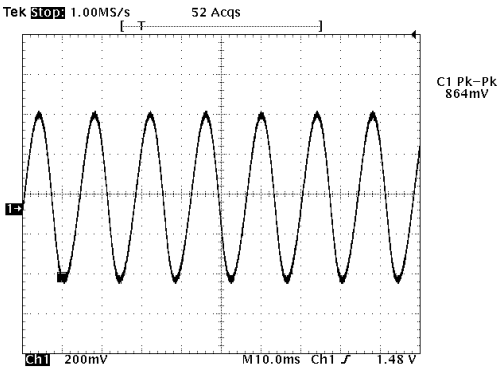
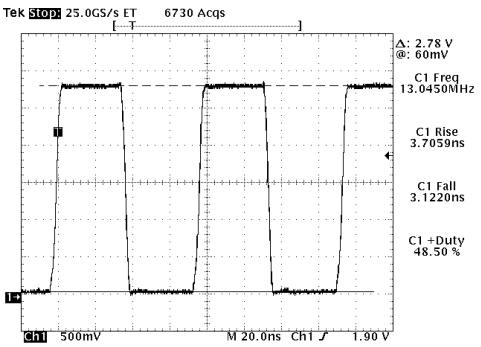
CPU Schematic - PLots

System clock.
Frequency is 13 MHz

RFC C303





Cobba clock.
Frequency is 13 MHz

J317 COBBACLK

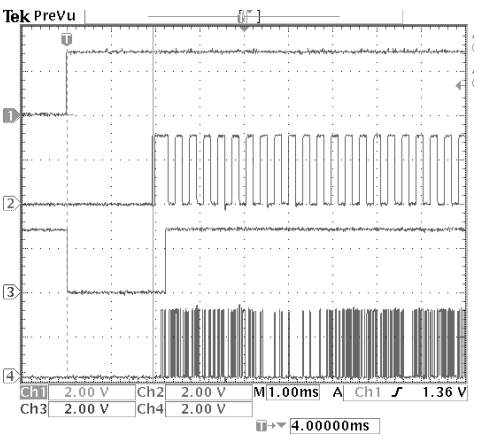
Programming flash

PURX R308

MBUS R307

FBUS[1] - Tx R304

FBUS[0] - Rx R302



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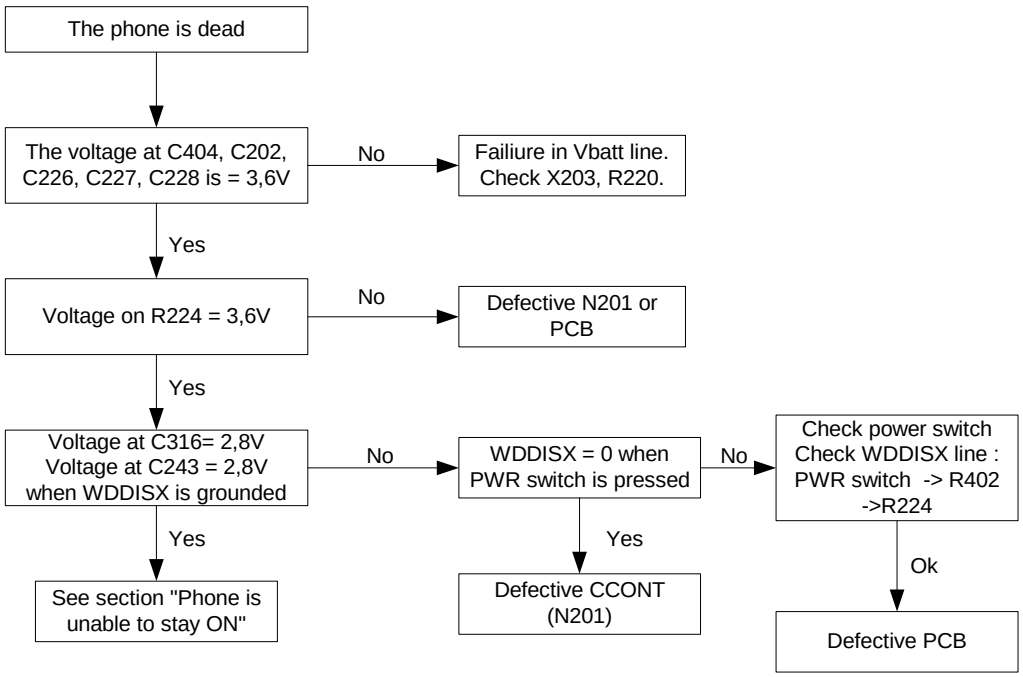
Fault Finding Charts

1. Phone is Dead

"Phone is dead" means that the phone does not take current when the power switch is pressed or when the watchdog disable pin WDDISX is grounded. Nominal supply voltage to the phone is 3,6 V (Vbat voltage). If the battery voltage is below 3,1 V the CCONT prevents the phone from powering up

.



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2. Flash Programming Does Not Work

The flash programming is done in two steps and via two different connectors. FLALI (Flash align - **Production only !!!**) is the first programming step and it is done via the X202 connector. This connector, however is hidden when the PCB is placed in the D-cover and therefore the last programming step must be done via the FINUI (Final UI) connector X201. The two main differences between these two connectors are :

- Flash programming voltage is produced in a different way (external Vpp in FLALI).Signal routings are different.
- In case of a flash programming error the prommer box is able to give some information on the error that has occurred.
- The error information could be :
- MCU does not boot
- Serial clock line failure
- Serial data line failure
- External RAM failiure
- Algorithm file or alias ID not found
- MCU flash Vpp error

Because of the use of ìBGA components it is not possible to verify if there is a short-circuit in any of the lines to and from the MAD2WD1 and the SRAM/flash circuits.
The faultfinding diagrams for flash programming are shown overleaf.

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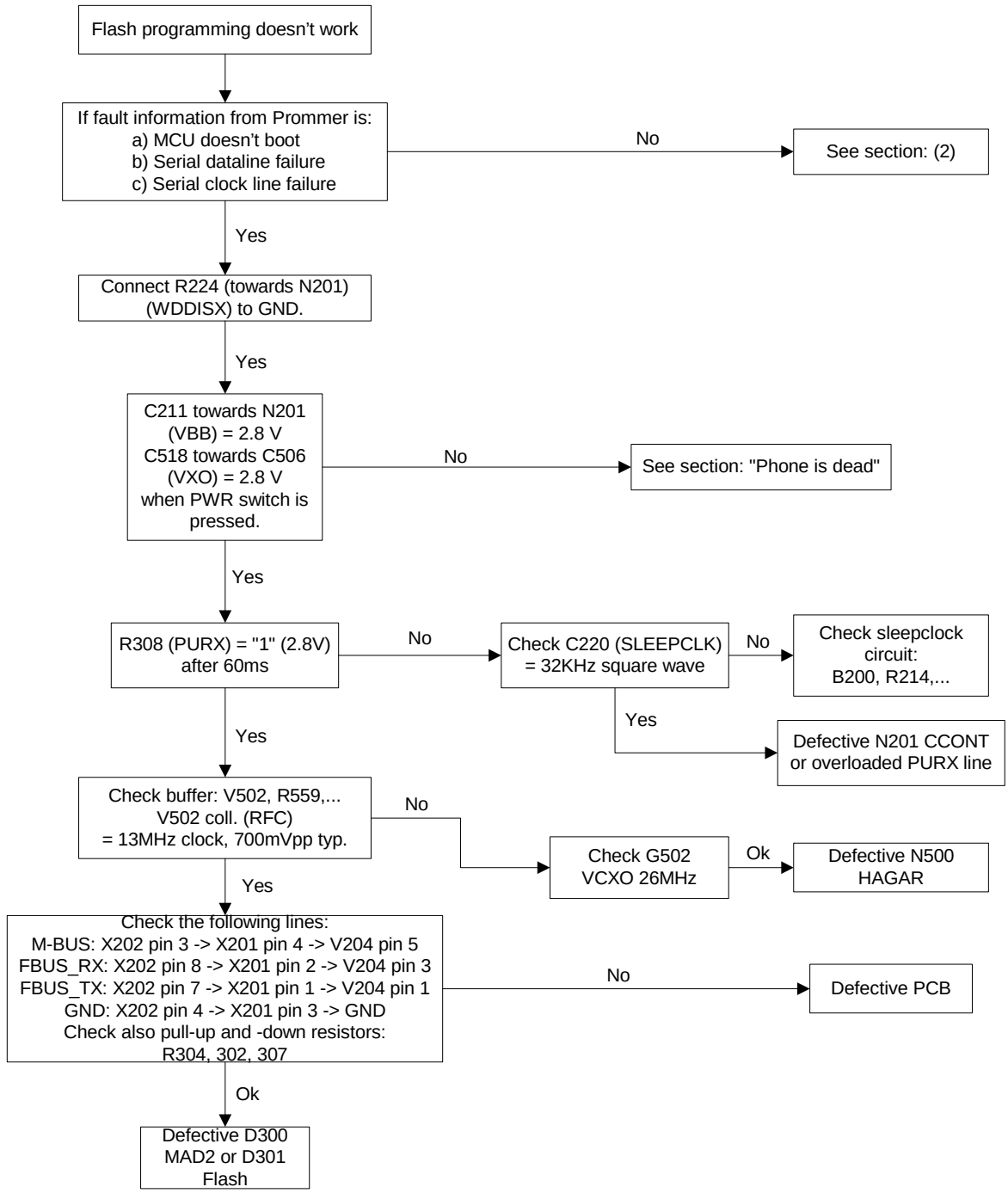
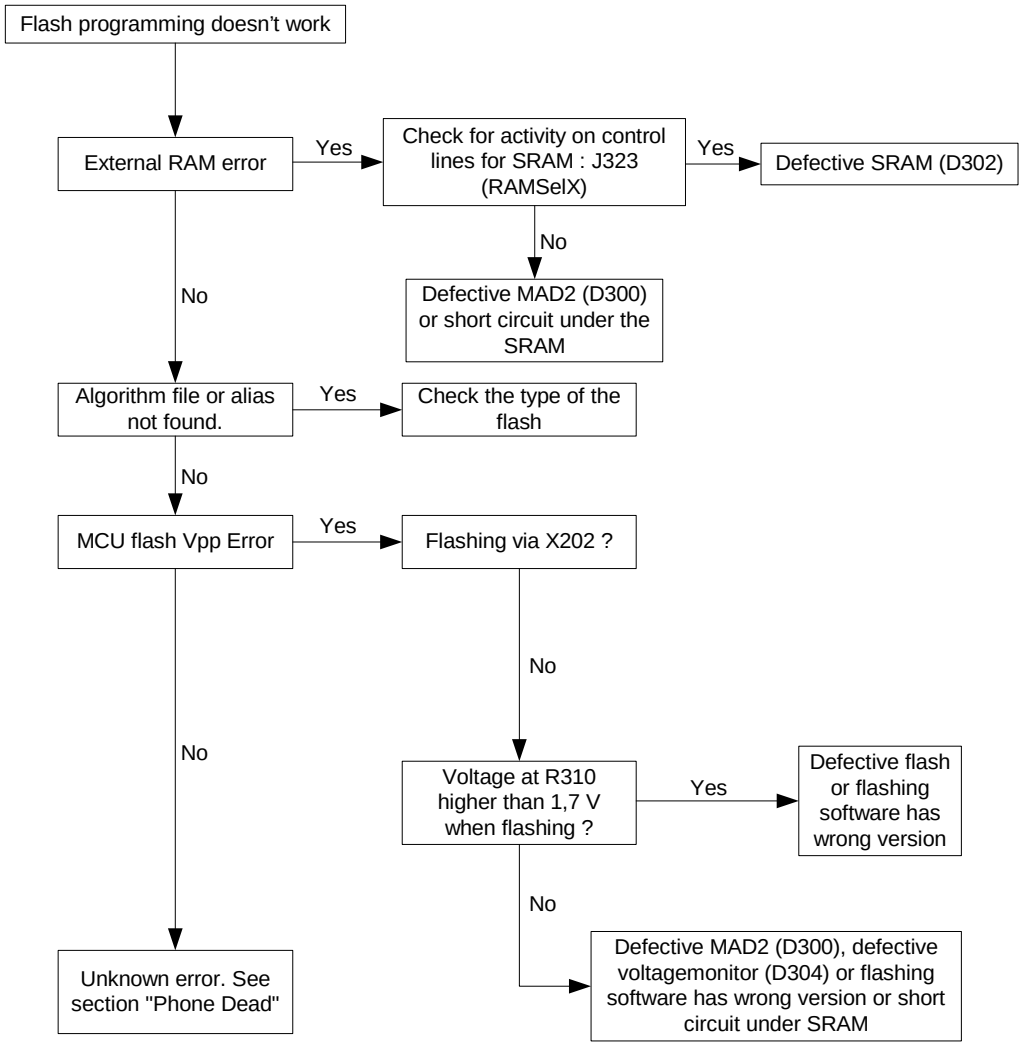
2.1 Flash programming diagram (1)



2.2 Flash programming diagram (2)



3. Phone Stays On or is Jammed

If this kind of error occurs after flashing the most plausible reason is open pins on an IC.

Normally the CCONT will power the phone down after 30 seconds if the watchdog has not been served by SW. Connecting an oscilloscope to J200 (DataSelX on the CCONT) can monitor the watchdog updating. Normally there is a short pulse from 1 to 0 every 8 seconds. Grounding J200 can disable the power off function.

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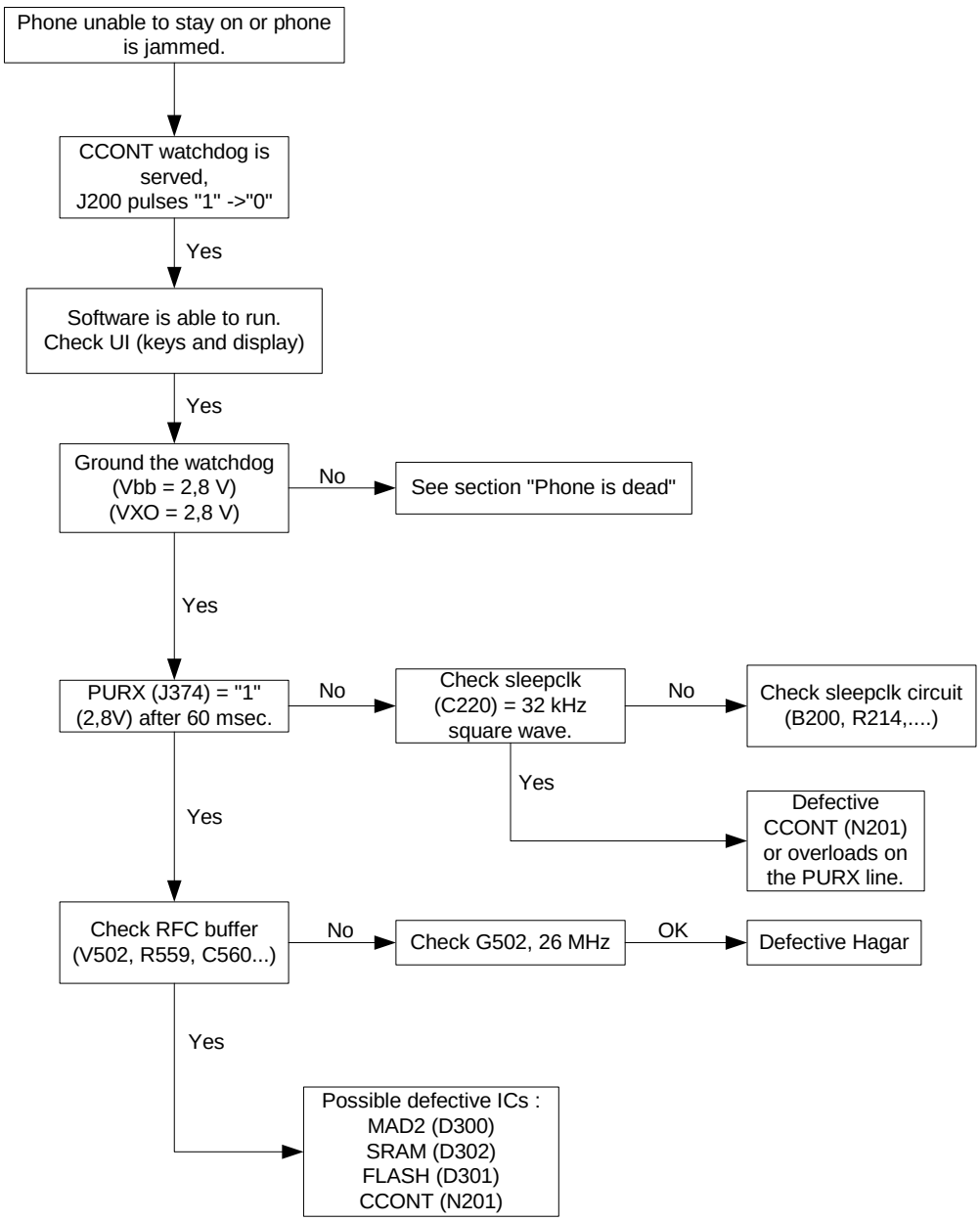
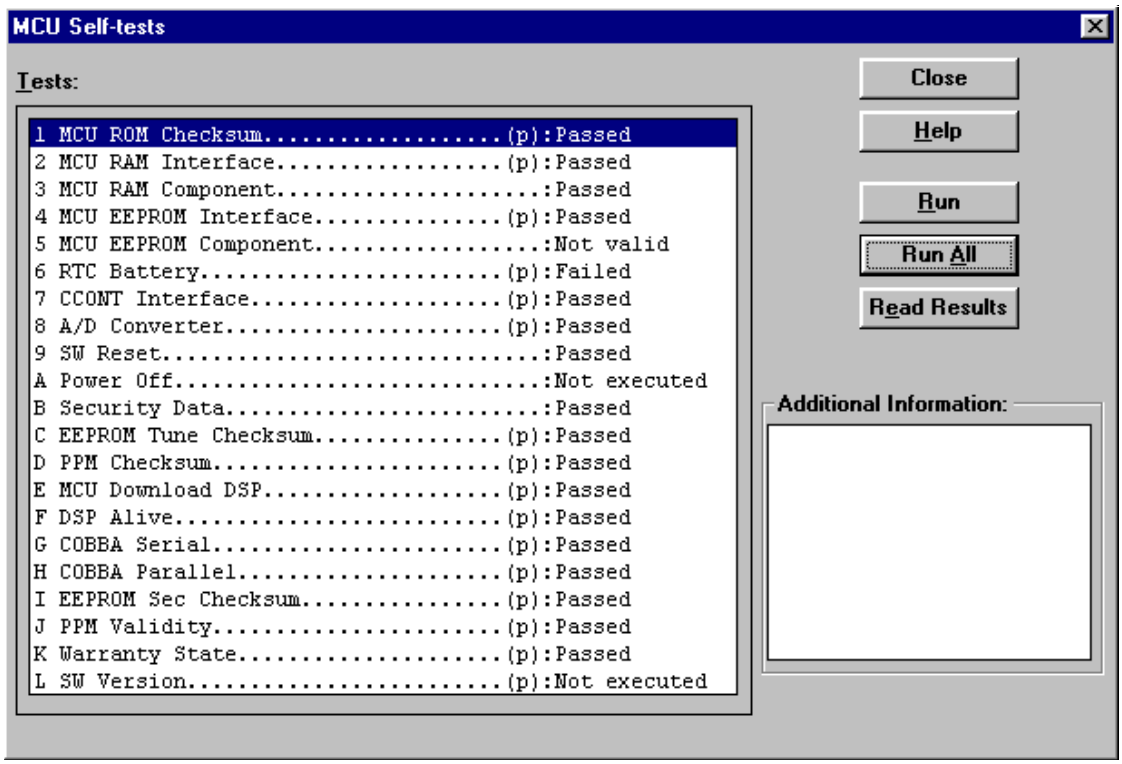
3.1 Fault finding diagram, ad. 3.



4. Display Information : "Contact Service"

If the message "Contact Service" is displayed one or more parts of the software is unable to execute properly. At the same time, the watchdog is triggered and is thereby able to tell if an error has occurred. Selftest functions are executed when the phone is powered on and if one or more selftest functions fails, the message "Contact Service" is shown in the display.

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



The information shown above can be used to diagnose the phone.

Explanation of MCU ROM Checksum : A 16 bit checksum is calculated from the flash code and the result is then compared to the one found in the flash.

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5. No Network Found, No Call Established

When the phone is unable to either find a network or establish a call, both the RF part and the baseband part can cause it. The phone can be set to required mode (RF measurements) by the WinTesla service software in order to determine if the error is placed either in the RF part or the baseband part.

There are two circuits that supplies the RF part of the phone. These circuits are :

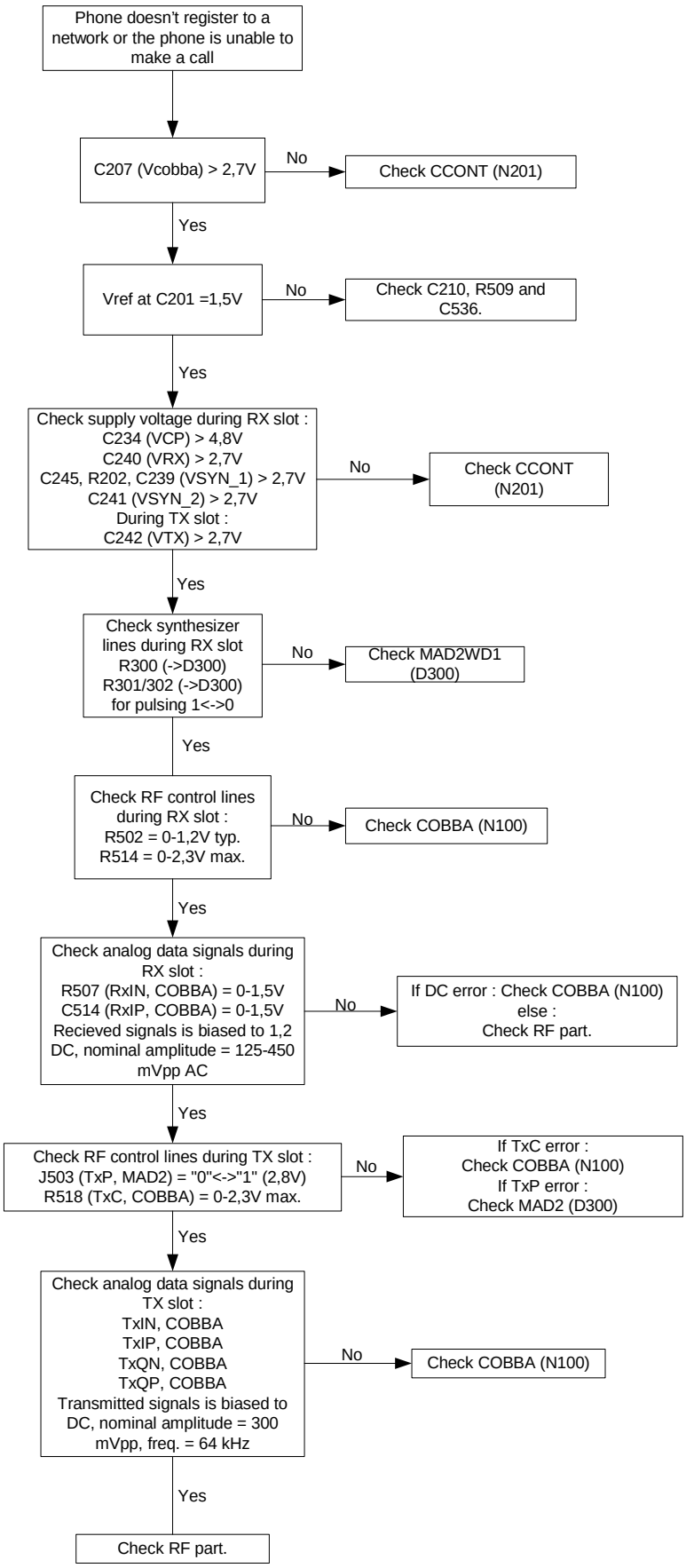
MAD2WD1 (D300)

COBBA (N100)

The MAD2WD1 circuit supplies the RF part with the digital control signals : SynthEna, TxP, etc. and the COBBA supplies the RF part with the analog control signals : AFC, TxC etc

After power up, DSP indicates all the completed functions by changing the state of the XF pin as shown overleaf.

6. Phone Not Registeing to a Network



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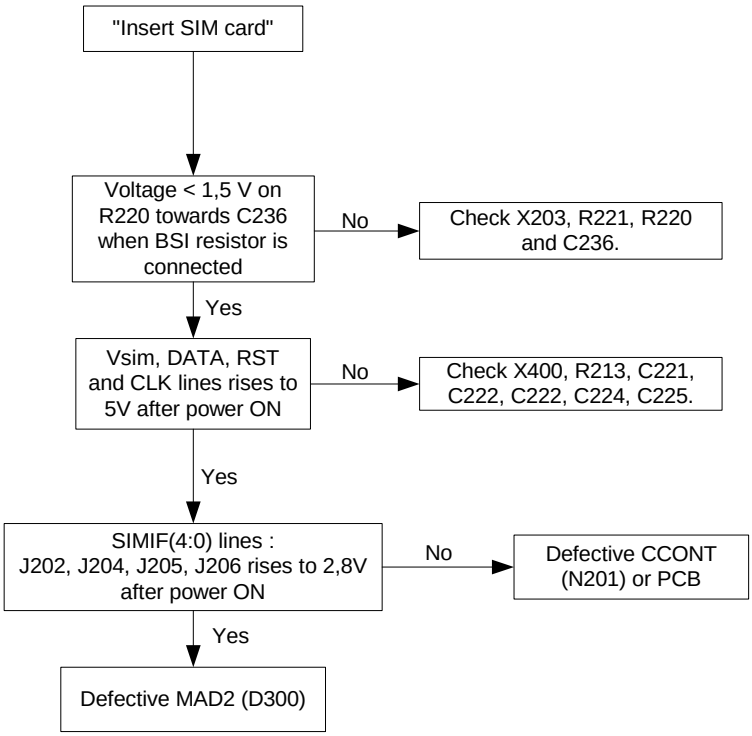
7. Sim Related Errors

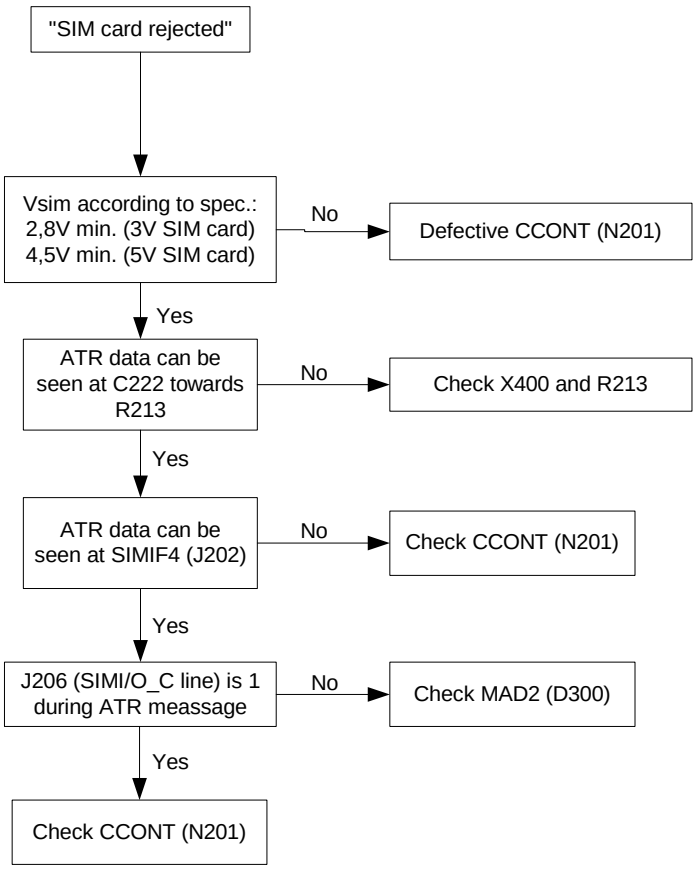
The SIM interface from the MAD2WD1 (D300) to the SIM connector (X400) can be tested without a SIM card. When the power is switched on and the BSI terminal is grounded by a resistor, all interface lines (VSIM, DATA_A, SIMRST_A, SIMCLK) rises, first to 3V the to 5V. This is repeated four times. In this way it is possible to find errors in the SIM interface without a SIM card.

In case of a "SIM card rejected" error, the ATR message is actually sent from the SIM card but it is somehow corrupted, the data signal levels are out of spec. or the factory set values is incorrect (SIM locks etc.).

7.1 "Insert SIM card" error



7.2 "SIM card rejected" error



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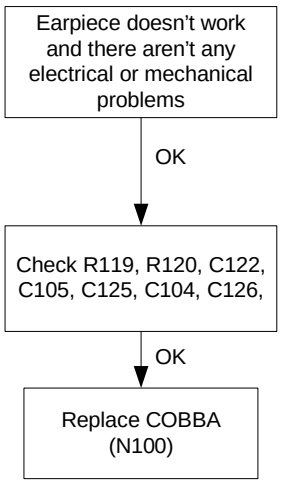
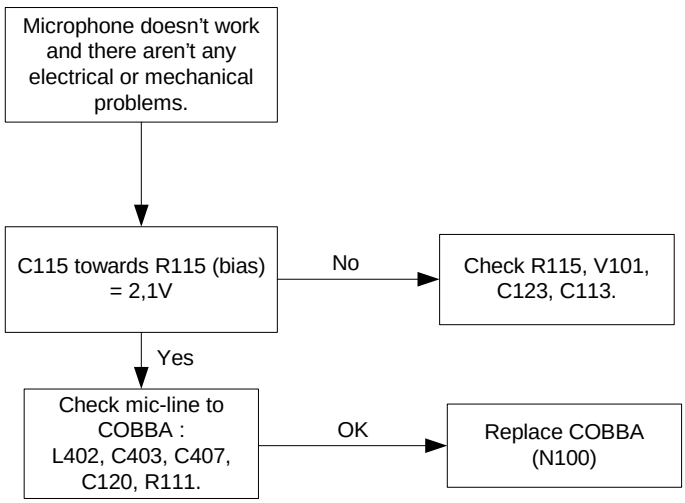
8. Audio Faults

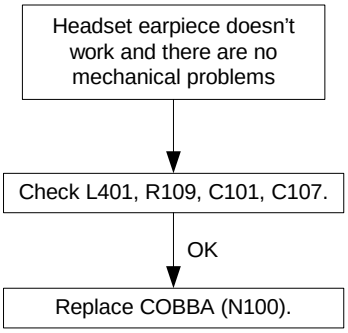
8.1 Internal earpeace



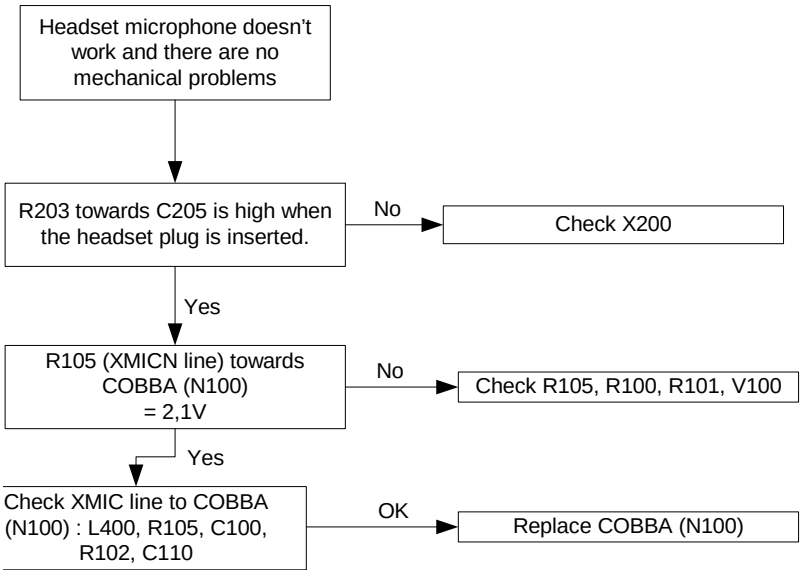
8.2 Internal microphone



8.3 External earpeace



8.4 External microphone



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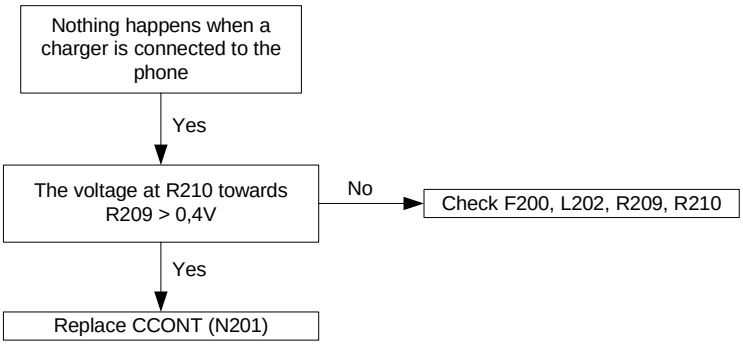
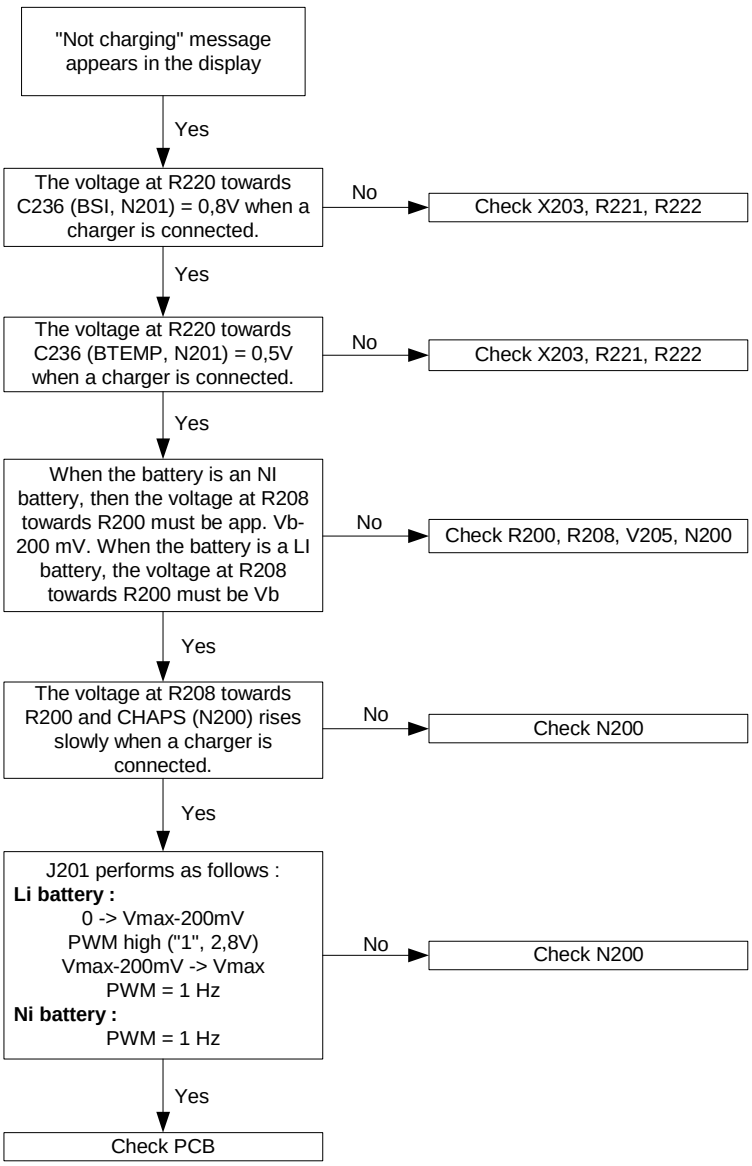
9. Charging Error

9.1 No detection of charger



9.2 "Not Charging" message



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 Analyzer 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 analyzer).

- LF (Low frequency) and DC measurements should be done with a 10:1 probe and an oscilloscope. The probe used in the following is 10MΩ/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). Hagar 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 PCB. 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.

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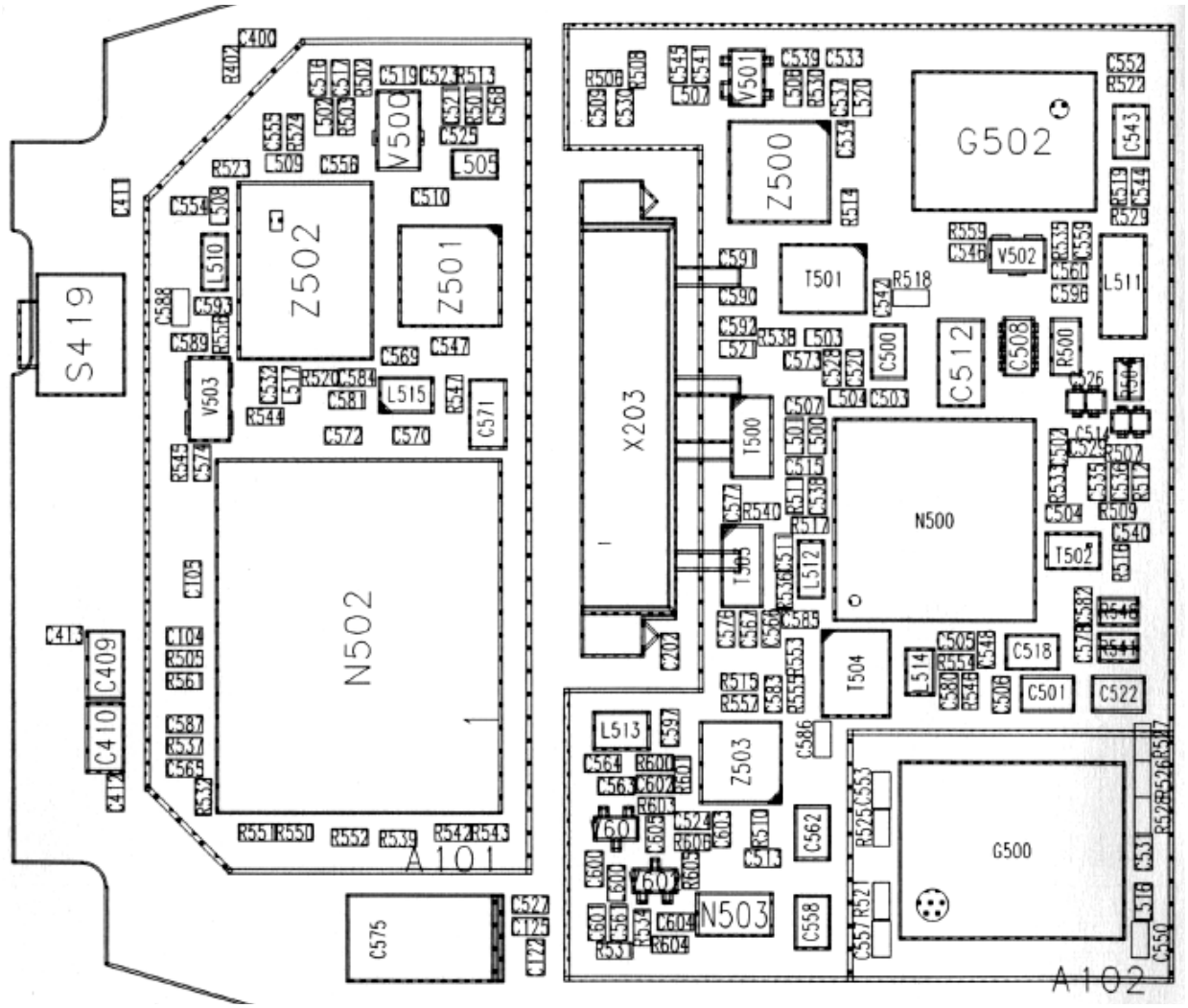
RF Key Component Placement



N502	**Power amplifier (PA)**
Z502	RXTX switch
Z501	1st Dual RX SAW filter (GSM900 & GSM1800)
Z500	2nd Dual RX SAW filter (GSM900 & GSM1800)
G502	VCTCXO (26 MHz Crystal oscillator)
N500	Hagar RF IC
G500	VCO (3.6 GHz UHF VCO)
Z503	TX SAW filter (GSM)

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Abbreviations in Fault Finding Charts

BB	Baseband
DC	Direct Current
ESD	Electro Static Dicharge
f:	Frequency of signal (measured with Spectrum Analyzer)
LF:	Low frequency (measured with oscilloscope)
LO	Local Oscillator
P:	Power of signal in decibels (dB) (measured with Spectrum Analyzer)
PA	Power Amplifier
PCB	Printed Circuit Board
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

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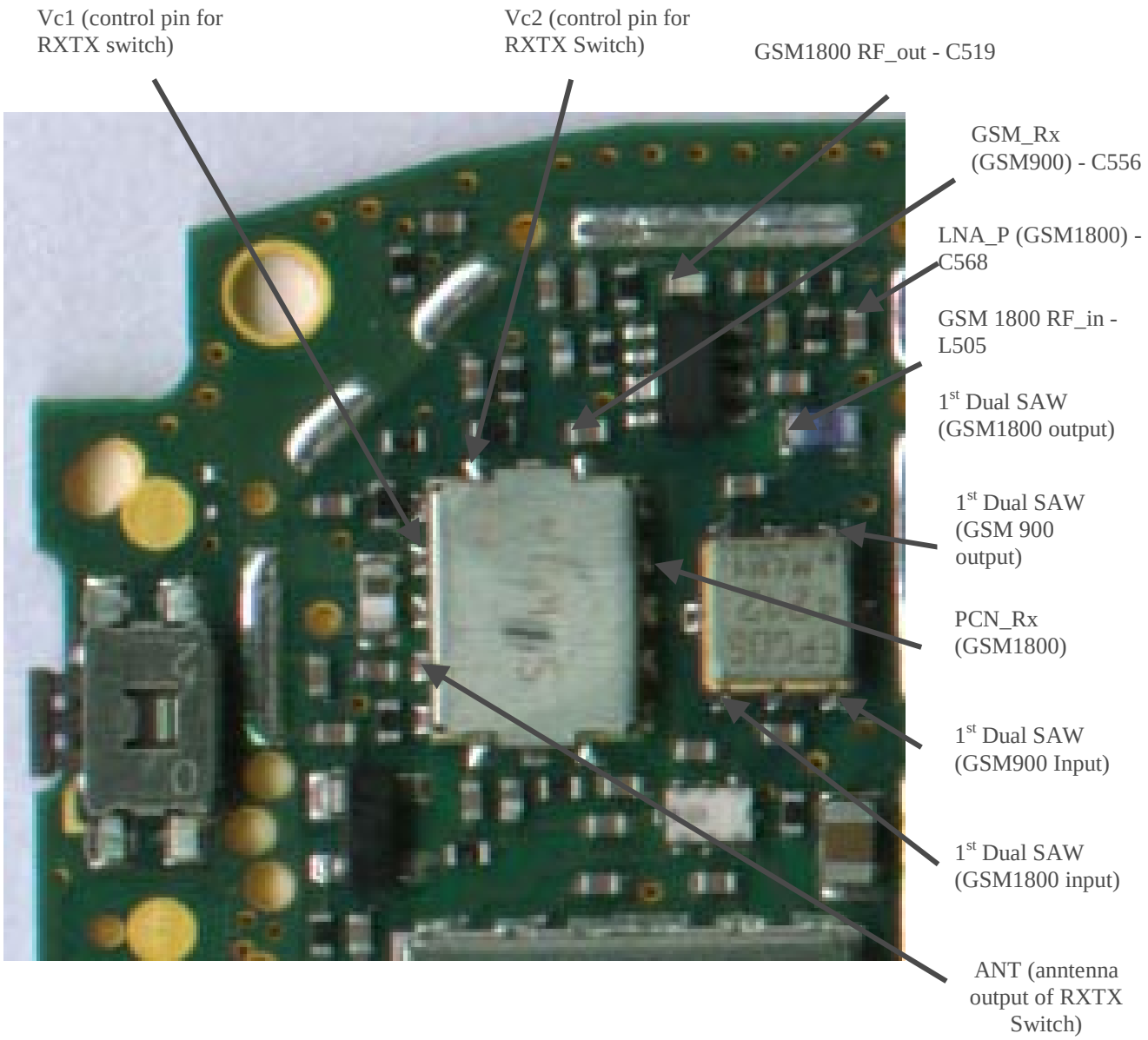
RF Component Locations



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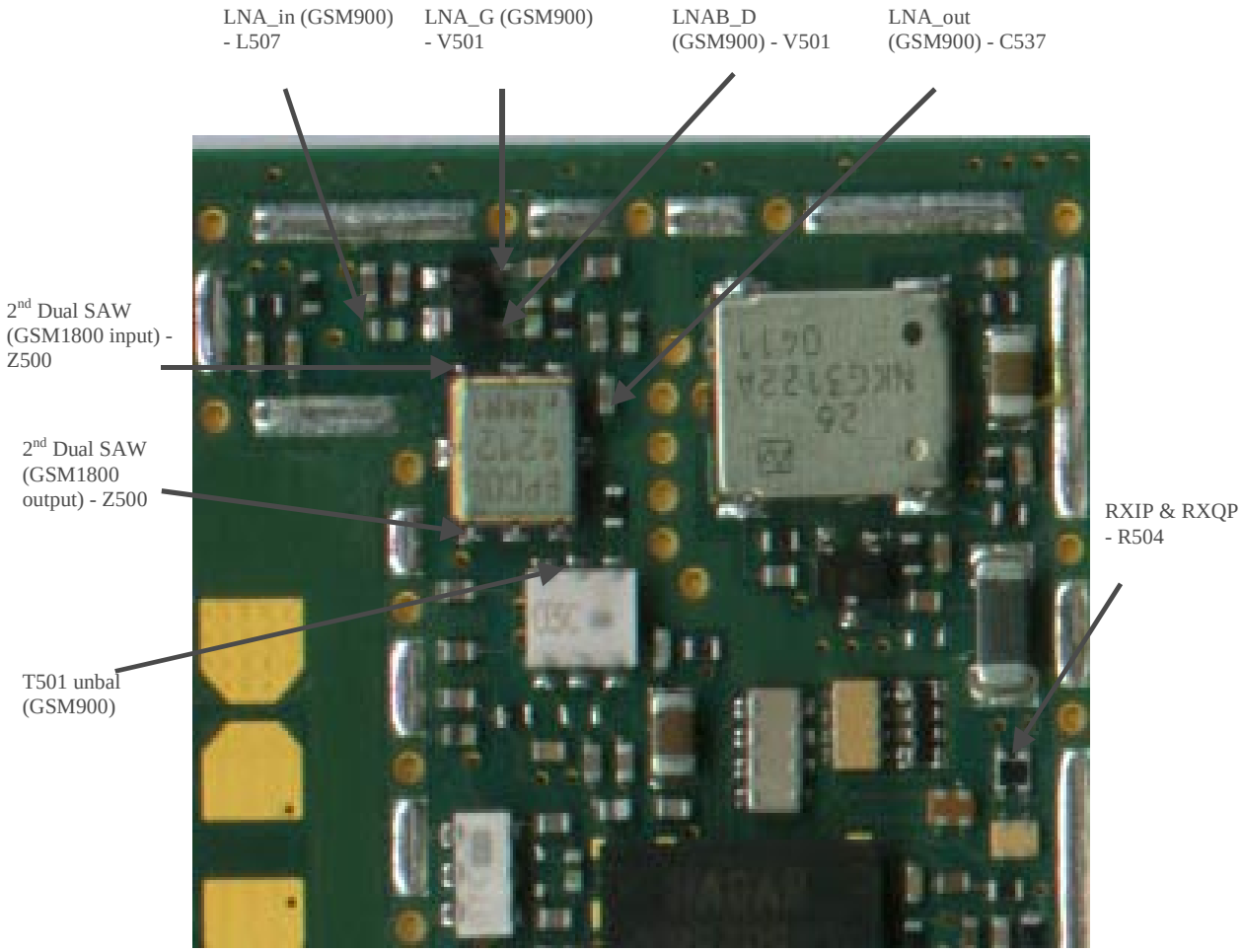

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GSM900 Receiver Troubleshooting

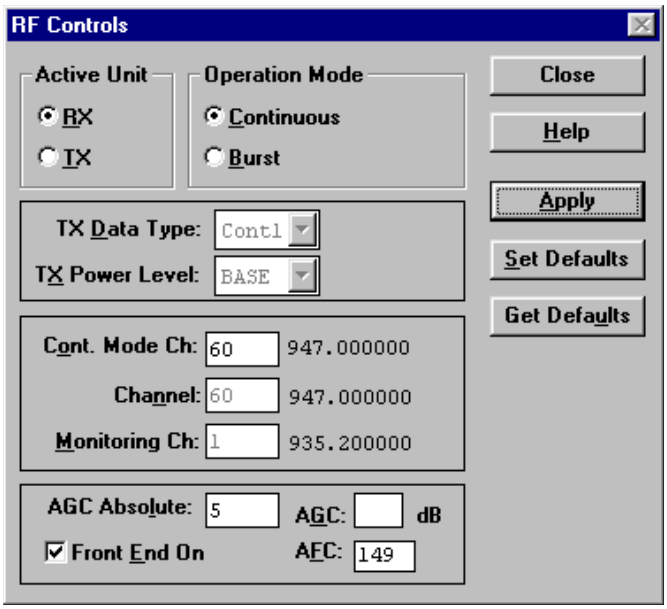
General instructions for GSM900 RX troubleshooting

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

Start Wintesla-Service-Software and

Select	Product	Alt+p
	Open…	
	NHM-5	
Select:	Product	Alt+p
	Band	b
	EGSM	e
Select:	Testing	Alt+e
	RF Controls	r
	RX Continuous	Alt+r
	Cont. Mode Ch: 60	Alt+o, 60
	AGC Absolute: 5	
	Apply	

The set-up should now look like this:



Apply a 947.0667 MHz (channel 60 + 67.710kHz offset) -55 dBm signal to the RF-connector.

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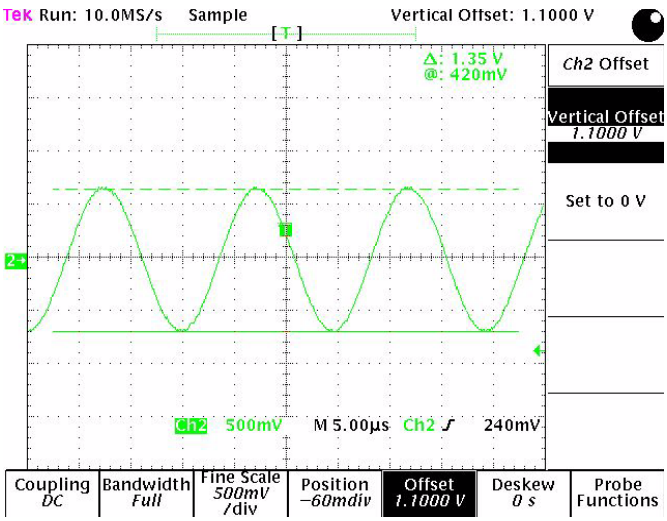
Measuring with an oscilloscope on “RXIP” or “RXQP” this picture should be seen on a working GSM900 receiver:



Signal amplitude ~1.35V

DC offset 1,1V

Frequency 67kHz

If this picture is not seen go to section Fault finding chart for GSM900 receiver of this document

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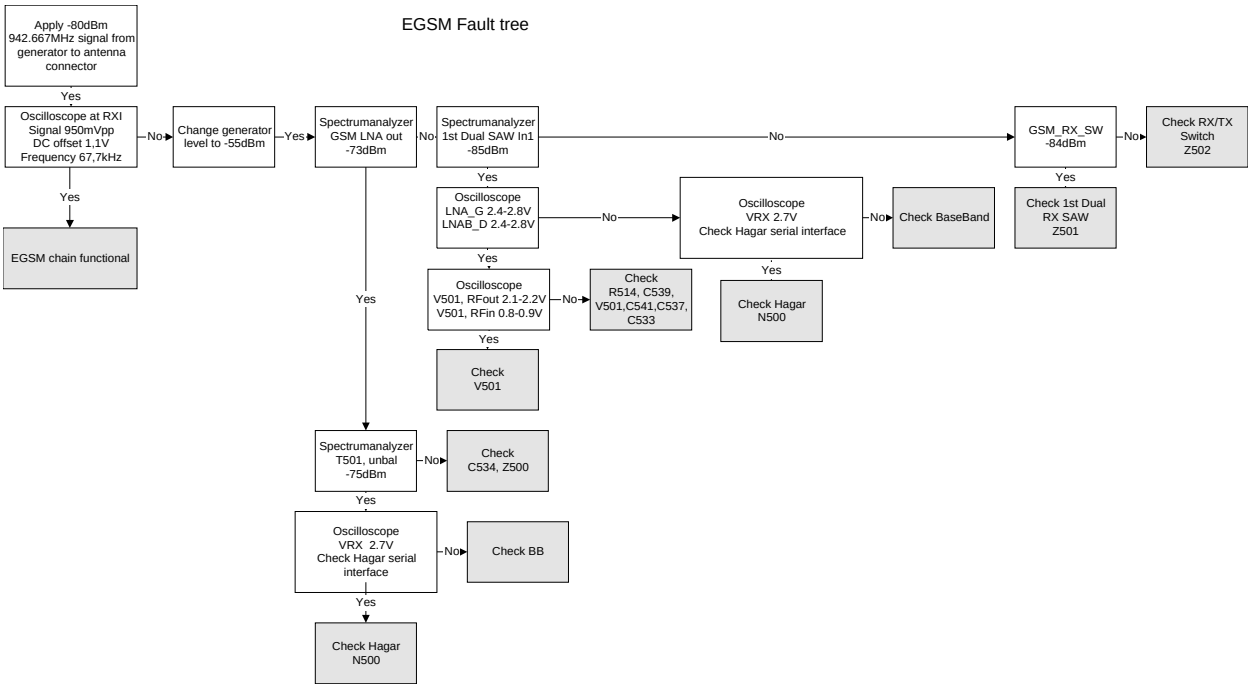
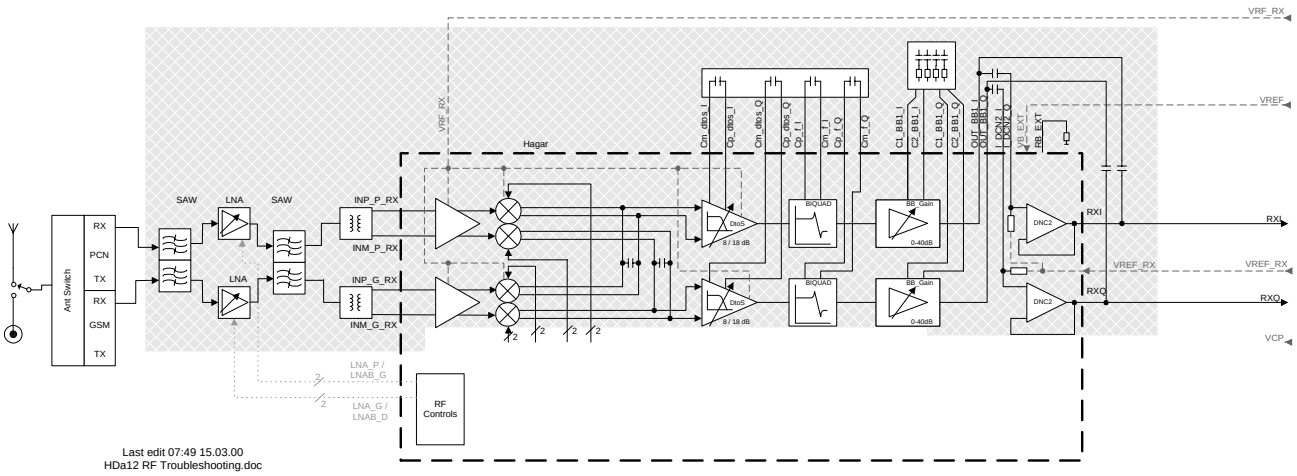
Fault finding chart for GSM900 receiver



GSM900 Signal path

For easy error tracing it is important to know the signal path of the GSM900 receiver. The components can be grouped into blocks and drawn as shown below.



RX/TX Switch

From the antenna-pad the RF signal is lead to the RX/TX switch (Z502).

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 the GSM900 signal is pass to GSM_Rx and the GSM1800 signal to DCS_Rx.

From GSM_Rx the GSM900 signal is feed to the 1st Dual RX SAW filter via C556.

Front-end

The GSM900 front-end consists mainly of two SAW filters (Z501 and Z500) and one LNA (V501) in-between and finally one balun (T501). 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 Z501 (In-band insertion-loss 3,5dB), through the matching circuit (C545, L507 and C541) and to the GSM900 LNA (V501, RFin).

The LNA has about 18dB gain when it is "on" (LNA_G = 2.8V and LNAB_D = 2.8V). If the signal applied to the antenna-connector is more than –45dBm the AGC will gain-step the LNA (LNA_G = 2.8V and LNAB_D = 0V) which means the LNA Gain will now have negative gain (loss) of –12 dB.

From the LNA (V501 RF out) the signal is lead through the LNA-output-matching-circuit (C537, L520 and C534), through the 2nd Dual RX SAW Z500 (In-band insertion-loss 3,5dB) to the GSM900 balun T501. From the balun the signal is balanced and is lead to Hagar (N500 IMP_G_RX and INM_G_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 single-ended signal in the DtoS (Differential to Single-ended) amplifier. The signal is now filtered in a BIQUAD filter to provide channel separation,

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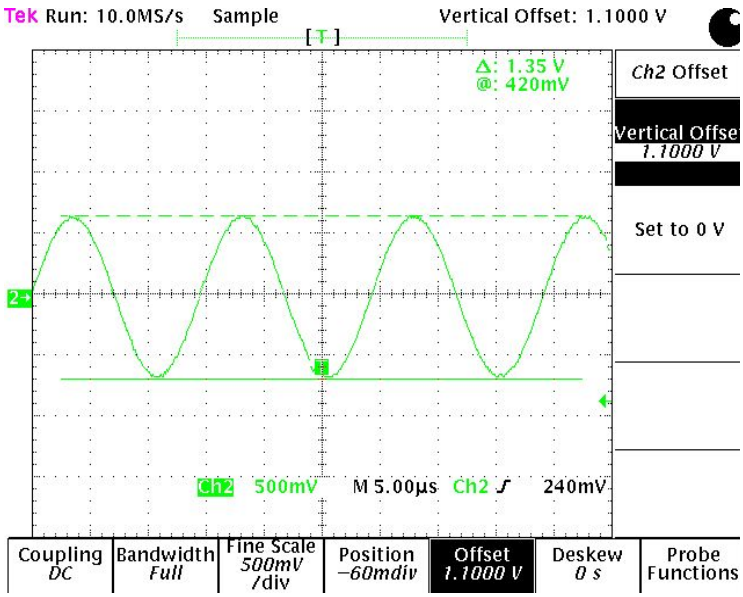
amplified in the BB_Gain amplifier and DC compensated in DCN2.

GSM1800 Receiver Troubleshooting

General instructions for GSM1800 RX troubleshooting

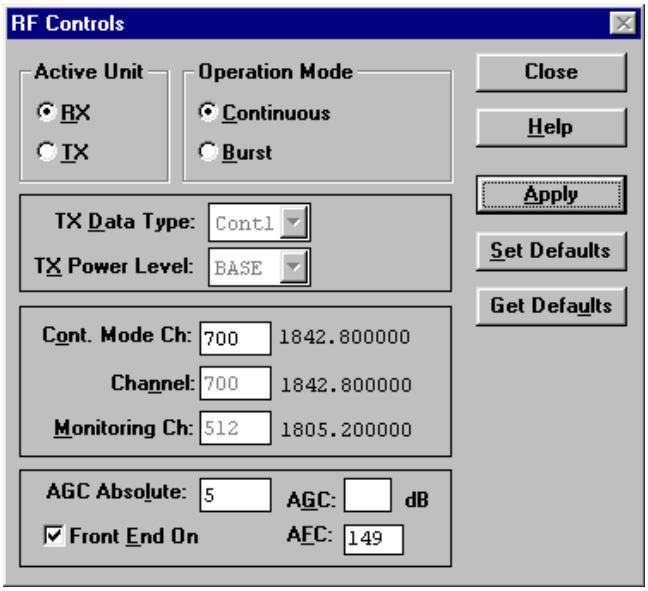


Connect the phone to a PC with the module repair jig.

Start Wintesla-Service-Software and

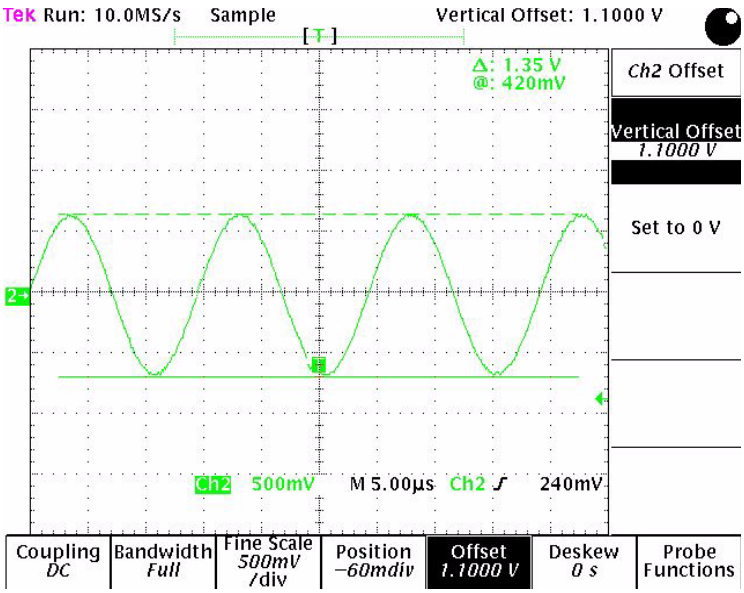
Select	Product	Alt+p
	Open…	
	NHM-5	
Select:	Product	Alt+p
	Band	b
	PCN	p
Select:	Testing	Alt+e
	RF Controls	r
	RX Continuous	Alt+r
	Cont. Mode Ch: 700	Alt+o, 700
	AGC Absolute: 5	
	Apply	

The set-up should now look like this:



Apply an 1842.867 MHz (channel 700 + 67.710kHz offset) -55 dBm signal to the RF connection (remember to compensate for cable and adapter attenuation).

Measuring with an oscilloscope on “Hagar RXI” or “Hagar RXQ” this picture should be seen on a working GSM1800 receiver:



Signal amplitude	~1.35V
DC offset	1,1V
Frequency	67kHz

If this picture is not seen not go to section Fault finding chart for GSM1800 receiver of this document

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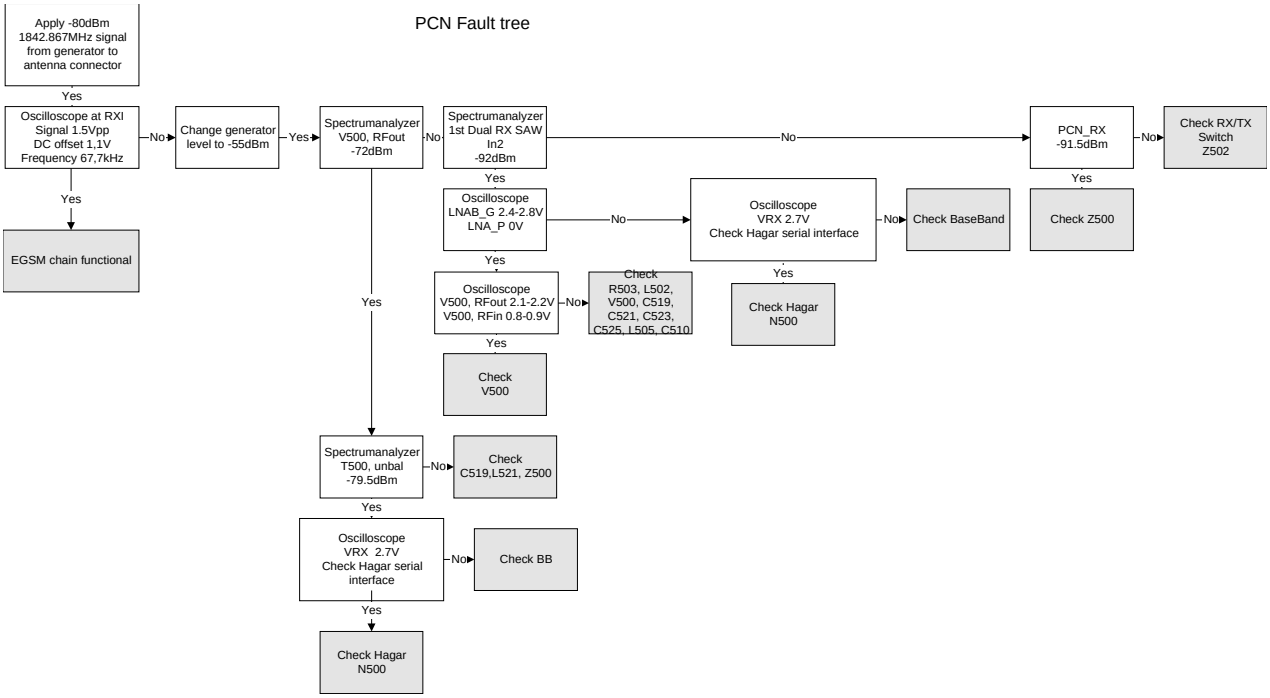
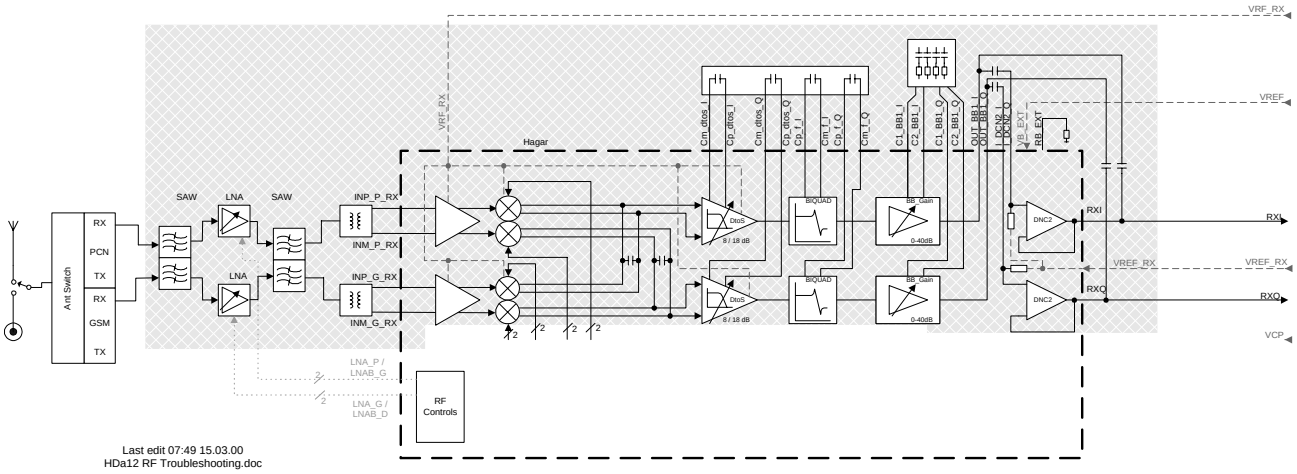
Fault finding chart for GSM1800 receiver



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.



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RX/TX Switch

From the antenna-pad the RF signal is lead to the RX/TX switch (Z502).

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 the GSM900 signal is pass to GSM_Rx and the GSM1800 signal to DCS_Rx.

From GSM_Rx the GSM1800 signal is feed to the 1st Dual RX SAW filter via C547.

Front-end

The GSM1800 front-end consists mainly of two SAW filters (Z501 and Z500) and one LNA (V500) in-between and finally one balun (T500). 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 Z501 (In-band insertion-loss 3,5dB), through the matching circuit (C510, L505 and C525) and to the GSM1800 LNA (V500, RFin).

The LNA has about 17dB gain when it is "on" (LNAB_G = 2.8V and LNA_P = 0V). If the signal applied to the antenna-connector is more than –45dBm the AGC will gain-step the LNA (LNAB_G = 2.8V and LNA_P = 0V) which means the LNA Gain will now have negative gain (loss) of –8 dB.

From the LNA (V500 RF out) the signal is lead through the LNA-output-matching-circuit (C519), through the 2nd Dual RX SAW Z500 (In-band insertion-loss 3,5dB) to the GSM1800 balun T500. From the balun the signal is balanced and is lead to Hagar (N500 IMP_P_RX and INM_P_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 single-ended signal in the DtoS (Differential to Single-ended) amplifier. The signal is now filtered in a BIQUAD filter to provide channel separation, amplified in the BB_Gain amplifier and DC compensated in DCN2.

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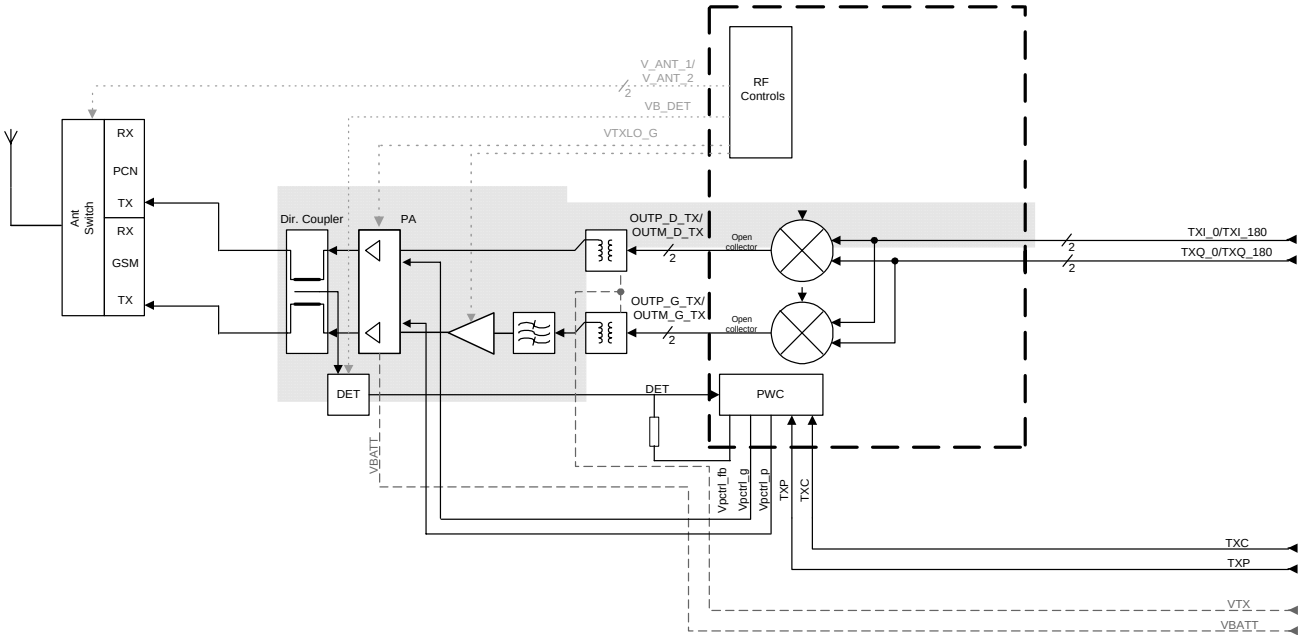
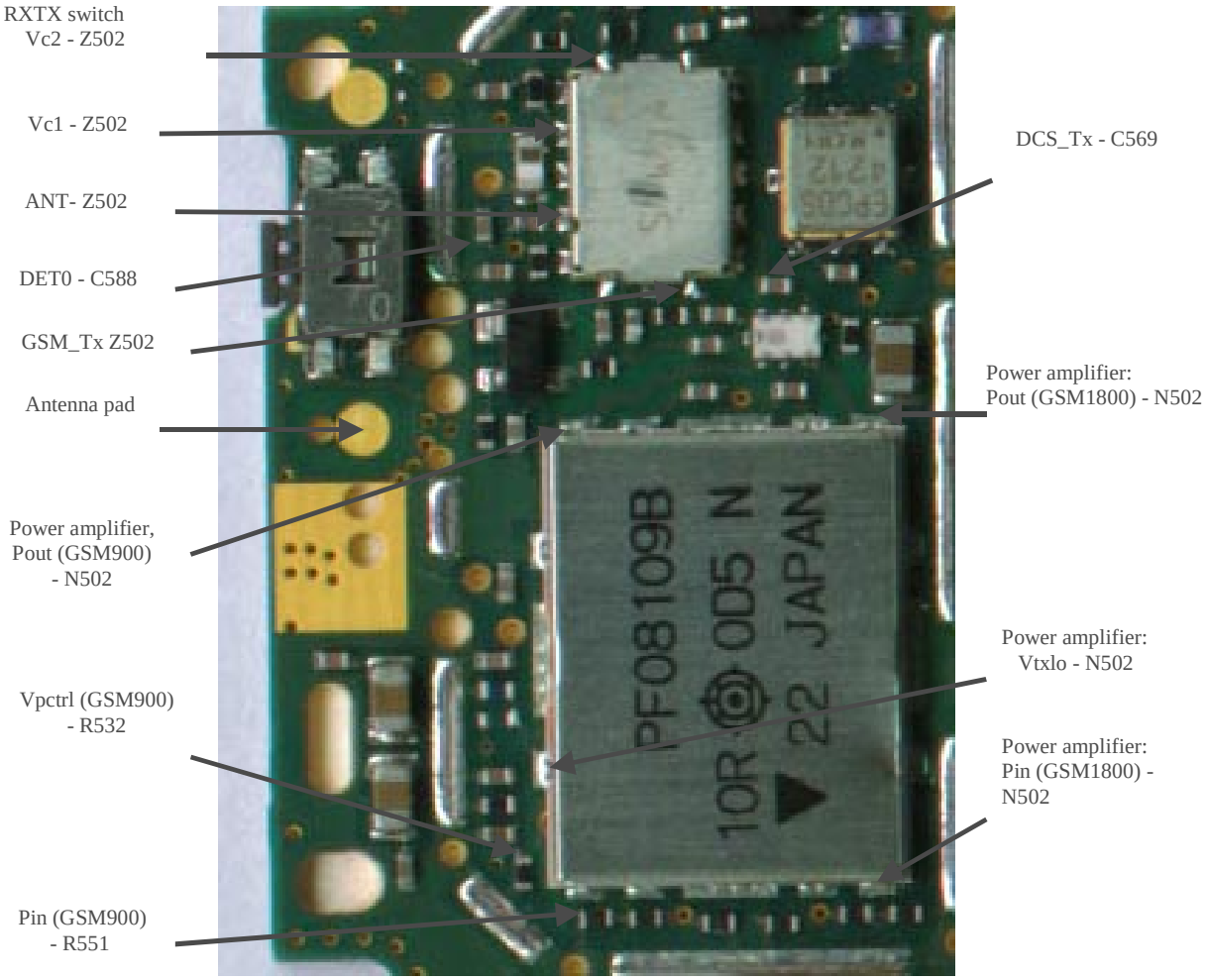
GSM900 Transmitter



TX measurement points



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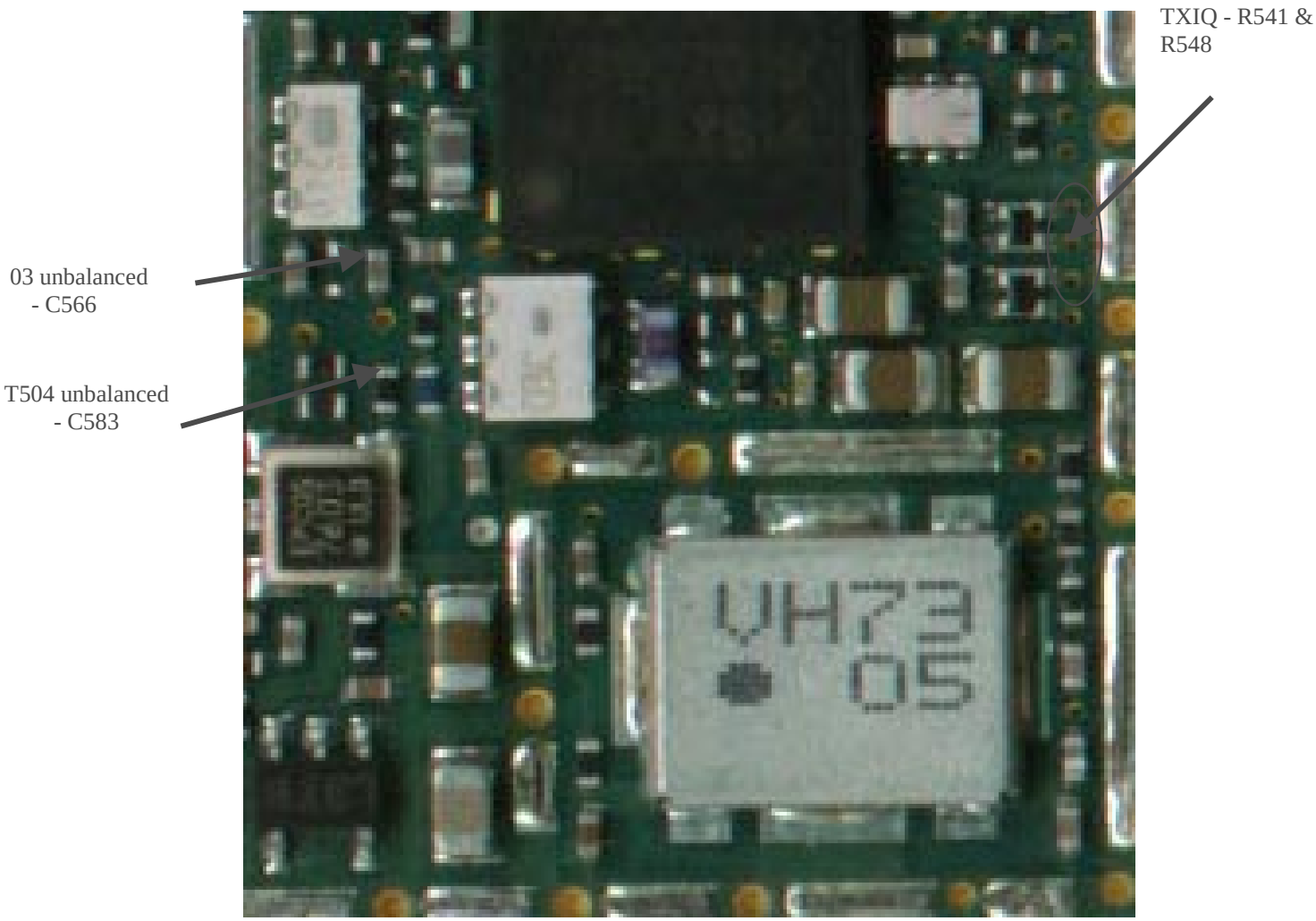

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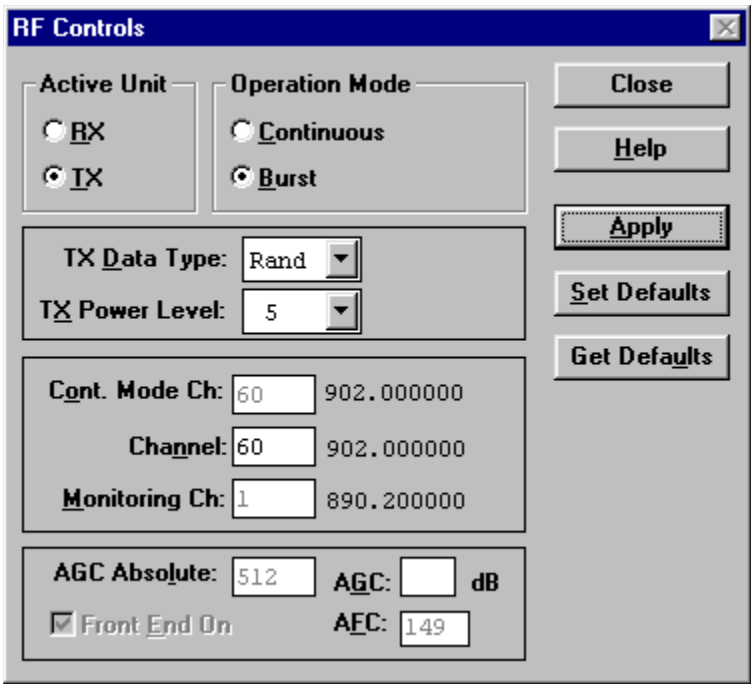
General instructions for GSM900 TX troubleshooting

Start WinTesla-Service-Software and

Select:	Product	Alt+p
	Band	b
	GSM	g
Select:	Testing	Alt+e
	RF Controls	r
	TX Burst	Alt+b
	TX Data Type: Random	Alt+d, r
	TX Power Level : 5	Alt+x, 5
	Channel: 60	Alt+n, 60
	Apply	Alt+a

Your screen should look like this:



Measure the output power of the phone; it should be around 32 dBm.

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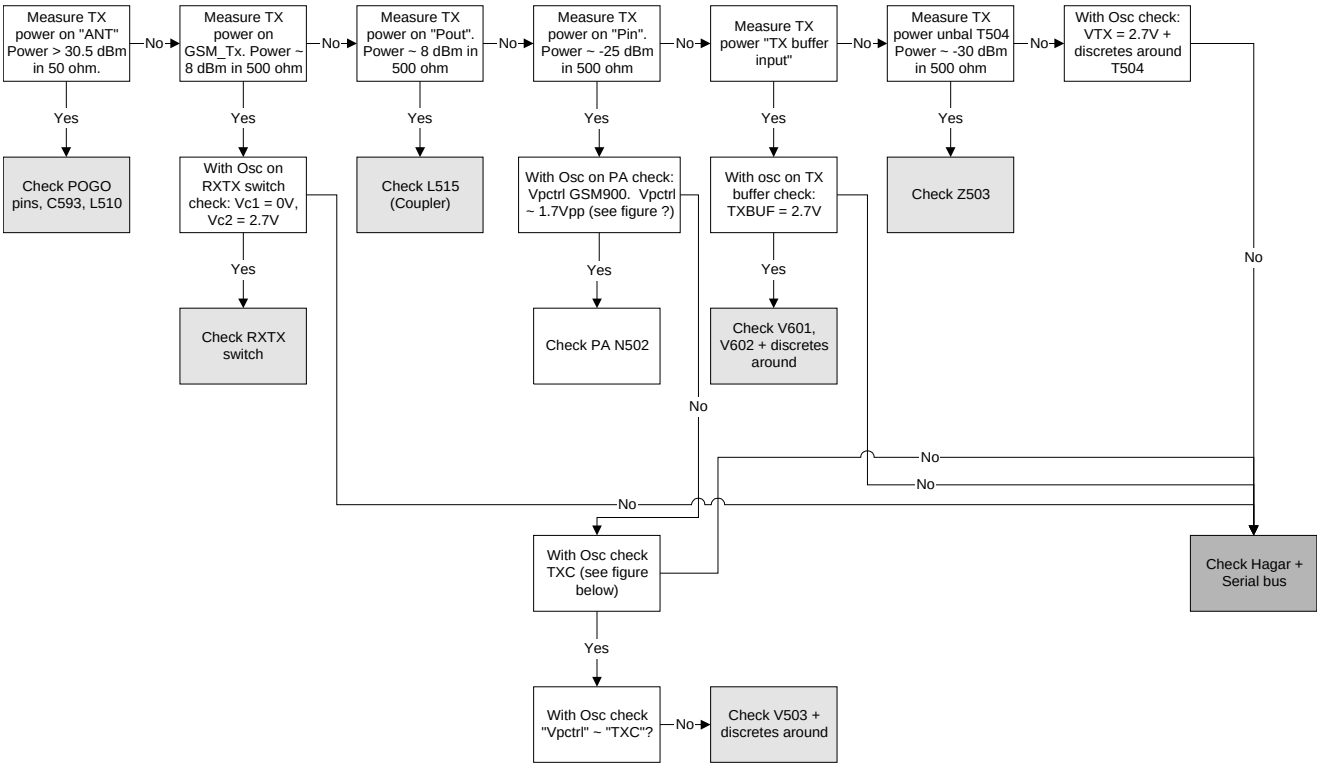
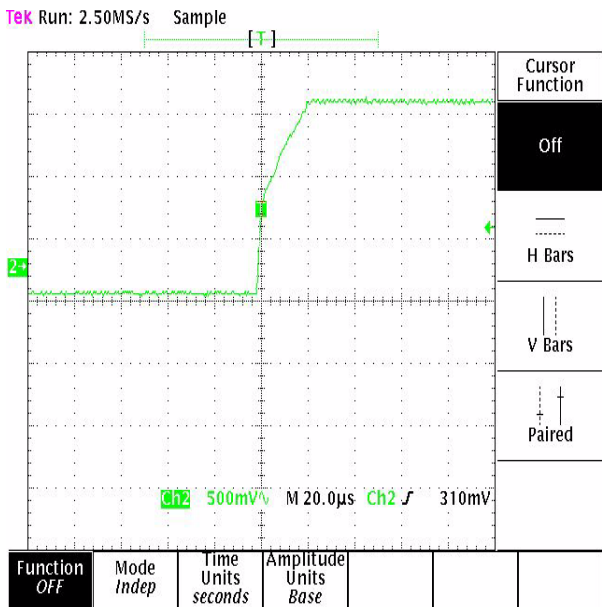
Fault finding chart for GSM900 transmitter

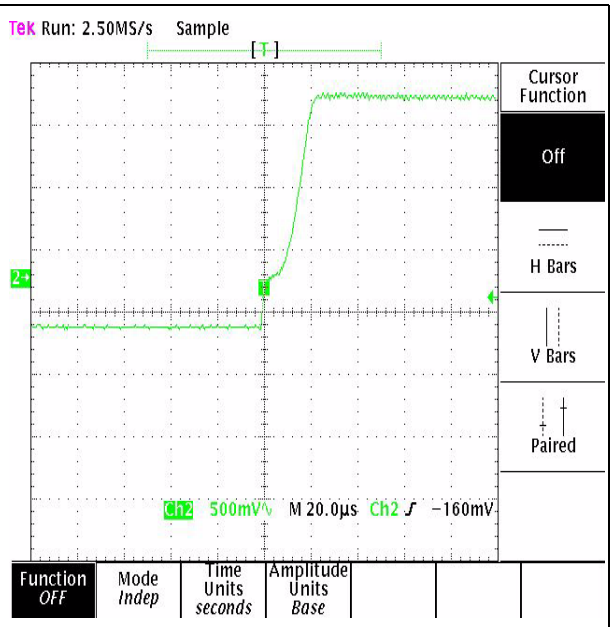
Fault finding in output power

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





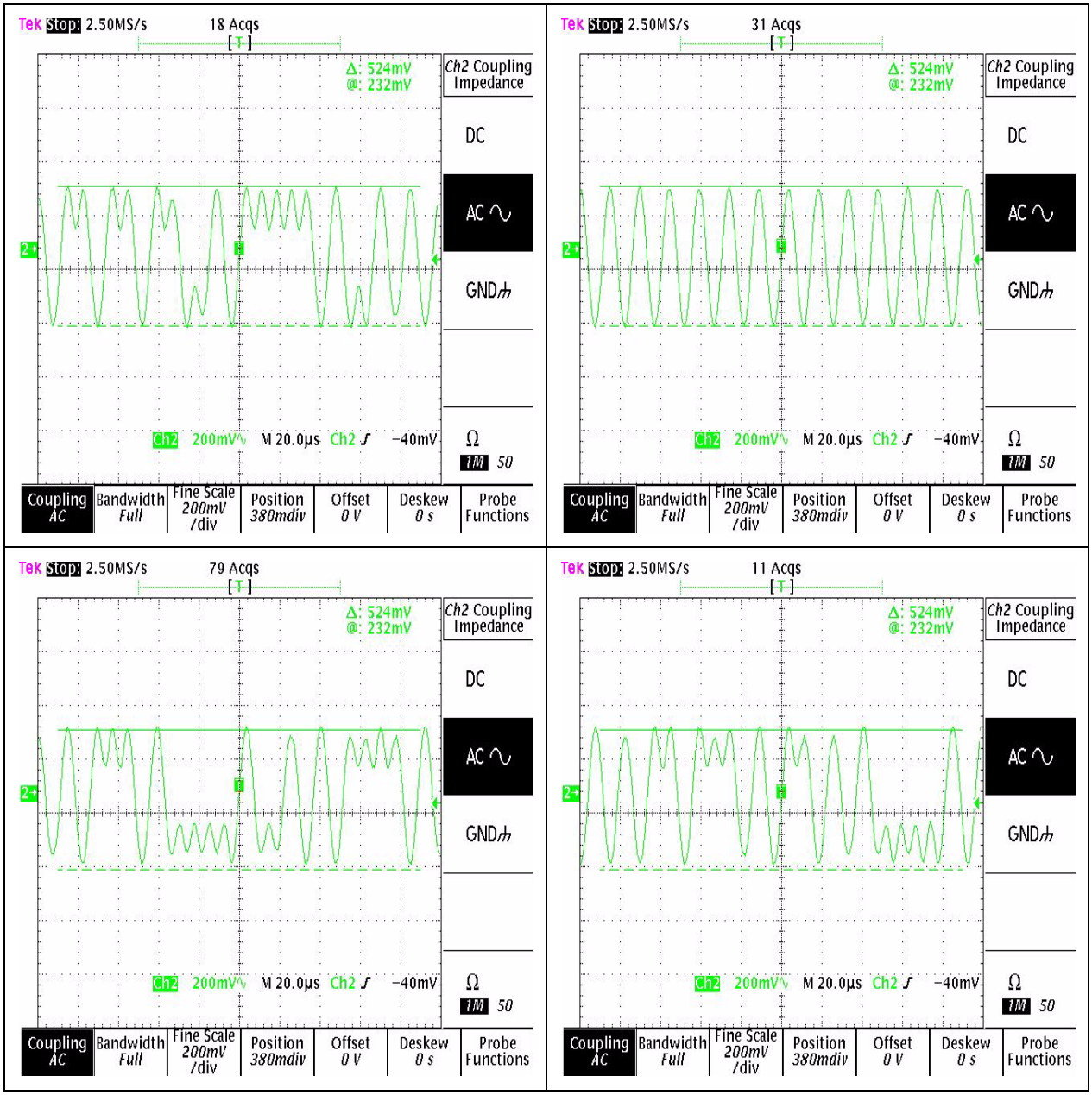
Vpctrl GSM 900 @ power level 5



TXC signal @ power level 5

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.



For how to check Hagar and serial bus see section Hagar and serial interface.

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PCN Transmitter

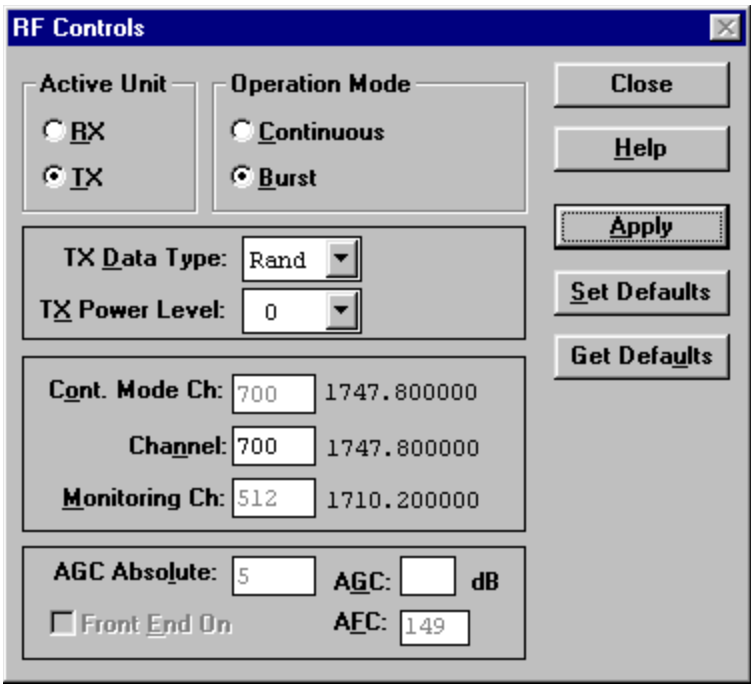
General instructions for PCN TX troubleshooting

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 WinTesla-Service-Software and

Select:	Product	Alt+p
	Band	b
	PCN	p
Select:	Testing	Alt+e
	RF Controls	r
	TX Burst	Alt+b
	TX Data Type: Random	Alt+d, r
	TX Power Level: 0	Alt+x, 0
	Channel: 700	Alt+n, 700
	Apply	Alt+a

Your screen should look like:



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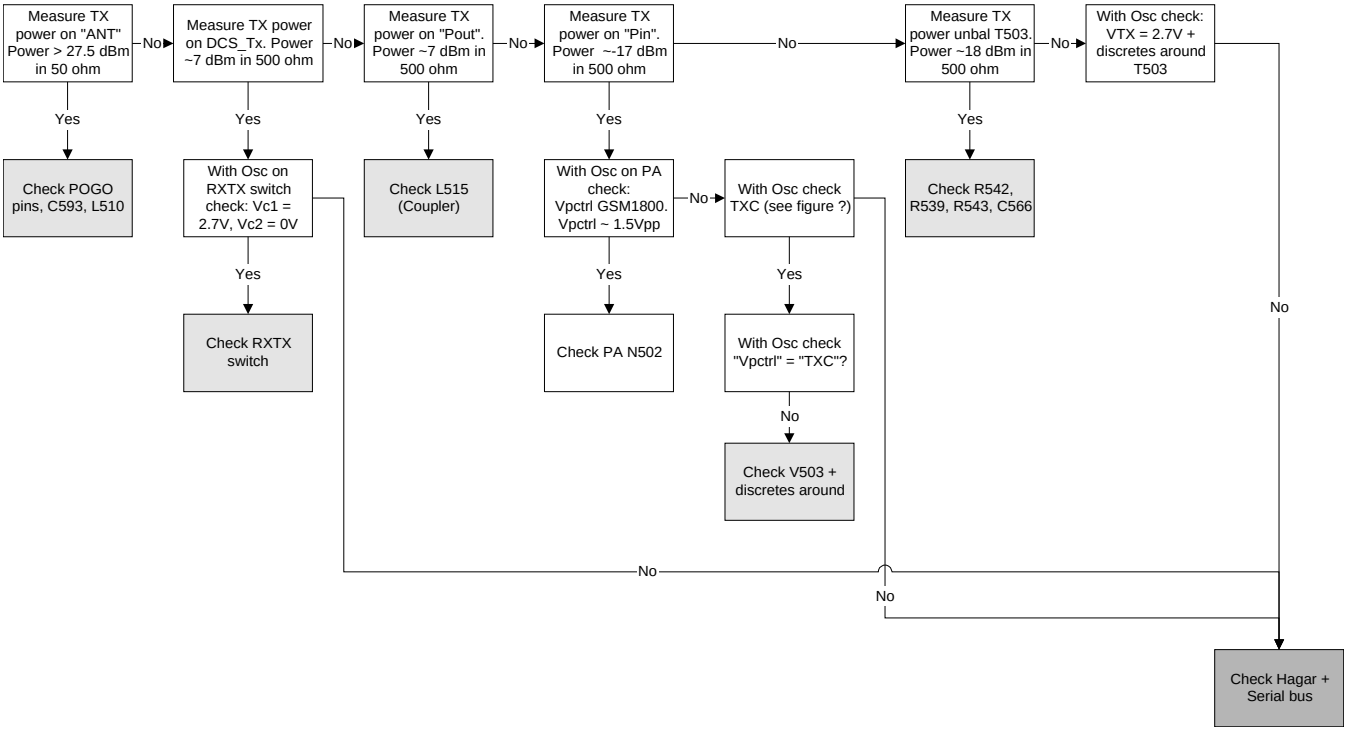
Path of the transmitted PCN signal

Fault finding chart for PCN transmitter



TXIQ signals look the same in PCN and GSM.

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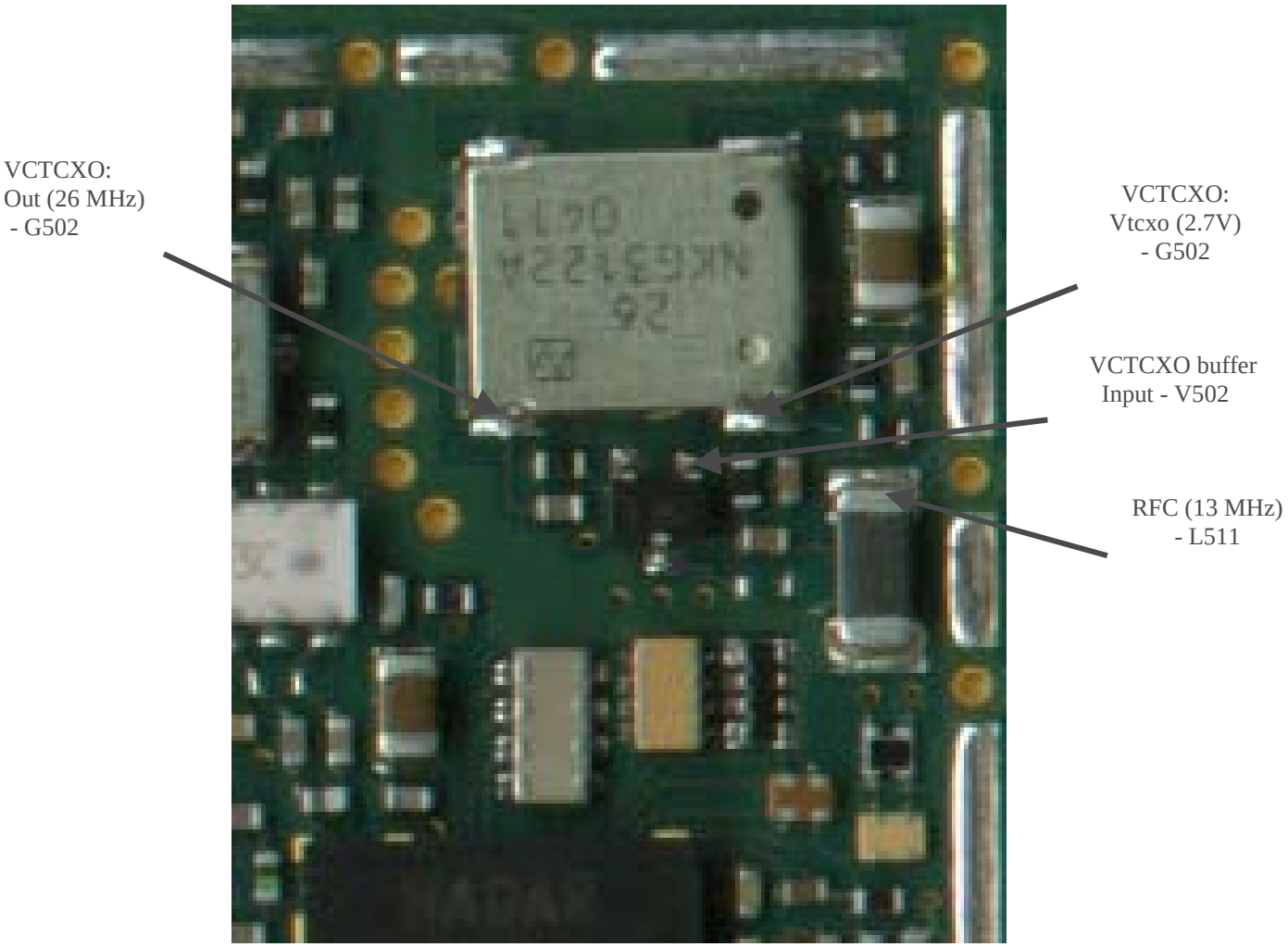
Synthesizer

There is only one PLL synthesizer 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.

Measurement points at the VCTCXO



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General instructions for Synthesizer troubleshooting

Start WinTesla-Service-Software and

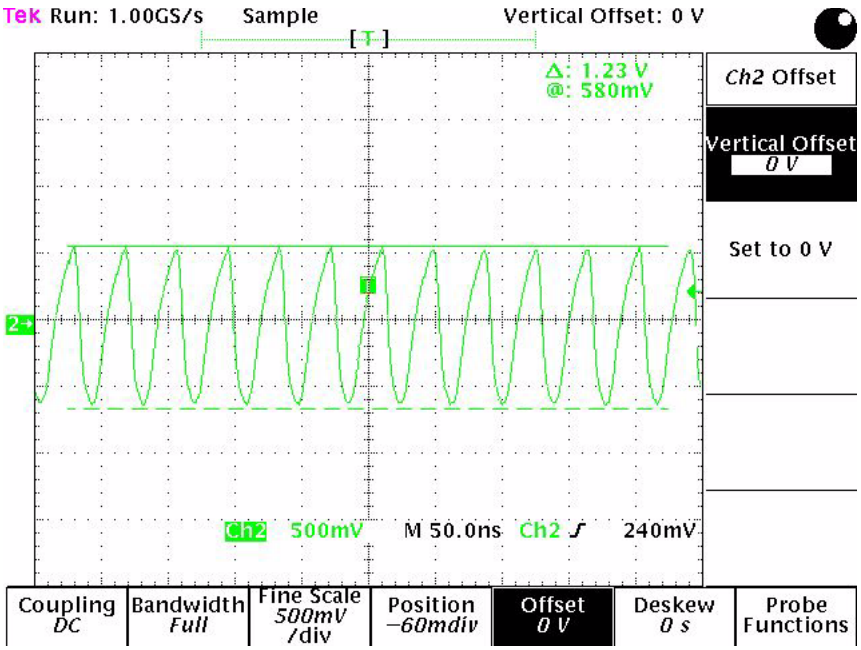
Select:	Product	Alt+p
	Band	b
	EGSM	e
Select:	Testing	Alt+e
	RF Controls	r
	RX Continuous	Alt+r
	Cont. Mode Ch: 60	Alt+o, 60

Measure the output of the VCO (G500) with spectrum analyzer and 500 ohm passive probe; the power should be around –20 dBm.

26 MHz reference oscillator (VCTCXO)

The 26 MHz oscillator (G502) is used as a reference frequency for the PLL synthesizer 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.

Measuring on the VCTCXO component



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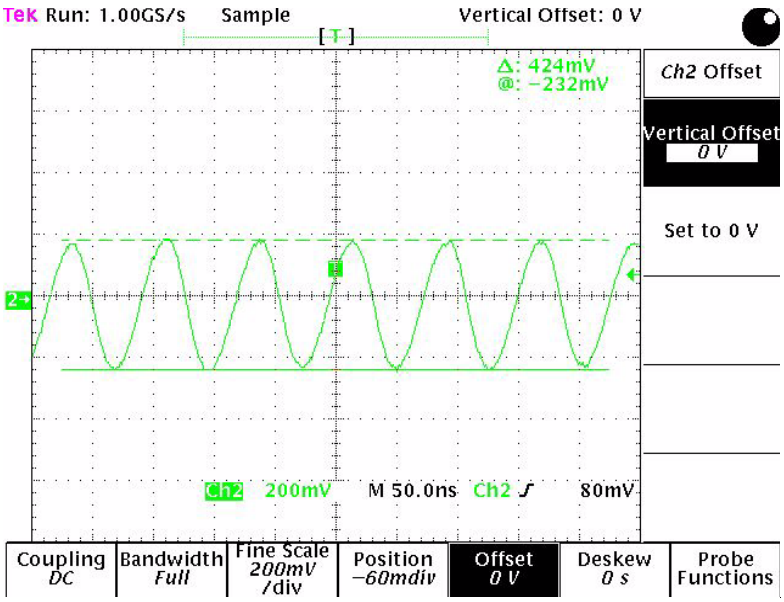
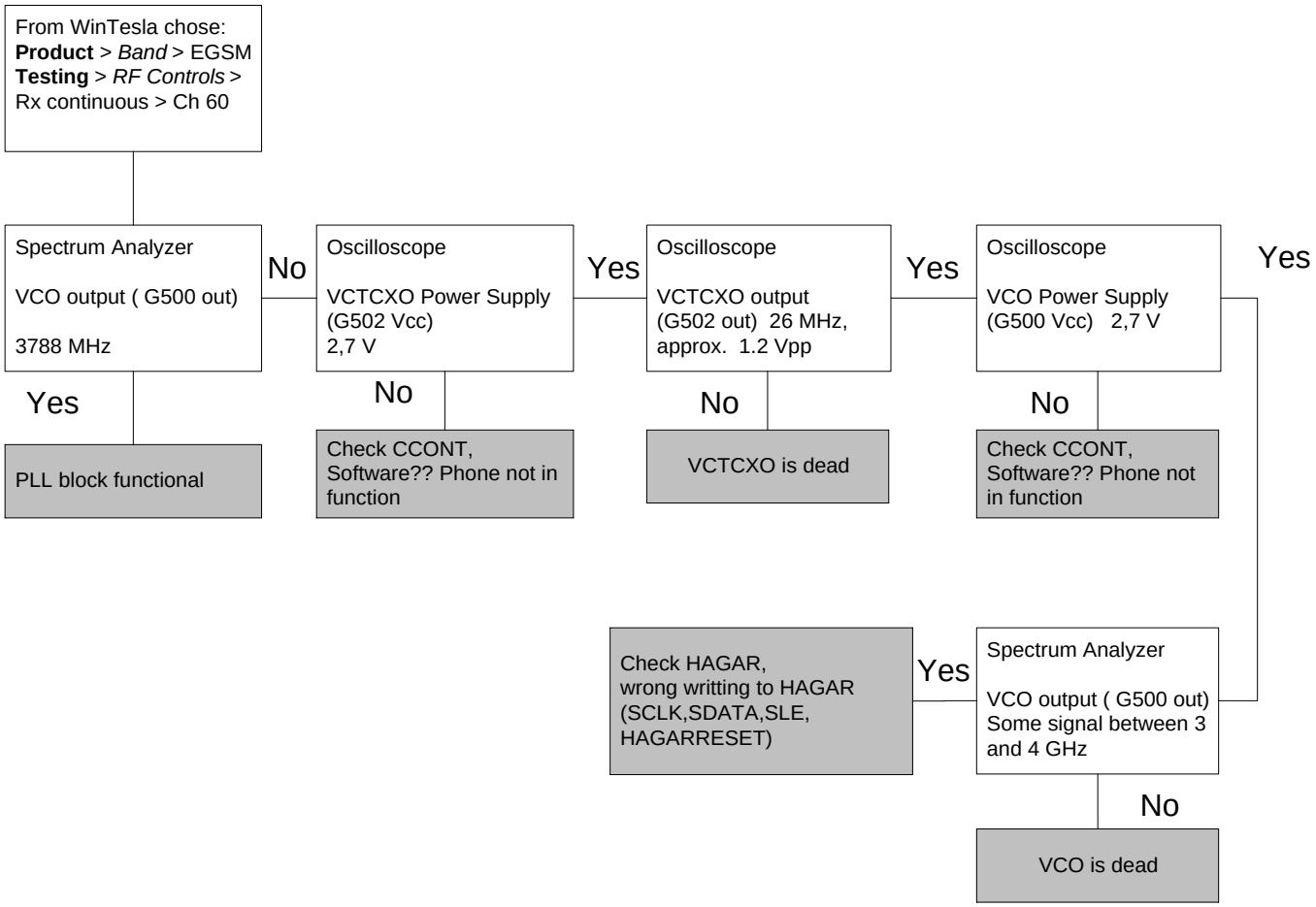
Measuring on the VCTCXO buffer



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 in lock state (Vc out of range) there is some frequency at the output of the VCO (G500) which is between 3 and 4 GHz. This is of course true only if VCO is working and if VCO power supply is present (2.7V).

Fault finding chart for PLL Synthesizer



It is important to say that power supply for VCTCXO (VXO) is OFF only in 'Deep Sleep Mode' and power supply for VCO (G500 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.

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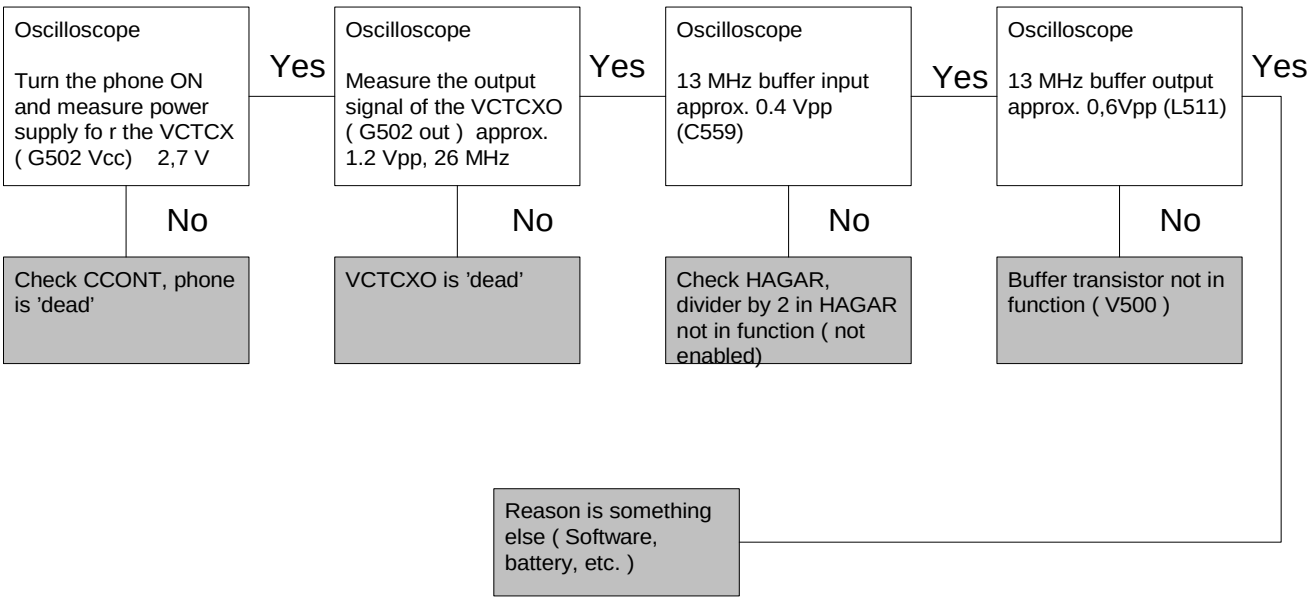
Oscilloscope
Turn the phone ON and measure power supply fo r the VCTCX (G502 Vcc) 2,7 V
Yes
Oscilloscope
Measure the output signal of the VCTCXO (G502 out) approx. 1.2 Vpp, 26 MHz
Yes
Oscilloscope
13 MHz buffer input approx. 0.4 Vpp (C559)
Yes
Oscilloscope
13 MHz buffer output approx. 0,6Vpp (L511)
Yes
No
Check CCONT, phone is 'dead'
No
VCTCXO is 'dead'
No
Check HAGAR, divider by 2 in HAGAR not in function (not enabled)
No
Buffer transistor not in function (V500)
Reason is something else (Software, battery, etc.)

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

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PCN

Frequency list NHM-5 GSM1800

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1710.2	1805.2	3420.4	3610.4	606	1729	1824	3458	3648	700	1747.8	1842.8	3495.6	3685.6	794	1766.6	1861.6	3533.2	3723.2
513	1710.4	1805.4	6841.6	7221.6	607	1729.2	1824.2	3458.4	3648.4	701	1748	1843	3496	3686	795	1766.8	1861.8	3533.6	3723.6
514	1710.6	1805.6	6842.4	7222.4	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	796	1767	1862	3534	3724
515	1710.8	1805.8	6843.2	7223.2	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	797	1767.2	1862.2	3534.4	3724.4
516	1711	1806	6844	7224	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	798	1767.4	1862.4	3534.8	3724.8
517	1711.2	1806.2	6844.8	7224.8	611	1730	1825	3460	3650	705	1748.8	1843.8	3497.6	3687.6	799	1767.6	1862.6	3535.2	3725.2
518	1711.4	1806.4	6845.6	7225.6	612	1730.2	1825.2	3460.4	3650.4	706	1749	1844	3498	3688	800	1767.8	1862.8	3535.6	3725.6
519	1711.6	1806.6	6846.4	7226.4	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	801	1768	1863	3536	3726
520	1711.8	1806.8	6847.2	7227.2	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	802	1768.2	1863.2	3536.4	3726.4
521	1712	1807	6848	7228	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	803	1768.4	1863.4	3536.8	3726.8
522	1712.2	1807.2	6848.8	7228.8	616	1731	1826	3462	3652	710	1749.8	1844.8	3499.6	3689.6	804	1768.6	1863.6	3537.2	3727.2
523	1712.4	1807.4	6849.6	7229.6	617	1731.2	1826.2	3462.4	3652.4	711	1750	1845	3500	3690	805	1768.8	1863.8	3537.6	3727.6
524	1712.6	1807.6	6850.4	7230.4	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	806	1769	1864	3538	3728
525	1712.8	1807.8	6851.2	7231.2	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	807	1769.2	1864.2	3538.4	3728.4
526	1713	1808	6852	7232	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	808	1769.4	1864.4	3538.8	3728.8
527	1713.2	1808.2	6852.8	7232.8	621	1732	1827	3464	3654	715	1750.8	1845.8	3501.6	3691.6	809	1769.6	1864.6	3539.2	3729.2
528	1713.4	1808.4	6853.6	7233.6	622	1732.2	1827.2	3464.4	3654.4	716	1751	1846	3502	3692	810	1769.8	1864.8	3539.6	3729.6
529	1713.6	1808.6	6854.4	7234.4	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	811	1770	1865	3540	3730
530	1713.8	1808.8	6855.2	7235.2	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	812	1770.2	1865.2	3540.4	3730.4
531	1714	1809	6856	7236	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	813	1770.4	1865.4	3540.8	3730.8
532	1714.2	1809.2	6856.8	7236.8	626	1733	1828	3466	3656	720	1751.8	1846.8	3503.6	3693.6	814	1770.6	1865.6	3541.2	3731.2
533	1714.4	1809.4	6857.6	7237.6	627	1733.2	1828.2	3466.4	3656.4	721	1752	1847	3504	3694	815	1770.8	1865.8	3541.6	3731.6
534	1714.6	1809.6	6858.4	7238.4	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	816	1771	1866	3542	3732
535	1714.8	1809.8	6859.2	7239.2	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	817	1771.2	1866.2	3542.4	3732.4
536	1715	1810	6860	7240	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	818	1771.4	1866.4	3542.8	3732.8
537	1715.2	1810.2	6860.8	7240.8	631	1734	1829	3468	3658	725	1752.8	1847.8	3505.6	3695.6	819	1771.6	1866.6	3543.2	3733.2
538	1715.4	1810.4	6861.6	7241.6	632	1734.2	1829.2	3468.4	3658.4	726	1753	1848	3506	3696	820	1771.8	1866.8	3543.6	3733.6
539	1715.6	1810.6	6862.4	7242.4	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	821	1772	1867	3544	3734
540	1715.8	1810.8	6863.2	7243.2	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	822	1772.2	1867.2	3544.4	3734.4
541	1716	1811	6864	7244	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	823	1772.4	1867.4	3544.8	3734.8
542	1716.2	1811.2	6864.8	7244.8	636	1735	1830	3470	3660	730	1753.8	1848.8	3507.6	3697.6	824	1772.6	1867.6	3545.2	3735.2
543	1716.4	1811.4	6865.6	7245.6	637	1735.2	1830.2	3470.4	3660.4	731	1754	1849	3508	3698	825	1772.8	1867.8	3545.6	3735.6
544	1716.6	1811.6	6866.4	7246.4	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	826	1773	1868	3546	3736
545	1716.8	1811.8	6867.2	7247.2	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	827	1773.2	1868.2	3546.4	3736.4
546	1717	1812	6868	7248	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	828	1773.4	1868.4	3546.8	3736.8
547	1717.2	1812.2	6868.8	7248.8	641	1736	1831	3472	3662	735	1754.8	1849.8	3509.6	3699.6	829	1773.6	1868.6	3547.2	3737.2
548	1717.4	1812.4	6869.6	7249.6	642	1736.2	1831.2	3472.4	3662.4	736	1755	1850	3510	3700	830	1773.8	1868.8	3547.6	3737.6
549	1717.6	1812.6	6870.4	7250.4	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	831	1774	1869	3548	3738
550	1717.8	1812.8	6871.2	7251.2	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	832	1774.2	1869.2	3548.4	3738.4
551	1718	1813	6872	7252	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	833	1774.4	1869.4	3548.8	3738.8
552	1718.2	1813.2	6872.8	7252.8	646	1737	1832	3474	3664	740	1755.8	1850.8	3511.6	3701.6	834	1774.6	1869.6	3549.2	3739.2
553	1718.4	1813.4	6873.6	7253.6	647	1737.2	1832.2	3474.4	3664.4	741	1756	1851	3512	3702	835	1774.8	1869.8	3549.6	3739.6
554	1718.6	1813.6	6874.4	7254.4	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	836	1775	1870	3550	3740
555	1718.8	1813.8	6875.2	7255.2	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	837	1775.2	1870.2	3550.4	3740.4
556	1719	1814	6876	7256	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	838	1775.4	1870.4	3550.8	3740.8
557	1719.2	1814.2	6876.8	7256.8	651	1738	1833	3476	3666	745	1756.8	1851.8	3513.6	3703.6	839	1775.6	1870.6	3551.2	3741.2
558	1719.4	1814.4	6877.6	7257.6	652	1738.2	1833.2	3476.4	3666.4	746	1757	1852	3514	3704	840	1775.8	1870.8	3551.6	3741.6
559	1719.6	1814.6	6878.4	7258.4	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	841	1776	1871	3552	3742
560	1719.8	1814.8	6879.2	7259.2	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	842	1776.2	1871.2	3552.4	3742.4
561	1720	1815	6880	7260	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	843	1776.4	1871.4	3552.8	3742.8
562	1720.2	1815.2	6880.8	7260.8	656	1739	1834	3478	3668	750	1757.8	1852.8	3515.6	3705.6	844	1776.6	1871.6	3553.2	3743.2
563	1720.4	1815.4	6881.6	7261.6	657	1739.2	1834.2	3478.4	3668.4	751	1758	1853	3516	3706	845	1776.8	1871.8	3553.6	3743.6
564	1720.6	1815.6	6882.4	7262.4	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	846	1777	1872	3554	3744
565	1720.8	1815.8	6883.2	7263.2	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	847	1777.2	1872.2	3554.4	3744.4
566	1721	1816	6884	7264	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	848	1777.4	1872.4	3554.8	3744.8
567	1721.2	1816.2	6884.8	7264.8	661	1740	1835	3480	3670	755	1758.8	1853.8	3517.6	3707.6	849	1777.6	1872.6	3555.2	3745.2
568	1721.4	1816.4	6885.6	7265.6	662	1740.2	1835.2	3480.4	3670.4	756	1759	1854	3518	3708	850	1777.8	1872.8	3555.6	3745.6
569	1721.6	1816.6	6886.4	7266.4	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	851	1778	1873	3556	3746
570	1721.8	1816.8	6887.2	7267.2	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	852	1778.2	1873.2	3556.4	3746.4
571	1722	1817	6888	7268	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	853	1778.4	1873.4	3556.8	3746.8
572	1722.2	1817.2	6888.8	7268.8	666	1741	1836	3482	3672	760	1759.8	1854.8	3519.6	3709.6	854	1778.6	1873.6	3557.2	3747.2
573	1722.4	1817.4	6889.6	7269.6	667	1741.2	1836.2	3482.4	3672.4	761	1760	1855	3520	3710	855	1778.8	1873.8	3557.6	3747.6
574	1722.6	1817.6	6890.4	7270.4	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	856	1779	1874	3558	3748
575	1722.8	1817.8	6891.2	7271.2	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	857	1779.2	1874.2	3558.4	3748.4
576	1723	1818	6892	7272	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	858	1779.4	1874.4	3558.8	3748.8
577	1723.2	1818.2	6892.8	7272.8	671	1742	1837	3484	3674	765	1760.8	1855.8	3521.6	3711.6	859	1779.6	1874.6	3559.2	3749.2
578	1723.4	1818.4	6893.6	7273.6	672	1742.2	1837.2	3484.4	3674.4	766	1761	1856	3522	3712	860	1779.8	1874.8	3559.6	3749.6
579	1723.6	1818.6	6894.4	7274.4	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	861	1780	1875	3560	3750
580	1723.8	1818.8	6895.2	7275.2	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	862	1780.2	1875.2	3560.4	3750.4
581	1724	1819	6896	7276	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	863	1780.4	1875.4	3560.8	3750.8
582	1724.2	1819.2	6896.8	7276.8	676	1743	1838	3486	3676	770	1761.8	1856.8	3523.6	3713.6	864	1780.6	1875.6	3561.2	3751.2
583	1724.4	1819.4	6897.6	7277.6	677	1743.2	1838.2	3486.4	3676.4	771	1762	1857	3524	3714	865	1780.8	1875.8	3561.6	3751.6
584	1724.6	1819.6	6898.4	7278.4	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	866	1781	1876	3562	3752
585	1724.8	1819.8	6899.2	7279.2	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	867	1781.2	1876.2	3562.4	3752.4
586	1725	1820	6900	7280	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	868	1781.4	1876.4	3562.8	3752.8
587	1725.2	1820.2	6900.8	7280.8	681	1744	1839	3488	3678	775	1762.8	1857.8	3525.6	3715.6	869	1781.6	1876.6	3563.2	3753.2
588	1725.4	1820.4	6901.6	7281.6	682	1744.2	1839.2	3488.4	3678.4	776	1763	1858	3526	3716	870	1781.8	1876.8	3563.6	3753.6
589	1725.6	1820.6	6902.4	7282.4	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	871	1782	1877	3564	3754
590	1725.8	1820.8	6903.2	7283.2	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	872	1782.2	1877.2	3564.4	3754.4
591	1726	1821	6904	7284	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	873	1782.4	1877.4	3564.8	3754.8
592	1726.2	1821.2	6904.8	7284.8	686	1745	1840	3490	3680	780	1763.8	1858.8	3527.6	3717.6	874	1782.6	1877.6	3565.2	3755.2
593	1726.4	1821.4	6905.6	7285.6	687	1745.2	1840.2	3490.4	3680.4	781	1764	1859	3528	3718	875	1782.8	1877.8	3565.6	3755.6
594	1726.6	1821.6	6906.4	7286.4	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	876	1783	1878	3566	3756
595	1726.8	1821.8	6907.2	7287.2	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	877	1783.2	1878.2	3566.4	3756.4
596	1727	1822	6908	7288	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	878	1783.4	1878.4	3566.8	3756.8
597	1727.2	1822.2	6908.8	7288.8	691	1746	1841	3492	3682	785	1764.8	1859.8	3529.6	3719.6	879	1783.6	1878.6	3567.2	3757.2
598	1727.4	1822.4	6909.6	7289.6	692	1746.2	1841.2	3492.4	3682.4	786	1765	1860	3530	3720	880	1783.8	1878.8	3567.6	3757.6
599	1727.6	1822.6	6910.4	7290.4	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	881	1784	1879	3568	3758
600	1727.8	1822.8	6911.2	7291.2	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	882	1784.2	1879.2	3568.4	3758.4
601	1728	1823	6912	7292	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	883	1784.4	1879.4	3568.8	3758.8
602	1728.2	1823.2	6912.8	7292.8	696	1747	1842	3494	3684	790	1765.8	1860.8	3531.6	3721.6	884	1784.6	1879.6	3569.2	3759.2
603	1728.4	1823.4	6913.6	7293.6	697	1747.2	1842.2	3494.4	3684.4	791	1766	1861	3532	3722	885	1784.8	1879.8	3569.6	3759.6
604	1728.6	1823.6	6914.4	7294.4	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4					
605	1728.8	1823.8	6915.2	7295.2	699	1747.6	1842.6	3495.2	3685.2	793	1766.4	1861.4	3532.8	3722.8					

Hagar and serial interface

In general, if phone is not in a sleep mode, Hagar chip is always active.

This means that, as long as we have set the phone in Normal mode or in Local mode (either RX or TX band) there is going to be some Hagar activities, which is controled through serial interface (SDATA,SCLK,SENA and HAGAR_RESET_X).

Pictures below show these four signals, measured on R301 (both SCLK and SENA) , on R300 (SDATA) and C540 (HAGAR_RESET_X). R301 and R300 are placed in BB part.

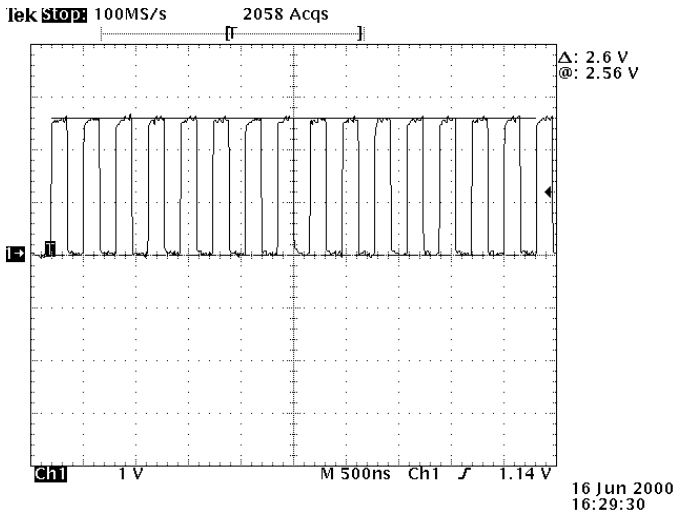

Figure 3. SCLK - clock signal

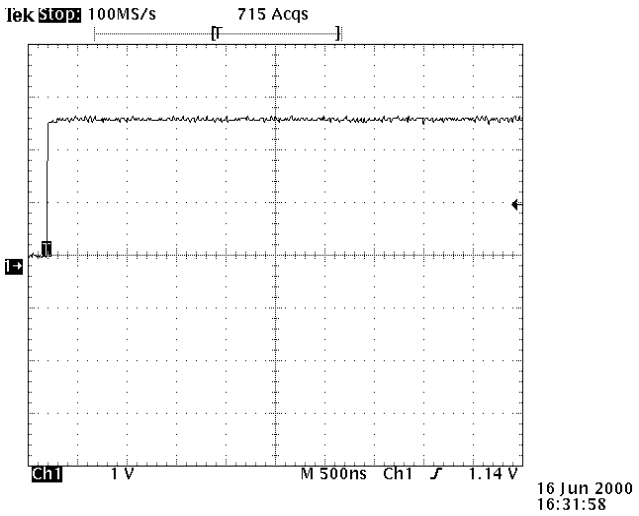

Figure 4. SENA - enable signal

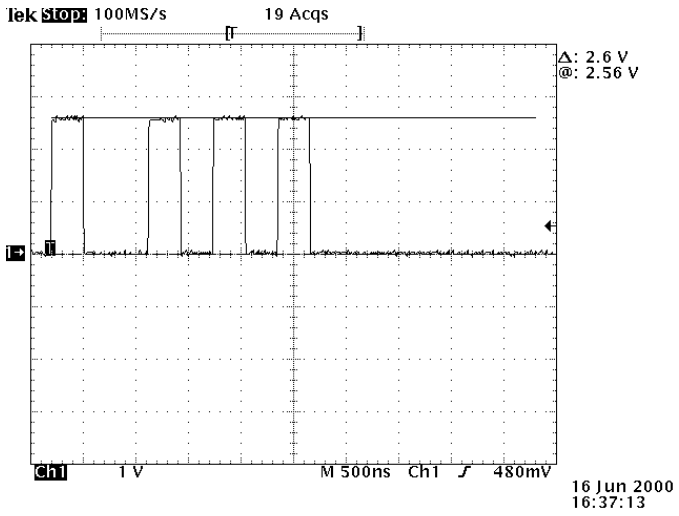

Figure 5. SDATA - data signal

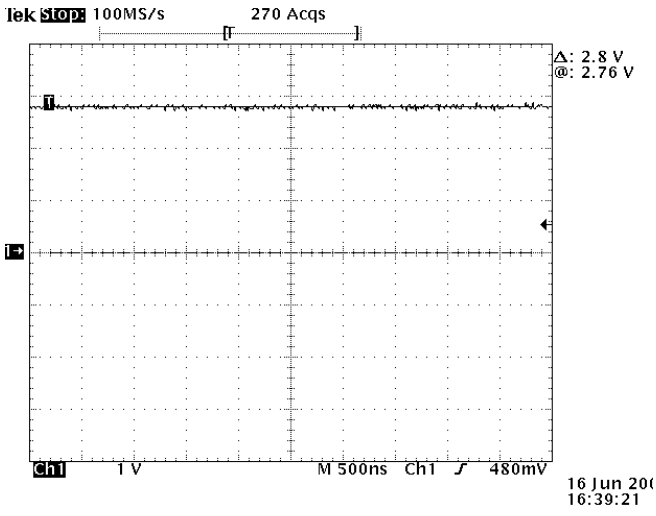

Figure 6. HAGAR_RESET_X - hagar reset "on"

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First precondition for Hagar to be in active (ON) mode is that HAGAR_RESET_X should be high (2.8V) and VREF, which is Hagar reference voltage, at 1.35V.

Easiest way to check these two voltages is by using oscilloscope with an standard passive probe (10kΩ/8pF). HAGAR_RESET_X is measured on C540 and VREF on C536.

Another " good spot" to check if Hagar's internal supplies are active, is to measure either on capacitor C538 or resistor R511. R511 is Hagar connection for a external resistor in order to create inernal bias currents. This volage should be excactly the same value as VREF on C536.

Next step towards examination of the the Hagar functionality can be based on verification of some important bias voltages and bias controls. Those signal coming from Hagar and they are used for controling the LNA's biasing(both 900/1800MHz), LNA power supply and TX power detector .

As a reference, here is a list of some typical test points for both Rx and Tx mode:

Frequency Band	RX	TX
EGSM	² 900 LNA bias control - L506 (pulses with ≈2.34V) ² 900 LNA power supply control – R514(pulses with ≈2.75V)	² supply for the 900 PA buffer – R606 (pulses with ≈2.34V) ² bias voltage for power detector – C573 ("high" 2.8V)
PCN	² 1800 LNA bias control – R502 (pulses with ≈2.34V) ² 1800 LNA power supply control – R513(pulses with ≈2.75V)	² bias voltage for power detector – C573 ("high" 2.8V)

Wintesla Tuning

Prior to any tuning the phone should be initialised:

Start Wintesla-Service-Software and

Select	Product	Alt+p
	Open…	
	NHM-5	
Select:	Product	Alt+p
	Initialise	Alt+I
	Normal Mode	F5

What RF to tune after repairs

Different repairs require different tuning. In general it is necessary to determine in which section the repair was done to establish which tunings to perform. To determine if RF tuning is necessary after repair it is important that the functionality of the repaired circuit is understood well. In case the circuit is not fully understood it might be wise to play it safe and do RF tunings in accordance with the table below.

In general repairs in the TX part will require tuning of "TX Power" and "TX I/Q" tuning.

In general repairs in the RX part or PLL will always require "RX Calibration" and in some cases require AM Suppression tuning (Automatic) and RX Filter Calibration (Automatic).

Other parts interfacing to TX, RX or PLL might require tuning, but common sense should be used.

In the table below guidelines for what to tune when can be seen (if it can be ruled out that a component will change RF performance, e.g. the microphone B200 there is no need to do any RF tuning).

	Required tuning				
Repairs affecting component number	RX calibration	AM suppression	RX filter calibration	TX power	TX IQ
100-199	Yes				
200-399					Yes
400-499					
500-599	Yes	Yes	Yes	Yes	Yes
600-699				Yes	Yes
Full factory setting	Yes	Yes	Yes	Yes	Yes

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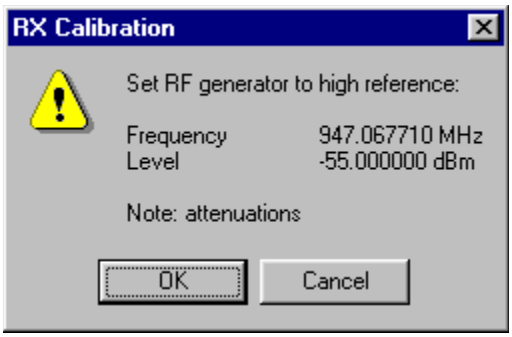
RX Calibration

The "RX calibration" is used to determine gain at different gain-settings for front-end and Hagar and needs to be done in both bands, but the calibration only have to be started once, it will automatically proceed to the PCN band after EGSM.

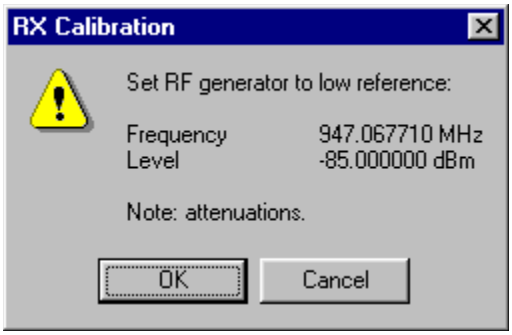
Select:	Product		Alt+p
	Band		b
		EGSM	e
Select:	Tuning	Alt+t	
	RX Calibration		r

A window will now pop-up:



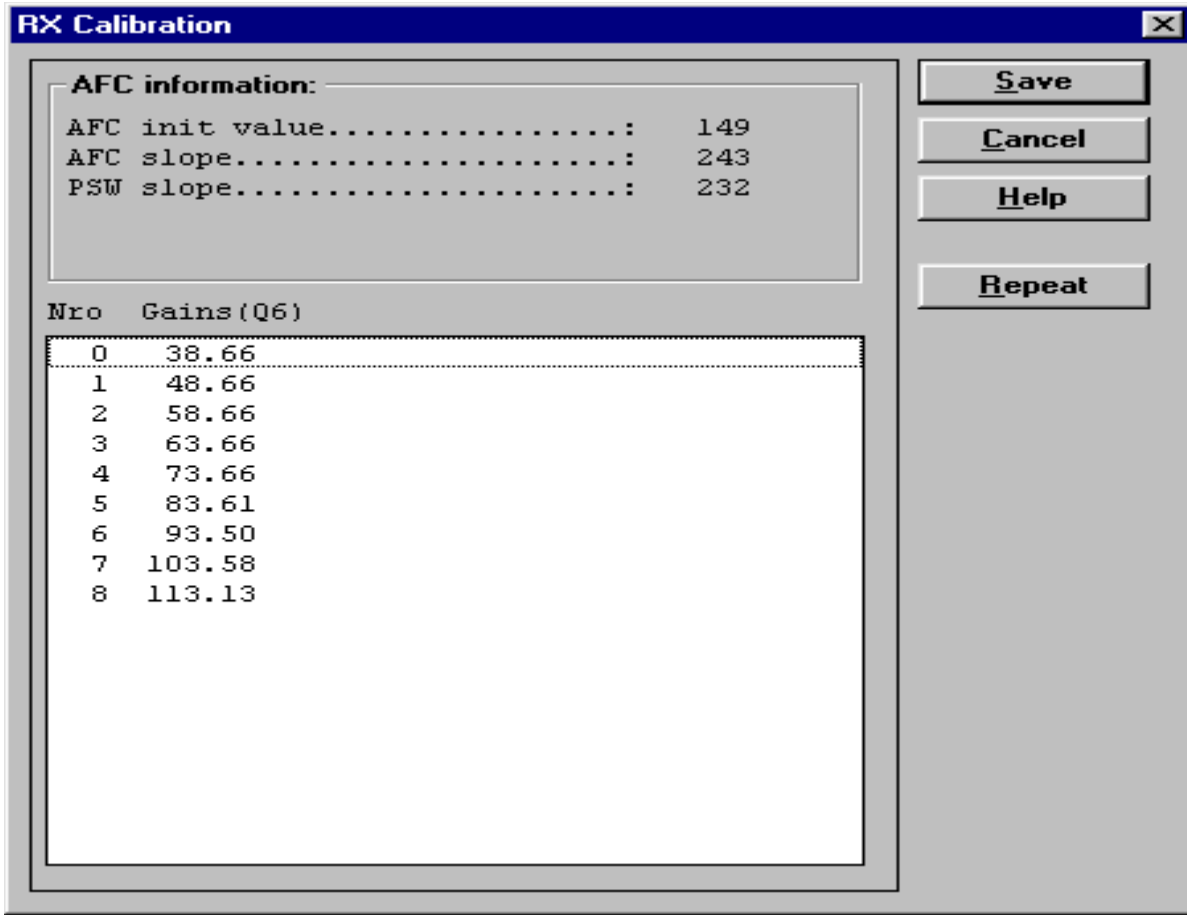
Connect an external generator to the phones RF connector and set the generator as the window tells you.

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

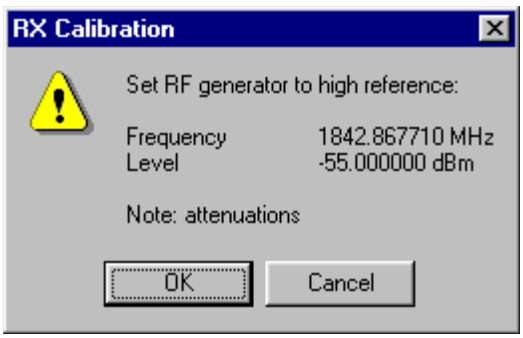


Change the level on the generator as the window tells you.

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:

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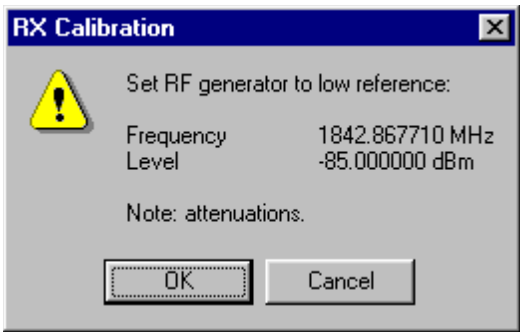
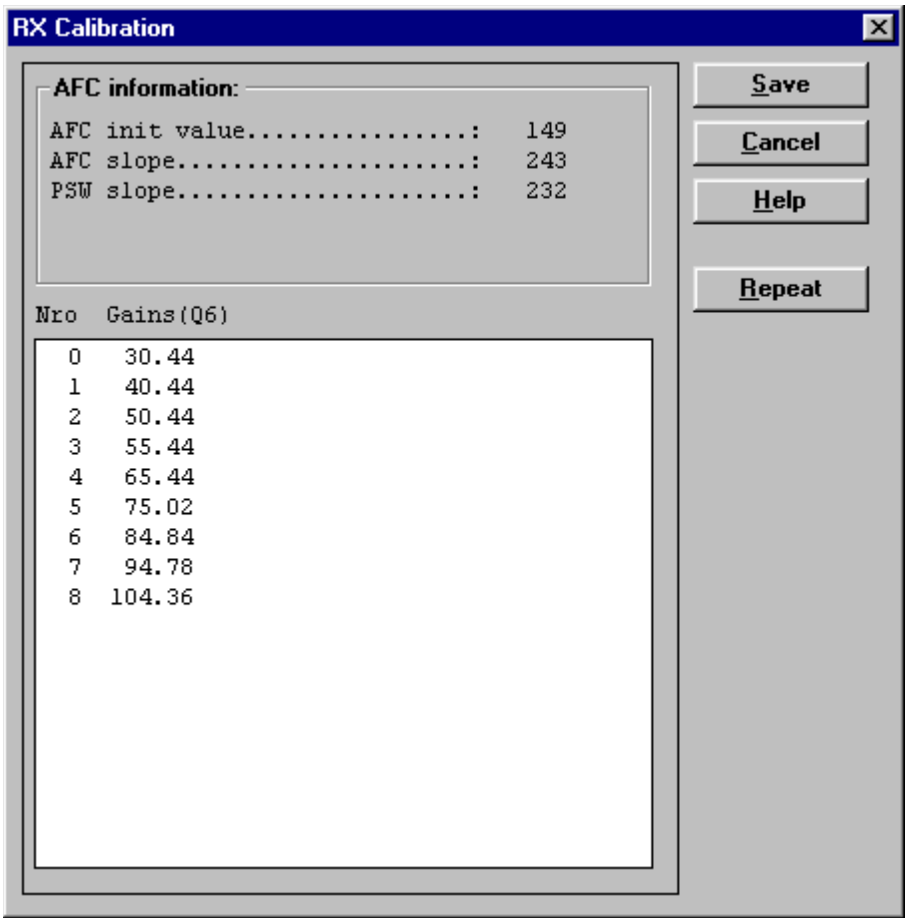


Change the level and frequency on the generator as the window tells you.

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



Click Save in the Wintesla window, RX Calibration is now completed

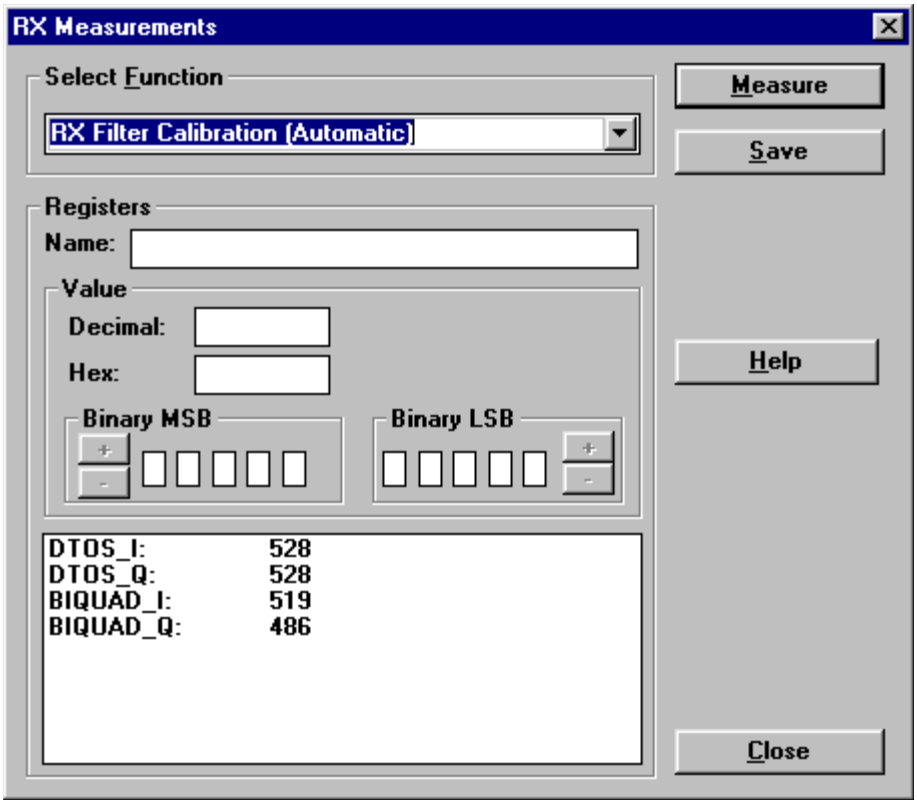
RX Filter Calibration (Automatic)

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"

RX AM Suppression (Automatic)

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

28 4 1 1 GSM900

Select: Product Alt+p

Band b

EGSM e

Select: Tuning Alt+t

RX Measurements

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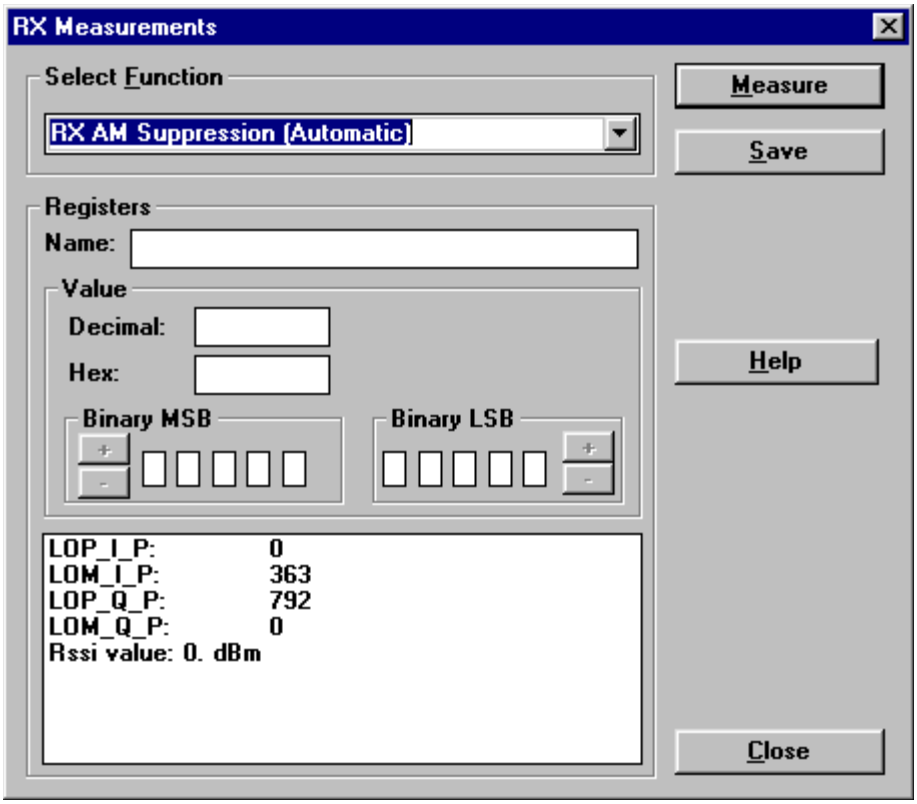
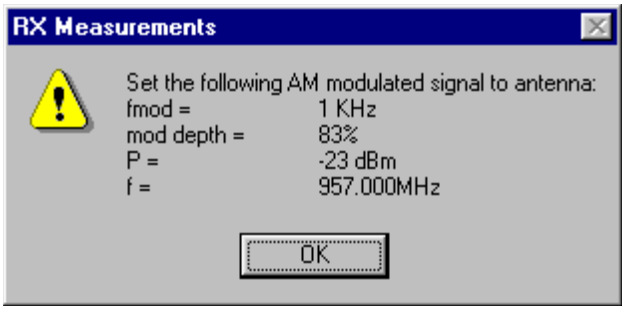
A window now pops-up:



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



Click Measure, A window now pops-up:

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

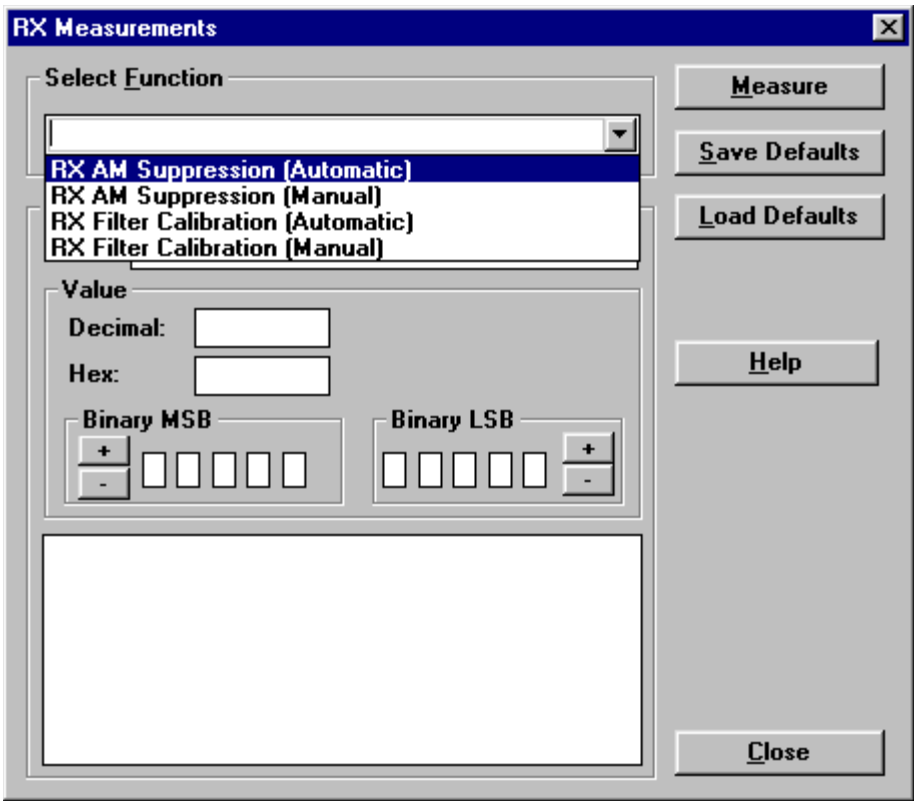
Click OK in the Winteslwindow, the RSSI value is updated in the RX Measurements window.

Click "Save ". The "RX AM suppression tuning" is now completed in GSM900.

PCN

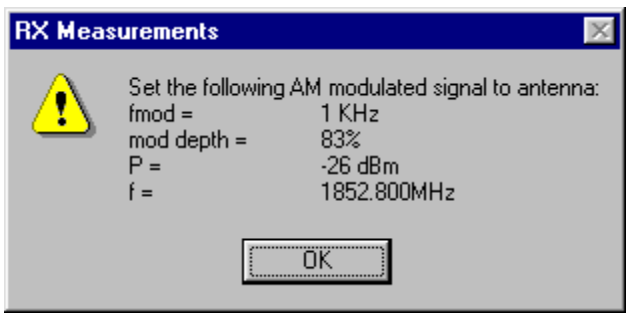
Select: Product Alt+p
Band b
PCN p
Select: Tuning Alt+t
RX Measurements

A window now pops-up:



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

Click Measure, A window now pops-up:



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

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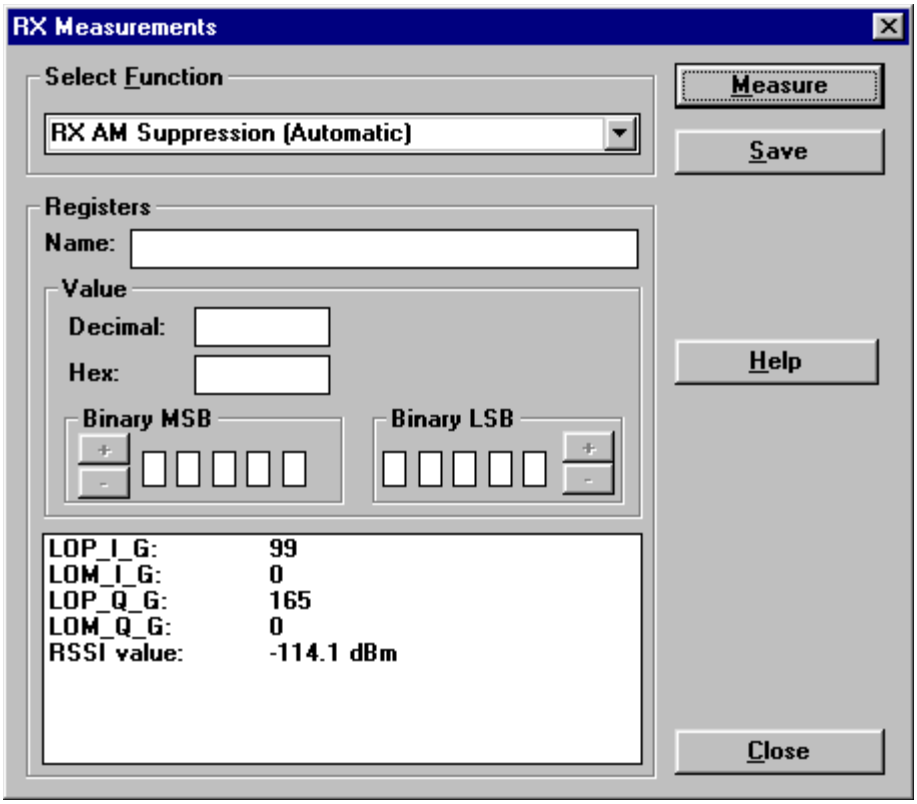
Click OK in the Wintesla window, the RSSI value is updated in the RX Measurements window.



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

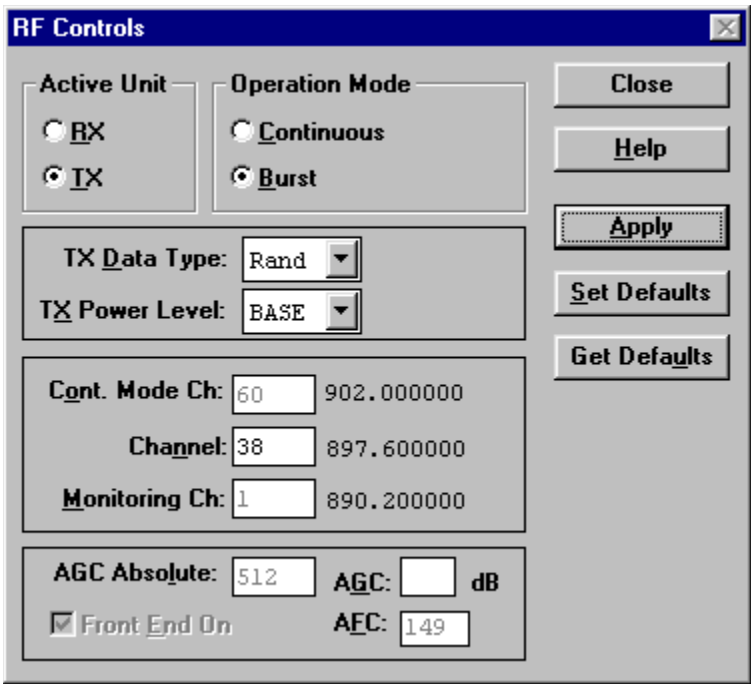
TX Power tuning

This tuning must be done in both bands.

28 5 1 GSM900

Select:	Product	Alt+p
	Band	b
	EGSM	e
Select:	Testing	Alt+e
	RF 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:

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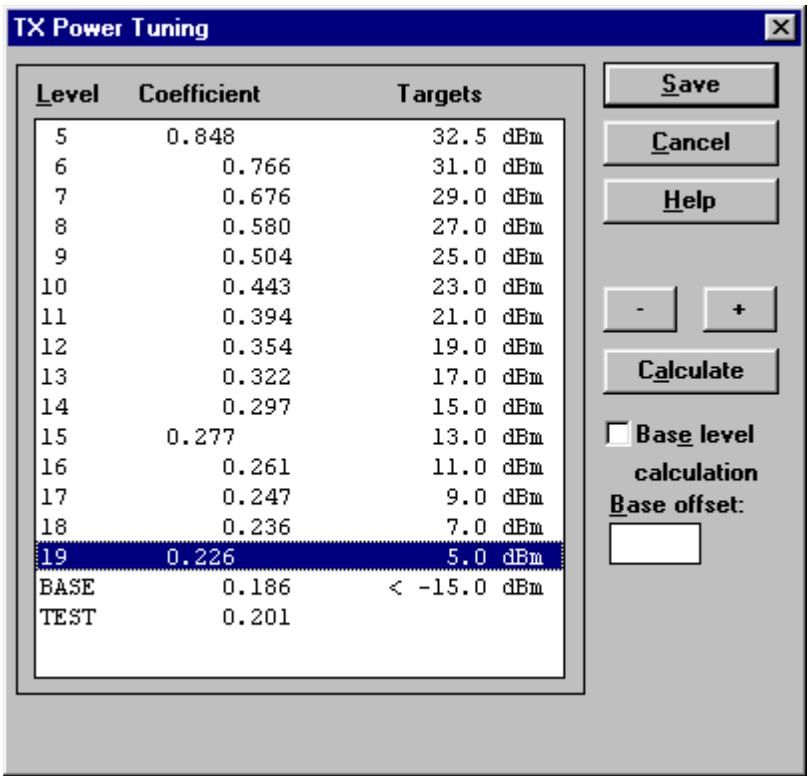


Tune level 19, 15, 5 and Base in accordance with the target values.

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

Click Save when all values match the targets.

PCN

Select: Product Alt+p

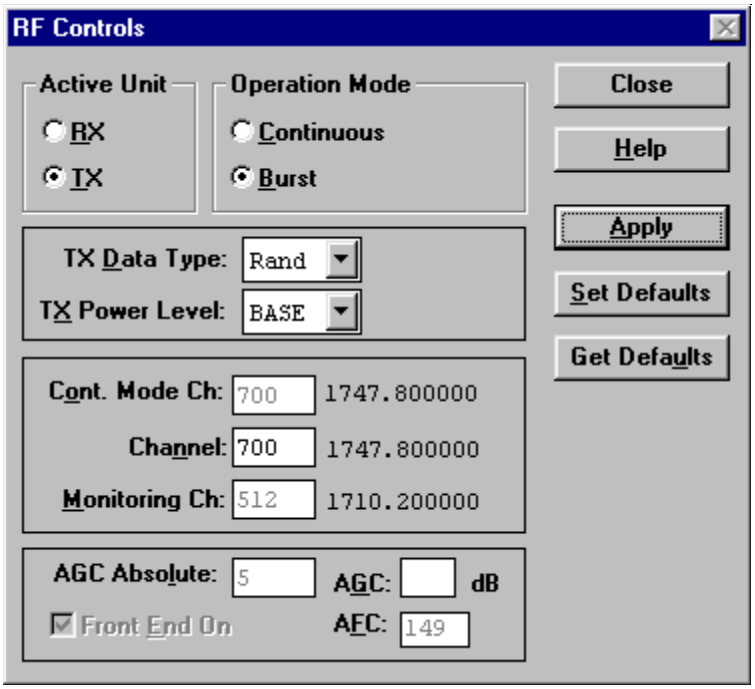
Band b

PCN p

Select: Testing Alt+e

RF Controls r

A window now pops-up:



Set Active unit to TX

Set TX Data Type: to Rand

Click Apply

Click Close

Select: Tuning Alt+t

TX Power… Alt+P

A window now pops-up:

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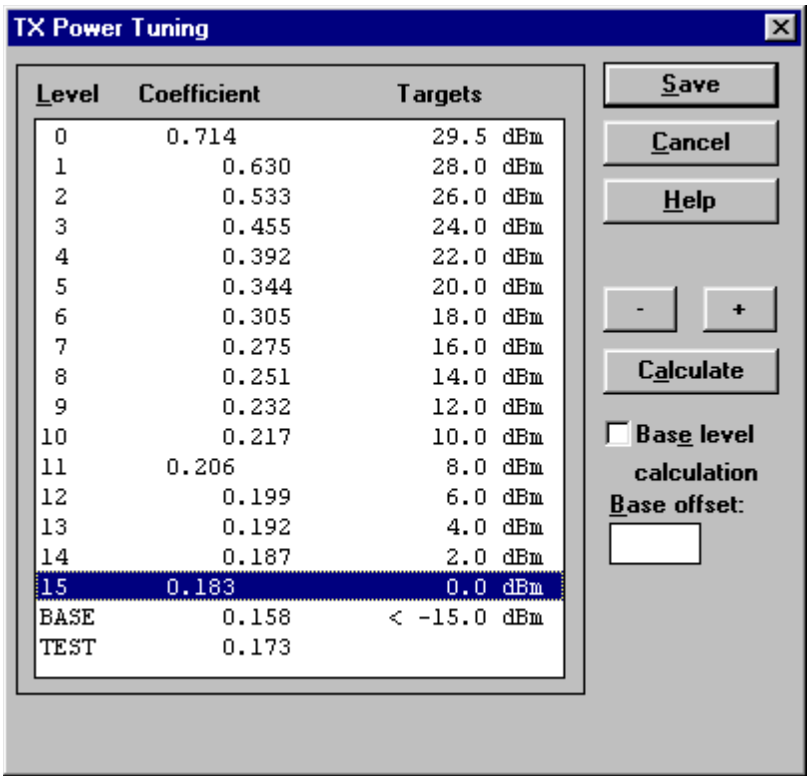


Tune level 15, 11, 0 and Base in accordance with the target values.

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

Click Save when all values match the targets.

TX I/Q Tuning

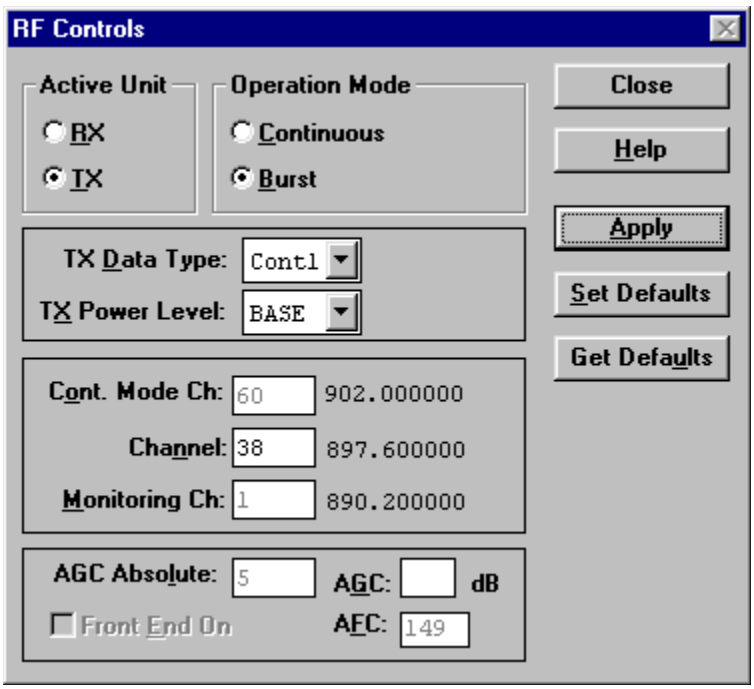
This tuning must be done in both band

Initial set-up GSM900

Select: Product Alt+p
Band b
EGSM e

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

Go through the "Common tuning procedure for GSM900 and PCN" described in section 11.6.2 of this document.

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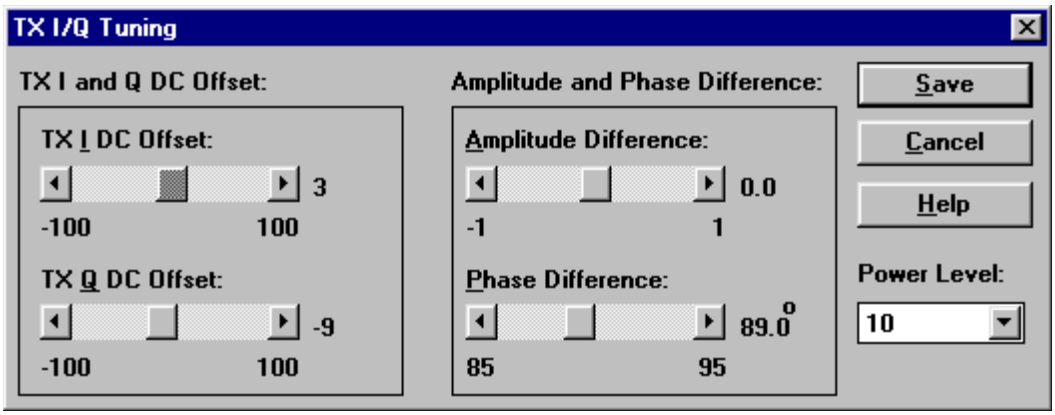
Common tuning procedure for GSM900 and PCN

Select: Tuning Alt+t

TX I/Q... Alt+q

A window now pops-up:

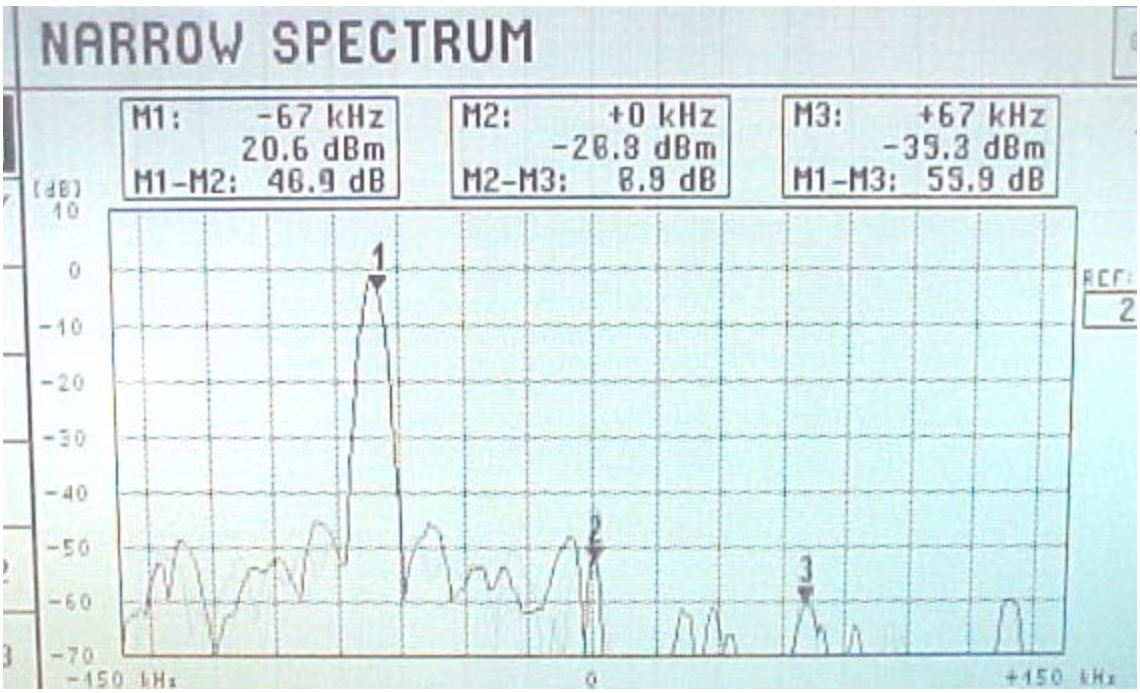


The carrier (M2) and +67kHz (M3) signal should now be tuned to a minimum.

The buttons in the "TX I and Q DC Offset:" will change the level of the carrier.

The buttons in the "Amplitude and Phase Difference:" window will change the level of the +67kHz signal.

When minimum values are reached, click Save



Initial set-up PCN

Select: Product Alt+p

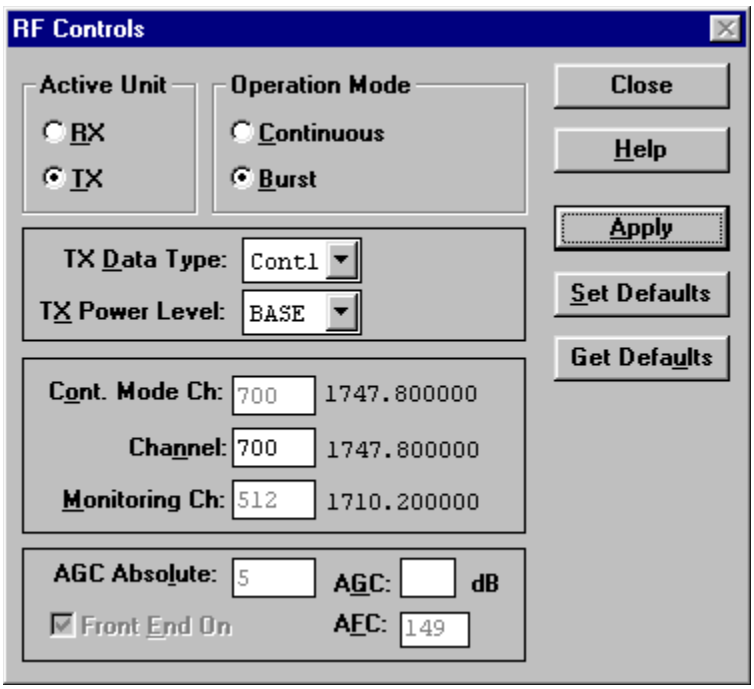
Band b

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

Go through the "Common tuning procedure for GSM900 and PCN" described in section 11.6.2 of this document.

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