

# **PAMS Technical Documentation**

## **NSE-5 Series Transceivers**

# **Troubleshooting**

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# TroubleShooting

## Baseband

The following hints should facilitate finding the cause of the problem when the circuitry seems to be faulty. This troubleshooting instruction is divided following section.

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. Plug in SIM card is out of order ( insert SIM card or 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:

- a) there are not any mechanical damages
- b) soldered joints are OK

**Note:** X201 is a connection that is ONLY present in the production. Therefore it is not applicable for the PAMS repair.

### 1. Phone is totally dead

This means that phone doesn't take current at all when the power switch is pressed (X400 pin 7) or when the watchdog disable pin (X201 pin 11) is grounded. Used battery voltage must be higher than 3.1 V. Otherwise the hardware of CCONT (N100) prevents totally to switch power on.

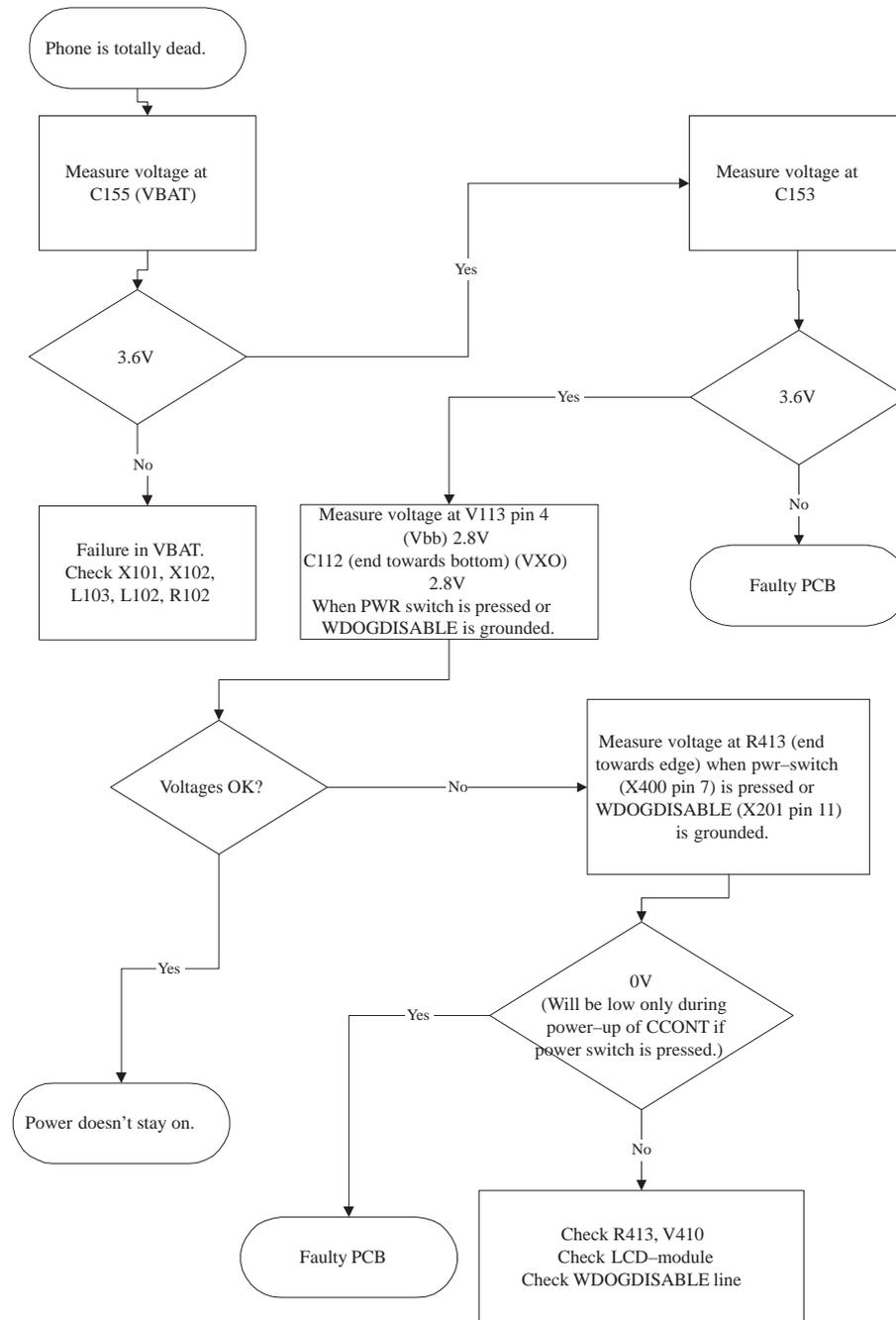


Figure 1.

## 2. Flash programming doesn't work

The flash programming can be done via panel connector X201 or via system connector X200.

In production, the first programming is done via panel connector X201. After this, the panel connector is cut away, thus other flash programming must be done via system connector X200.

The main differences between these are:

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

The fault finding diagrams for flash programming are shown in the next three figures

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 don't find
- MCU flash Vpp error

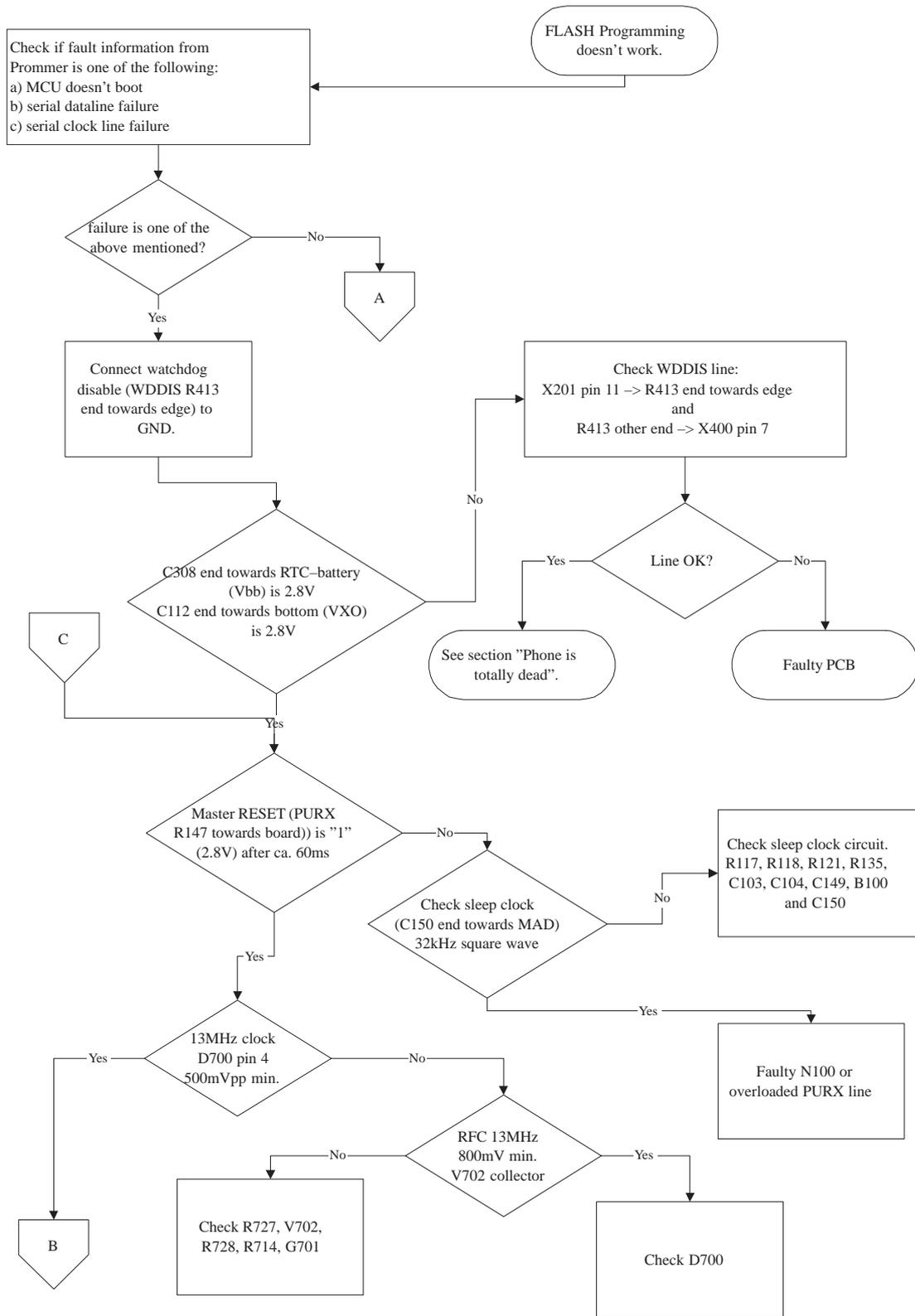


Figure 2.

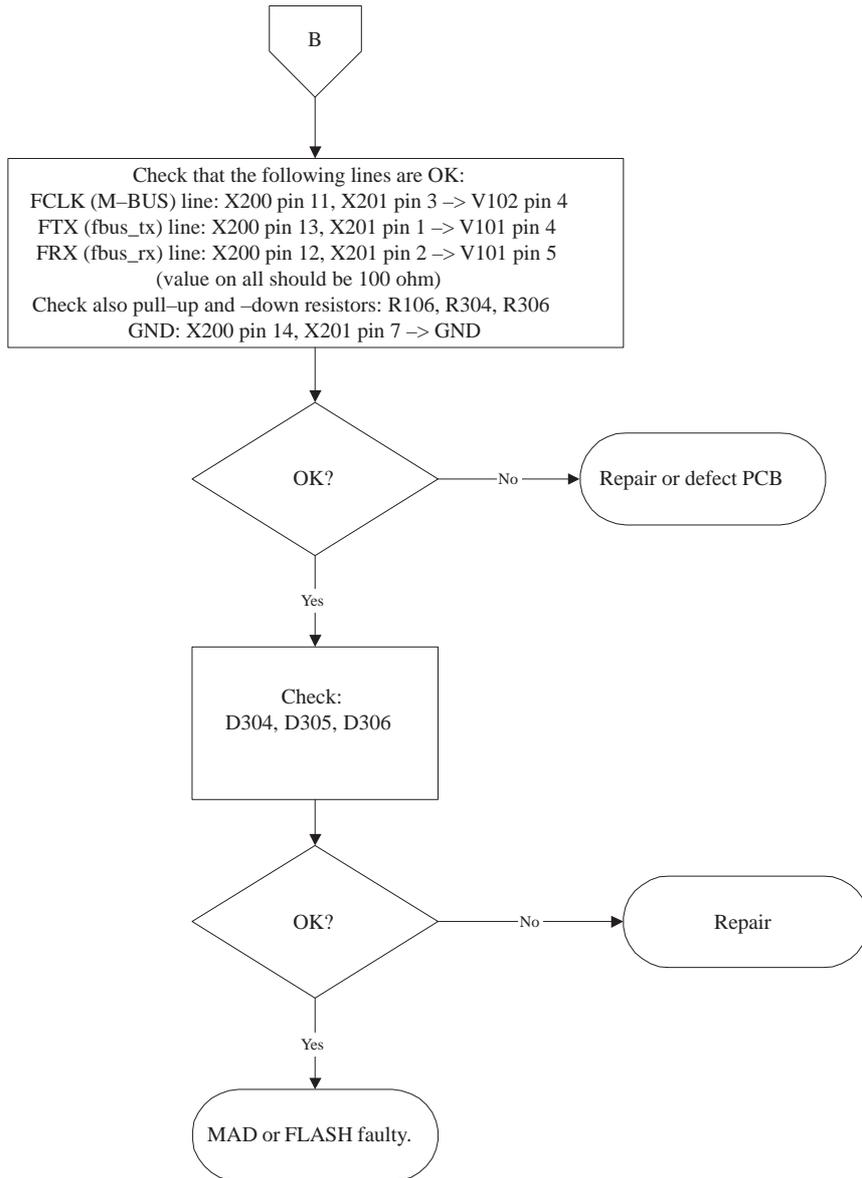


Figure 3.

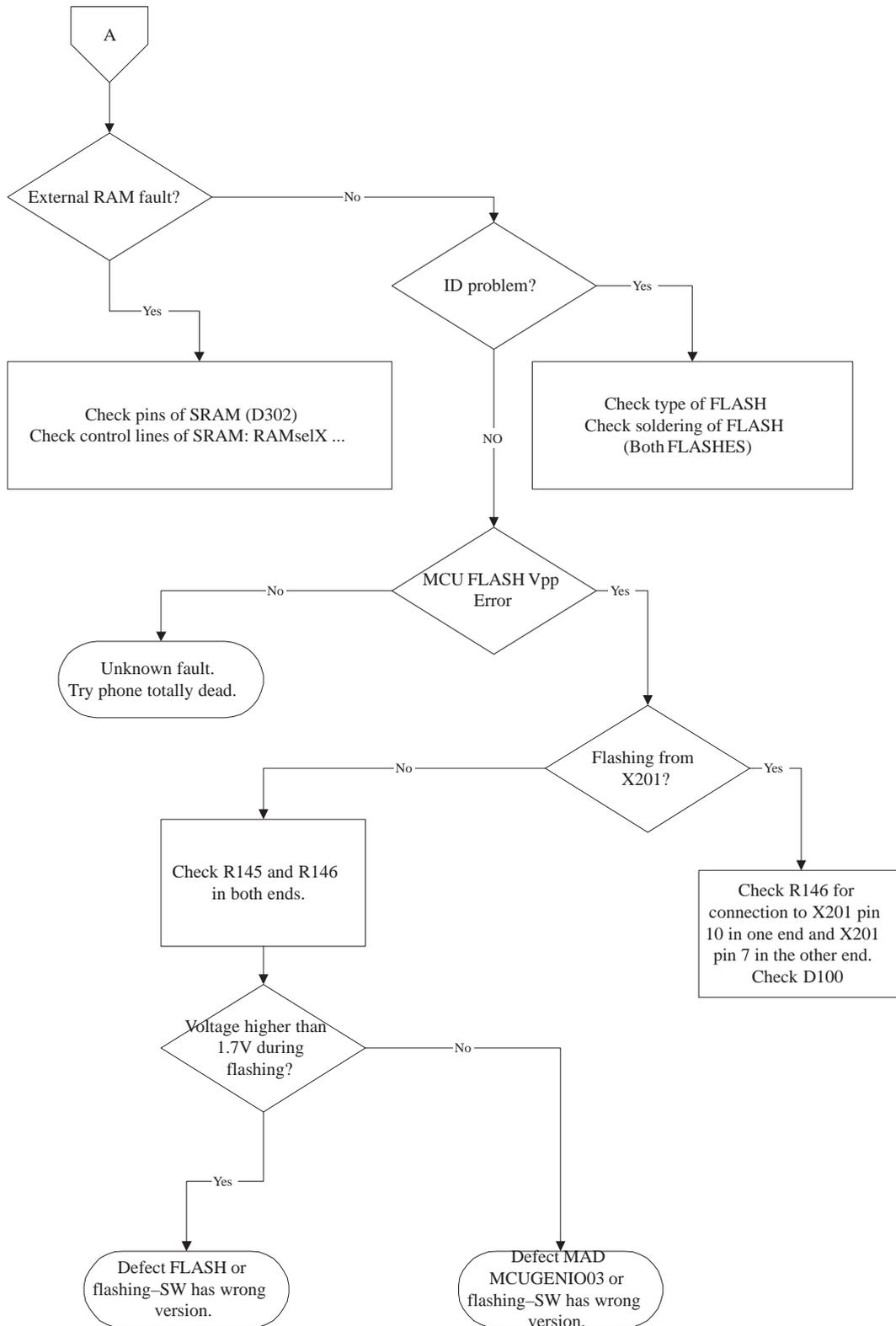


Figure 4.

### 3. 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 ICs.

The soldered joints of ICs: D300 (MAD2Pr1), D301 & D303 (FLASH), N100 (CCONT), D302 (SRAM) are useful to check at first.

Normally the power will be switched off by CCONT (N100) after 30 seconds, if the watchdog of the CCONT can not be served by software.

Check watchdog is updated. X400 pin 2 is high and at the same time X400 pin 13 toggles. In the normal case there is a short burst of pulses every 8 seconds.

The power off function of CCONT can be prevented by connecting a short circuit wire from CCONT R413 (end towards edge) to ground.

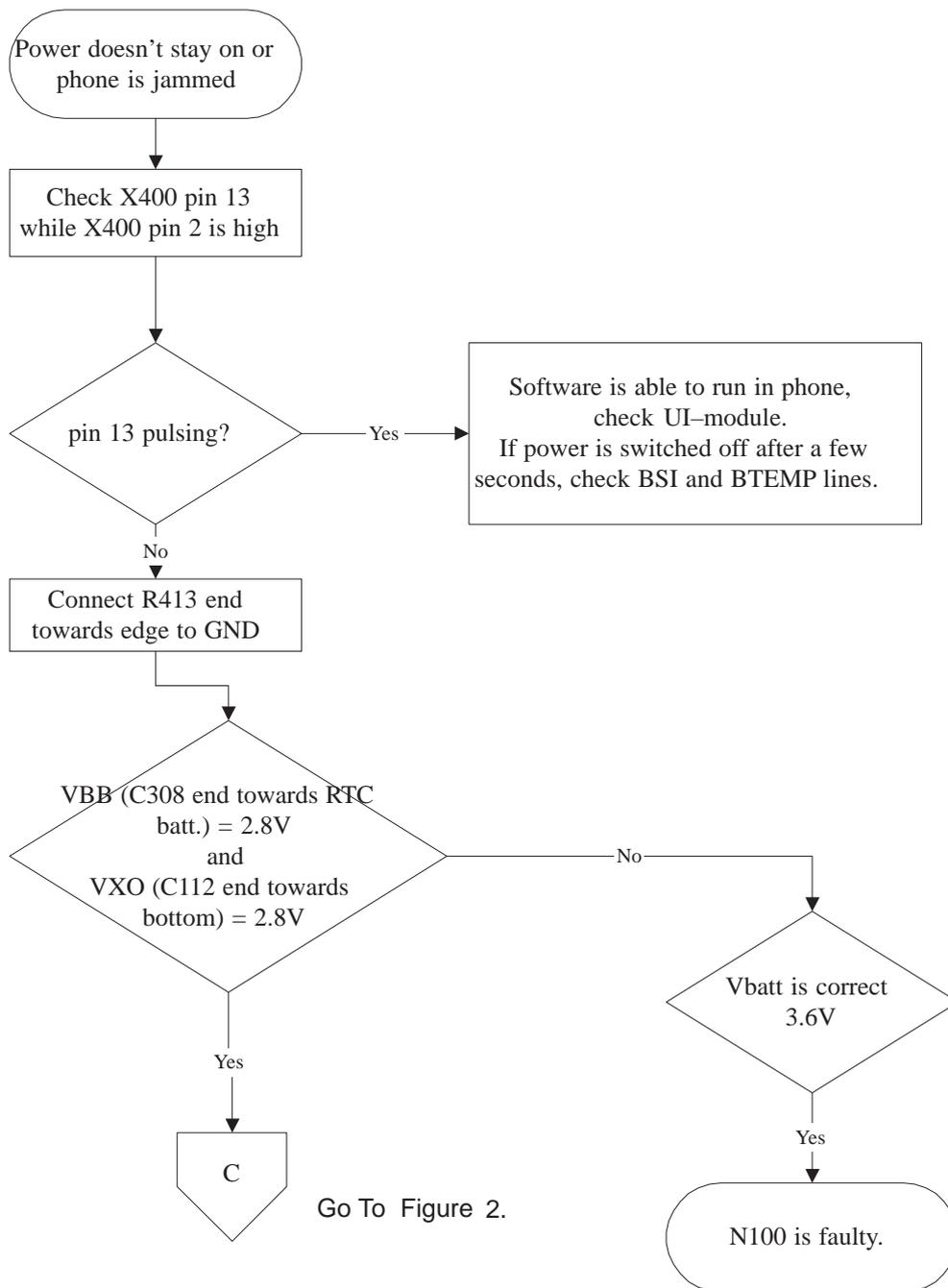


Figure 5.

#### 4. Display Information: Contact Service

This fault means that software is able to run and thus the watchdog of CCONT (N100) can be served.

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

If any of selftests is failed, contact service information will be shown on display.

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

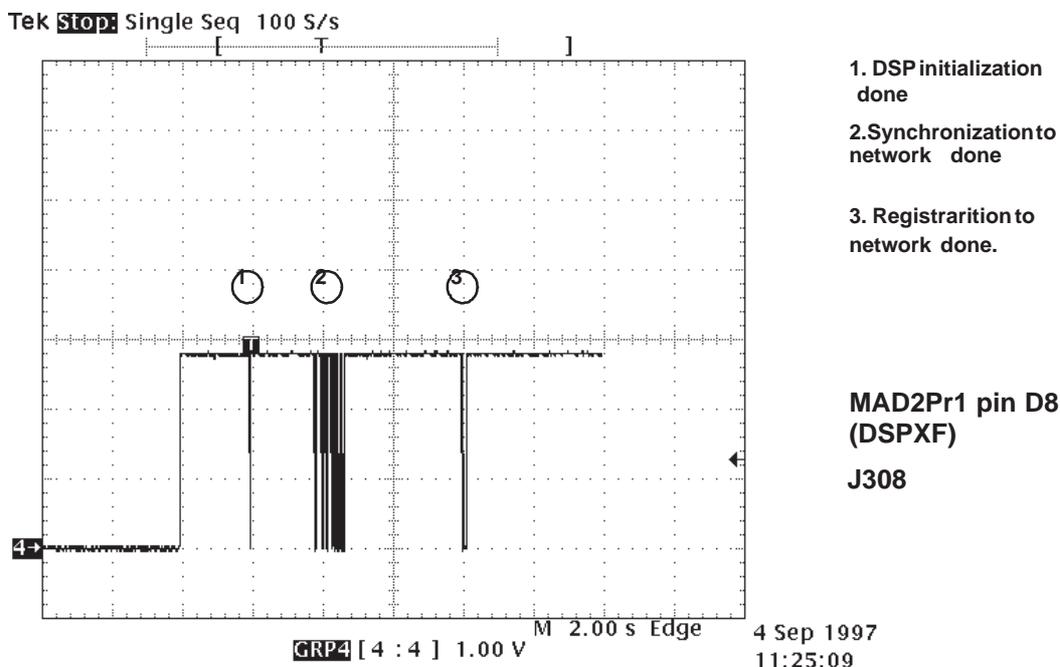
If the phone doesn't register to the network or the phone doesn't make a call, the reason could be either the baseband or the RF part.

The phone can be set to wanted mode by Wintesla service software and determinate if the fault is in RF or in baseband part (RF interface measurements).

The control lines for RF part are supplied both the System Asic (MAD2;D300) and the RFI (Cobba\_GJP; N200). MAD2Pr1 handles digital control lines (like synthena, TxP etc.) and Cobba handles analog control lines (like AFC, TxC etc.).

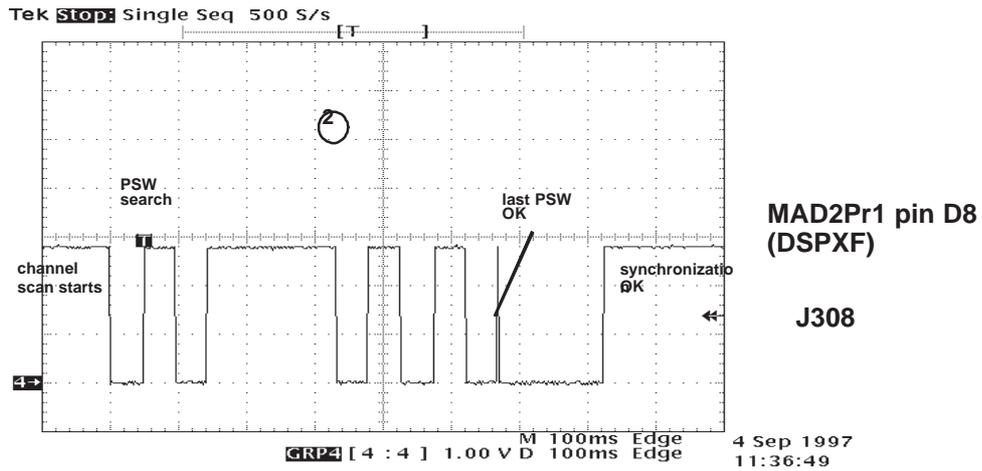
The DSP software is constructed so that operation states of DSP (MAD2Pr1) can be seen in external flag (DSPXF) output pin J308.

After power up, DSP signals all completed functions by changing the state of the XF pin (see Figure 1-6, Figure 1-7, Figure 1-8 and Figure 1-9).



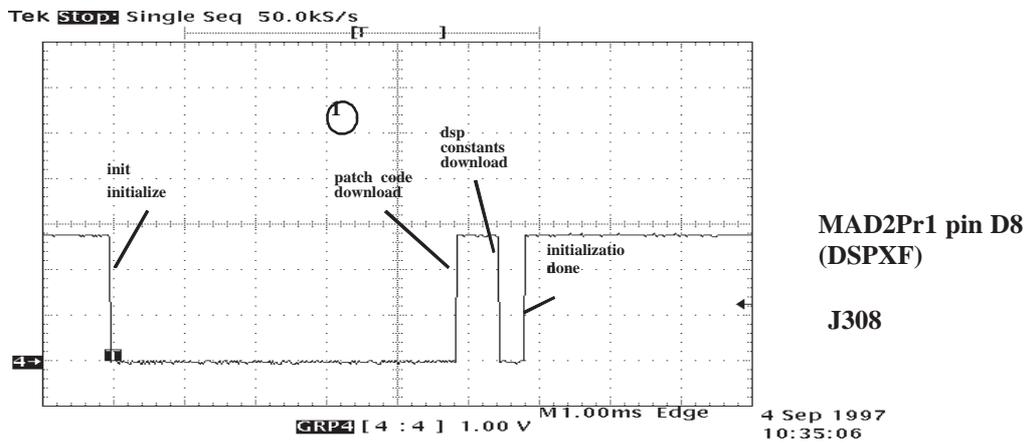
The states of DSP (MAD2) after power on

Figure 6.



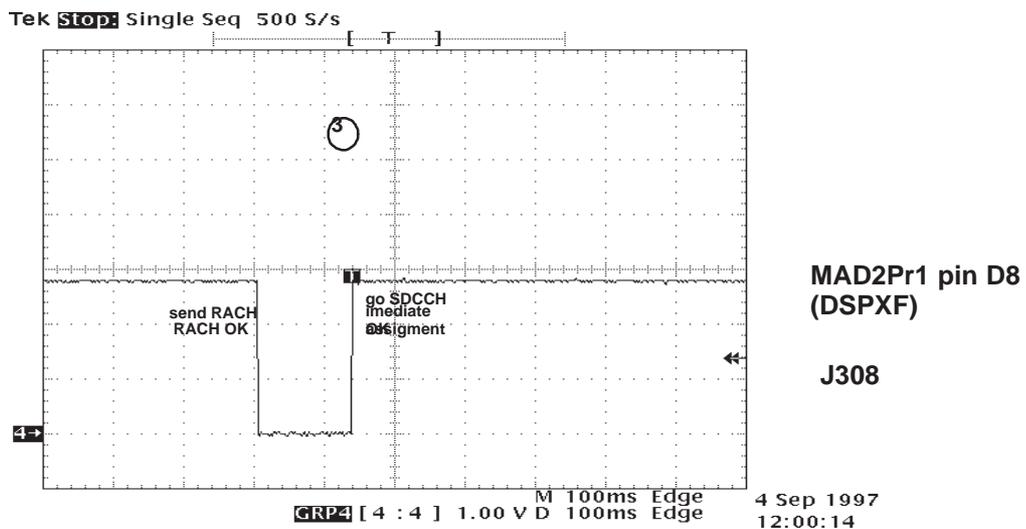
The states of DSP after power on

Figure 7.



The states of DSP after power on

Figure 8.



The states of DSP after power on

Figure 9.

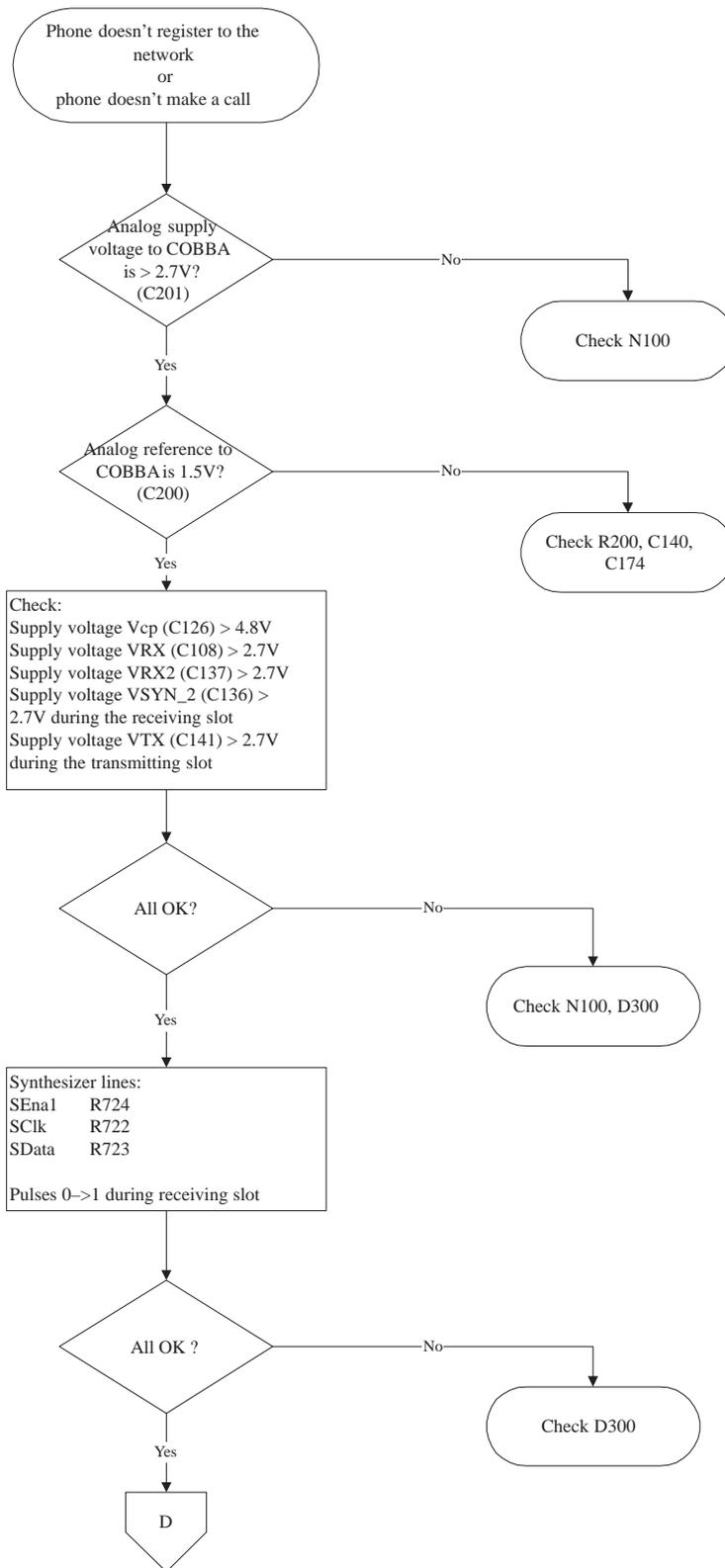


Figure 10.

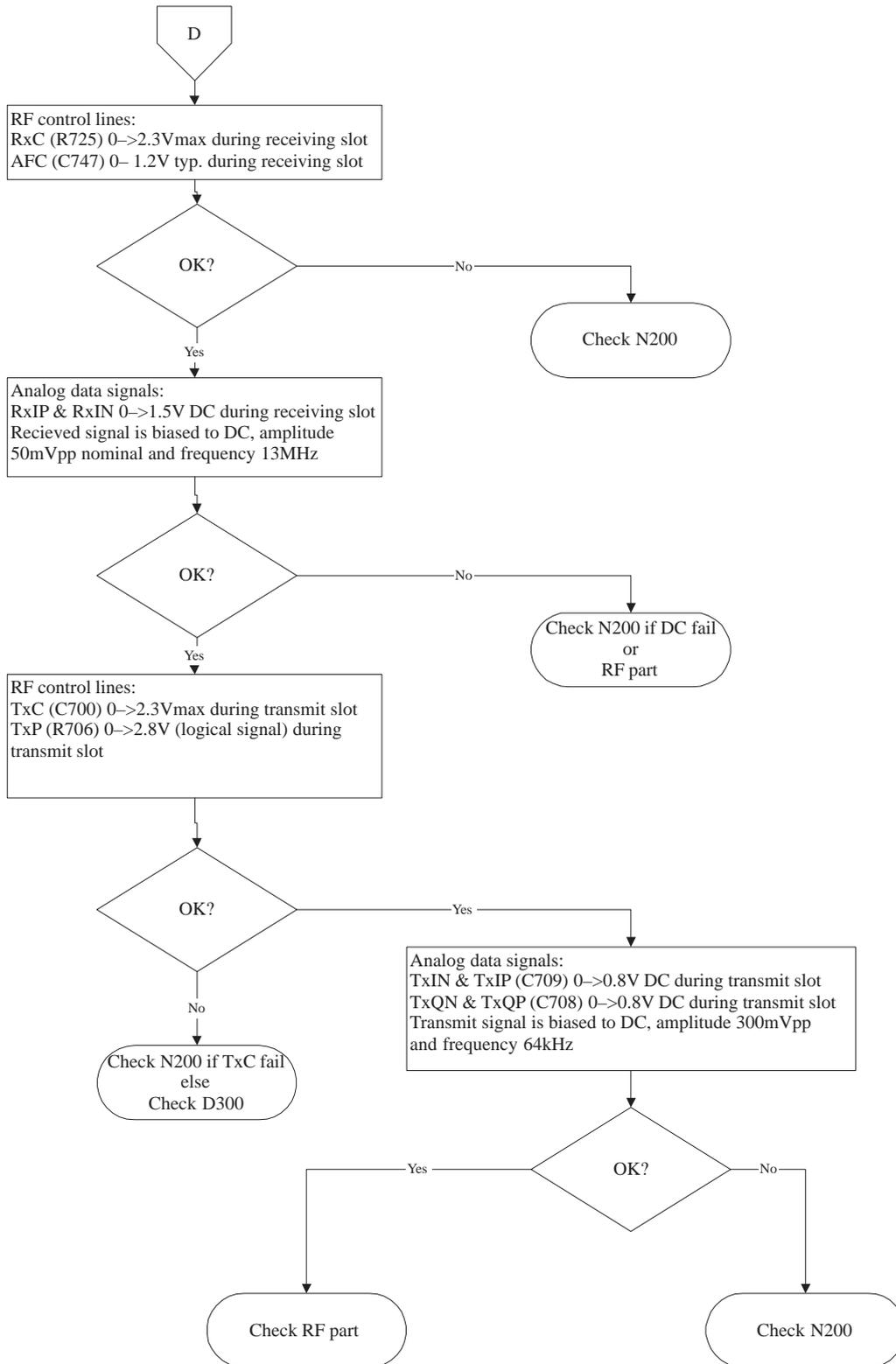


Figure 11.

## 6. SIM card is out of order

The hardware of the SIM interface from MAD2Pr1 (D300) to the SIM connector (X100) can be tested without SIM card.

When the power is switched on and if the BSI line (X102;1) is grounded by resistor, all the used lines (VSIM, RST, CLK, DATA) rises up to 5 V four times. Thus "Insert SIM card" faults can be found without SIM card.

The fault information "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 EEPROM) are not correct.

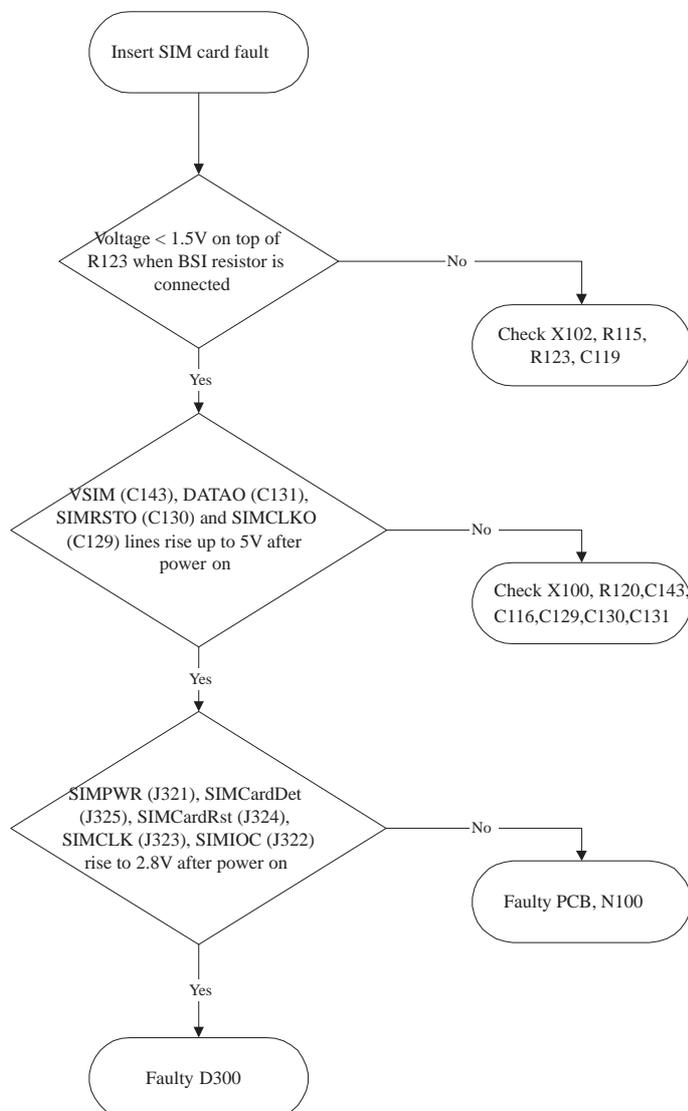


Figure 12.

If a 5V SIM card (or no SIM card) is used, the voltage will rise to 3Volts and then 5Volts (the phone will try this 4 times).

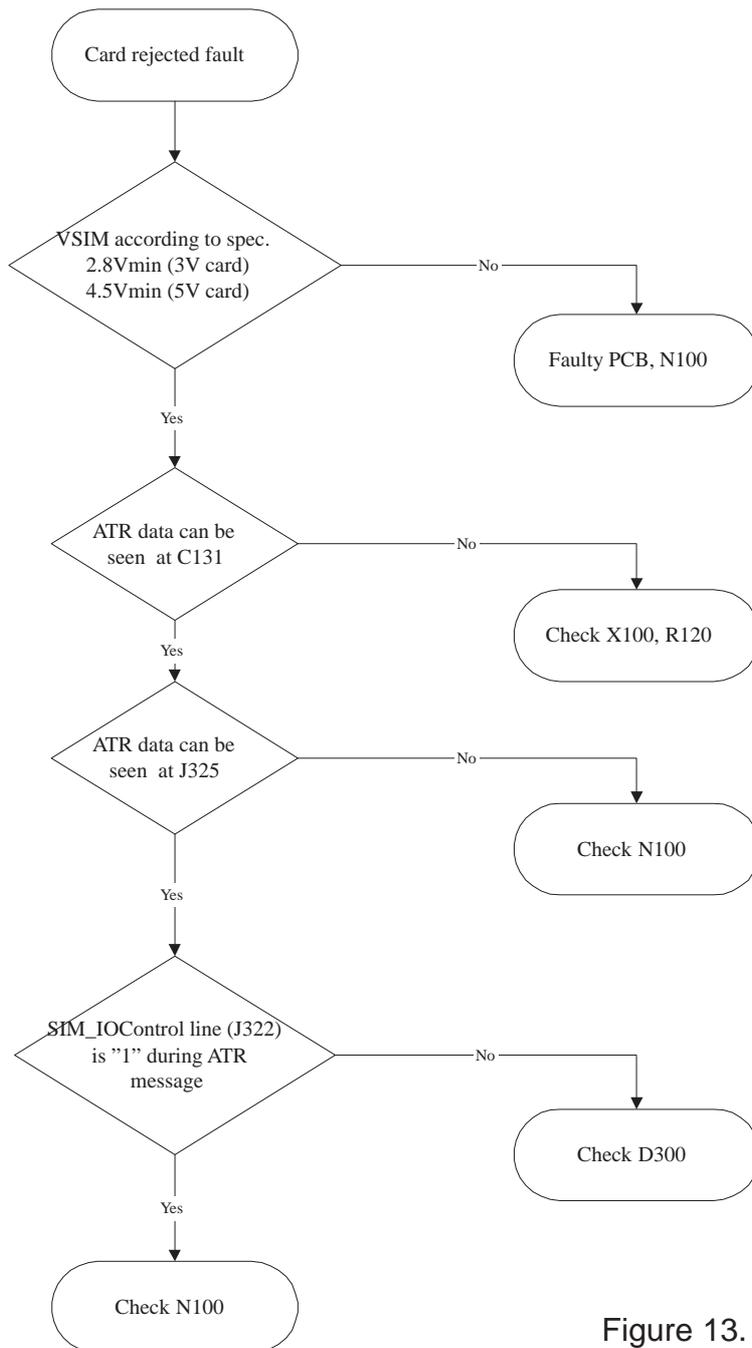


Figure 13.

## 7. Audio Faults

### 7.1 Uplink/Downlink Problem

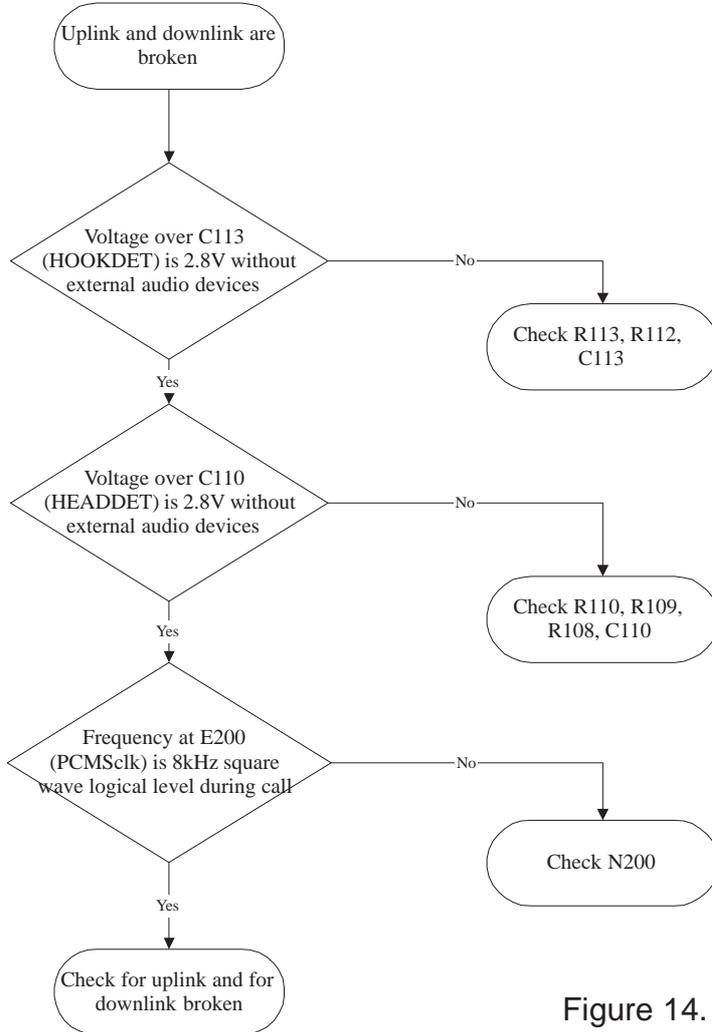


Figure 14.

### 7.1 Uplink Problem

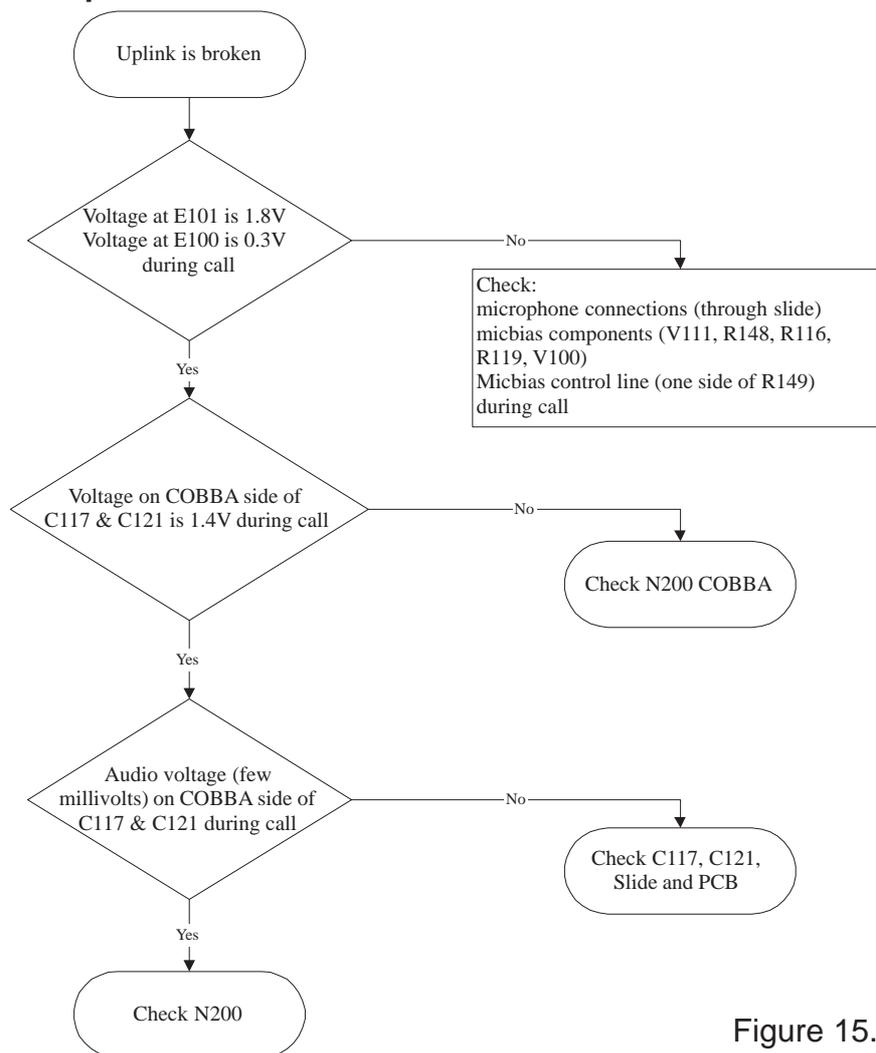


Figure 15.

### 7.1 Downlink Problem

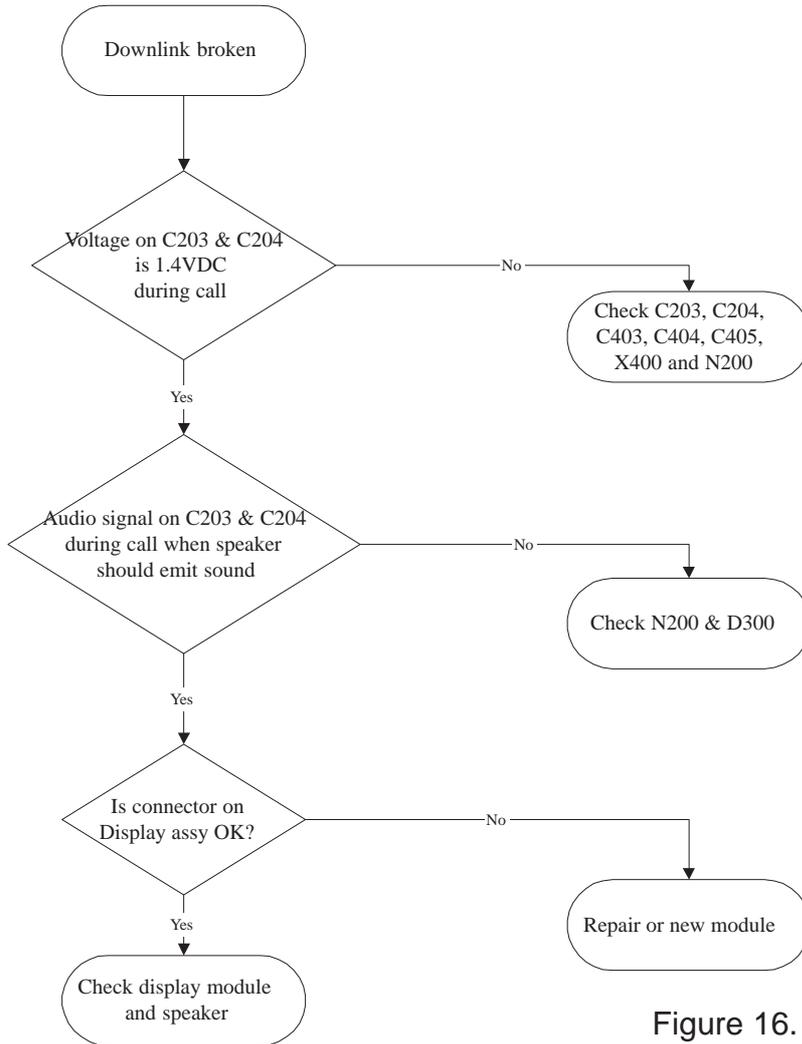


Figure 16.

## 8. Charging Faults

### 8.1 Seems Dead

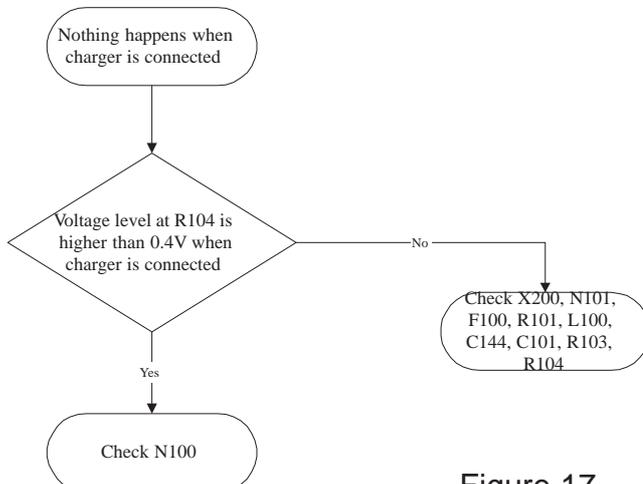


Figure 17.

### 8.2 Display Problem

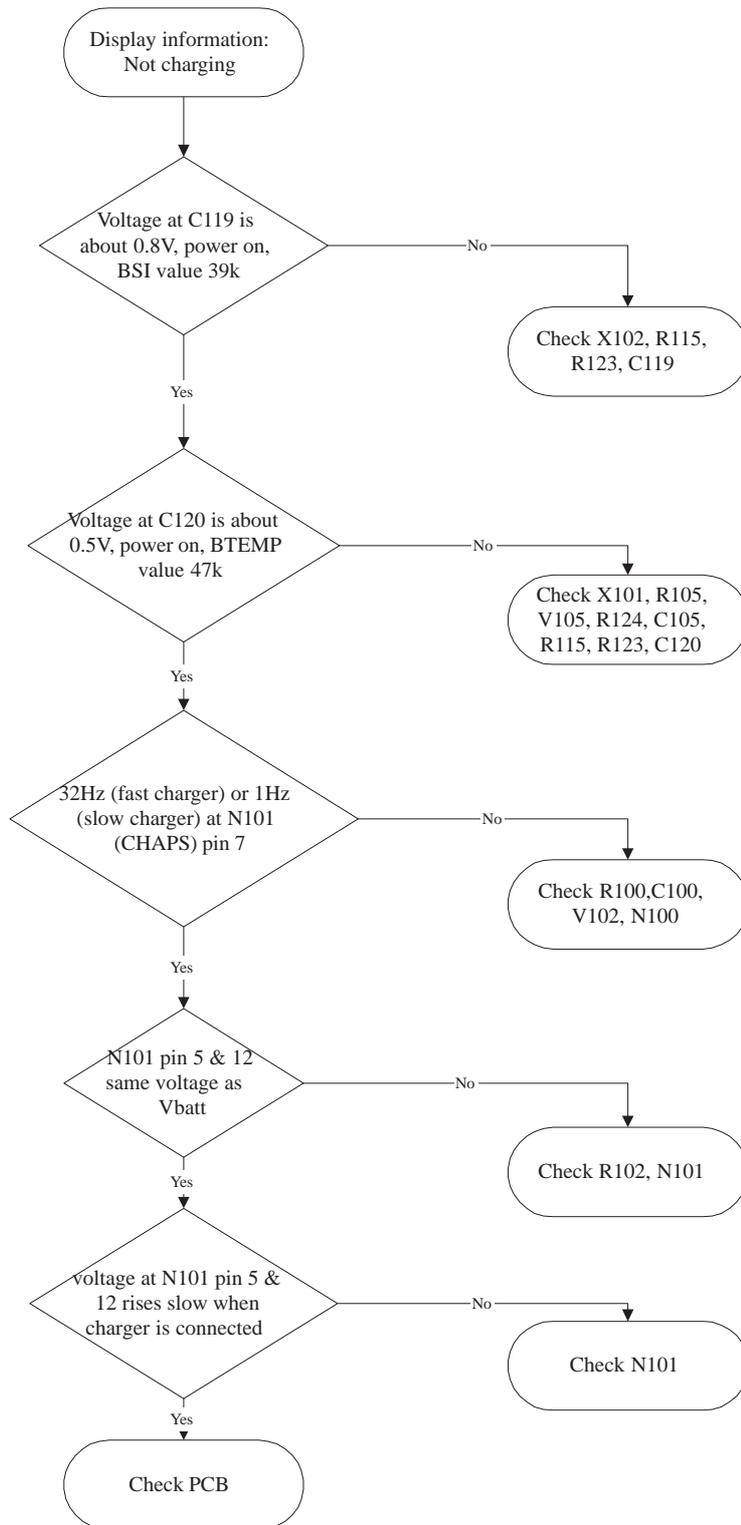


Figure 18.

## Rf Troubleshooting

Measurements should be done using a spectrum analyzer with a high-frequency 500 ohm passive probe (LO-/reference frequencies and RF-powerlevels) and oscilloscope with a 10:1 probe (DC-voltages and low frequency signals).

RF-section is mainly built from two ASICs CRFU3 (N600) and SUMMA (N700), external filters, MMIC PA-modules (N500, N501) and two synthesizers. For easier troubleshooting, this is divided into five sections: GSM Receiver, GSM Transmitter, PCN Receiver, PCN Transmitter and Synthesizer parts. The tolerance is specified for critical signals/voltages.

Before changing either of the ASICs, please check the following things: The soldering and connections of pins of the ASICs are OK, supply voltages are OK and the signals of the synthesizers are coming to ASICs. This will prevent the unnecessary changing of the ASICs.

Please note that the grounding of the PA-module is directly below the PA-module so it is difficult to check. **The PA-module is static discharge sensitive!** So ESD protection must be used when dealing with PA-module (ground straps and ESD soldering irons). The PA is also class 3 moisture sensitive so parts must be dry bake.

Check that discrete components i.e resistors, inductors and capacitors are not missing and are soldered properly.

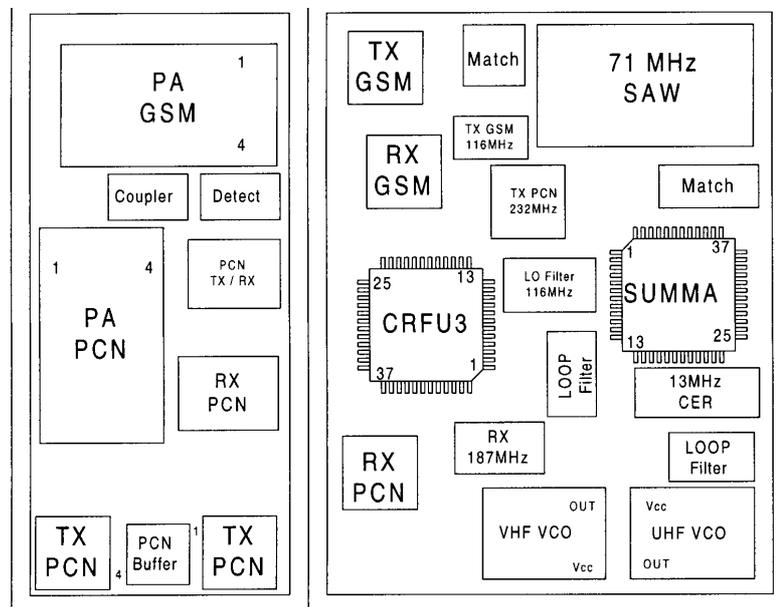


Figure 1. PCB Top View

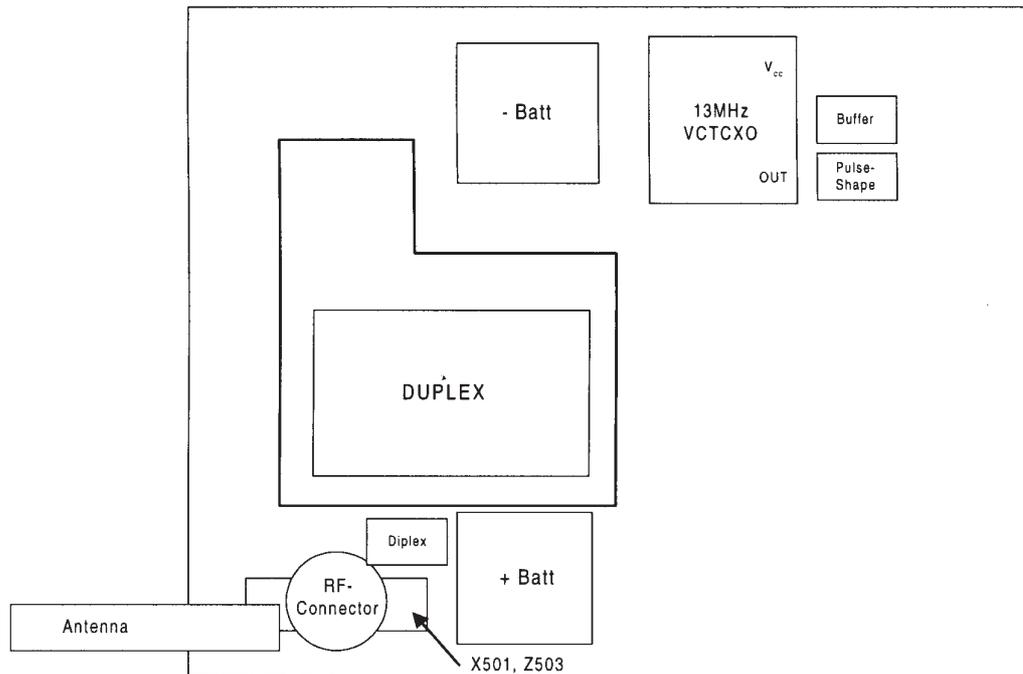


Figure 2. PCB Bottom view

### Abbreviations in fault finding charts

BB	Baseband
DC	Direct Current
ESD	Electro Static Discharge
f:	Frequency of signal (measured with spectrum analyzer)
LO	Local Oscillator
P:	Power of signal in desibels (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

## GSM Receiver

Start WinTesla–Service–Software and

Select: Product

Band

GSM

Select: Testing

RF Controls

RX Continuous

Cont. Mode Ch: 60

Front End On

Apply a 947.0 MHz (MID channel) –50 dBm signal to RF–connector. This signal is tracked through RX–path and will make the troubleshooting of the RX easier.

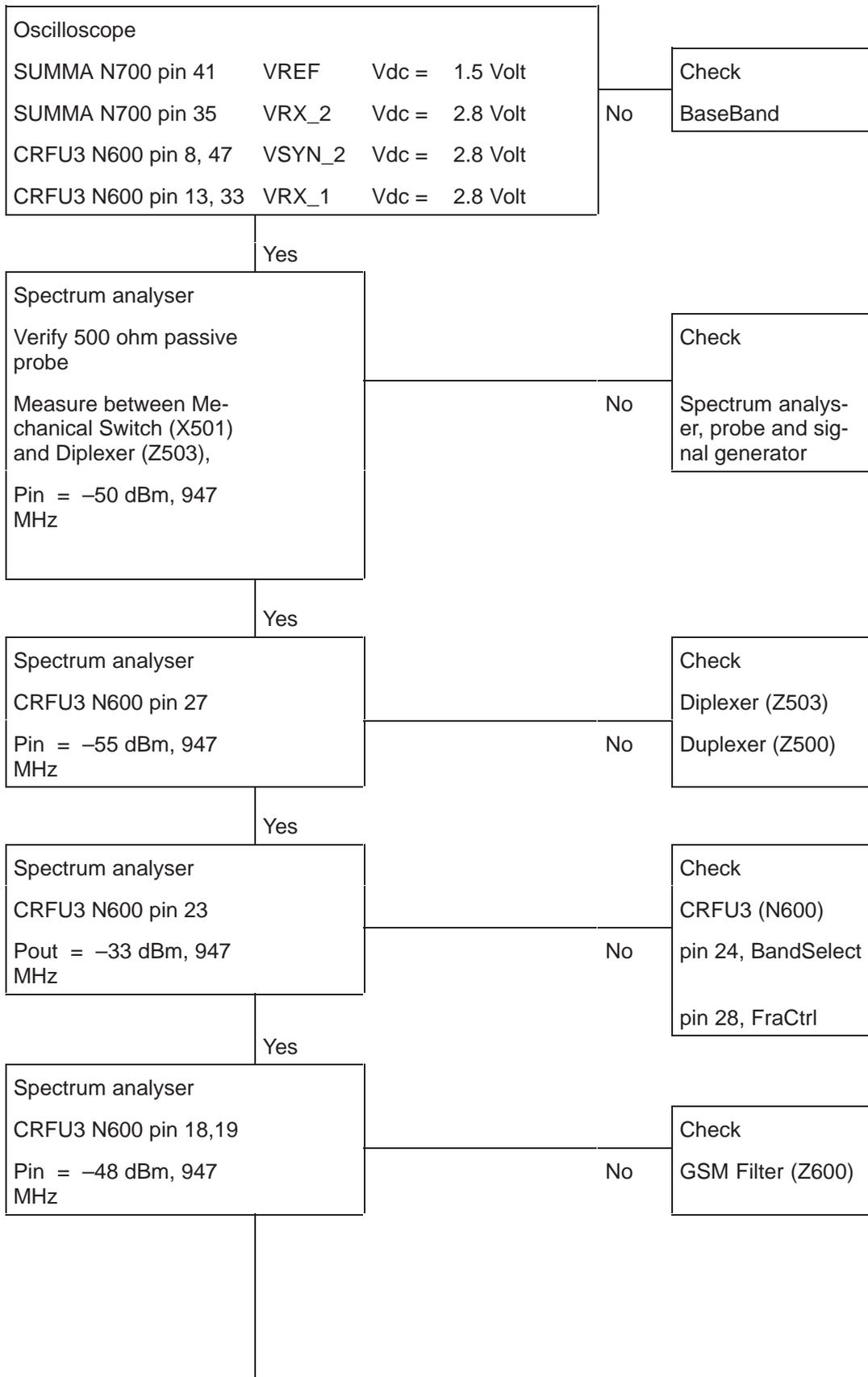
### Path of the received GSM signal

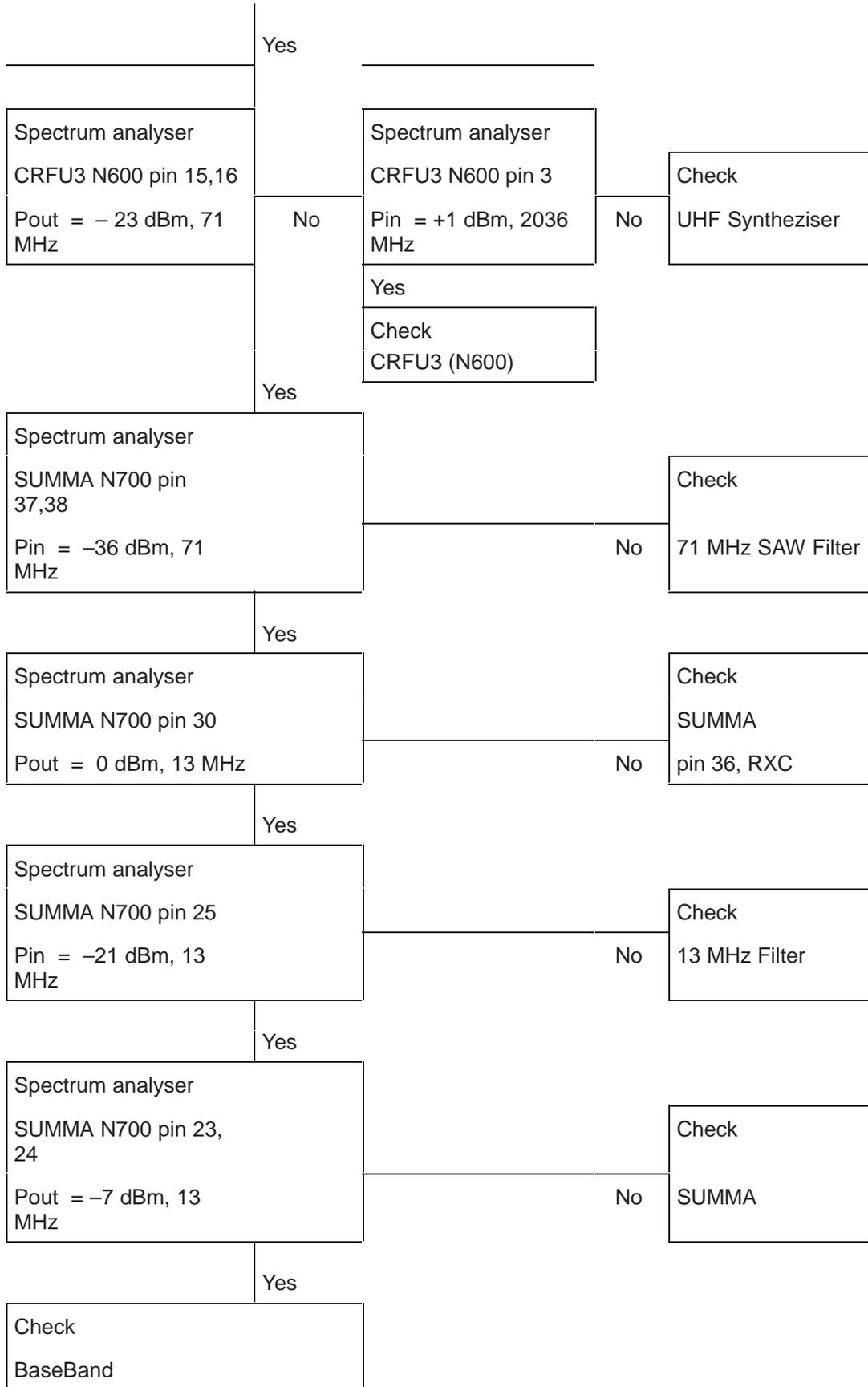
This path defines the general route of the received signal:

Antenna, Mechanical Switch (X501), Diplexer (Z503), Duplexer (Z500), CRFU3 (LNA N600), GSM Filter (Z600), CRFU3 (Mixer N600), SAW 71MHz Filter (Z700), SUMMA (N700), 13Mhz Filter (Z701), SUMMA, COBBA\_GJP (N200).

The related component number(s) *are defined inside (.).*

**Fault finding chart for GSM receiver**





**PCN Receiver**

Start WinTesla-Service-Software and

Select: Product

Band

PCN

Select: Testing

RF Controls

RX Continuous

Cont. Mode Ch: 700

Front End On

Apply a 1842.8 MHz (MID channel) -50 dBm signal to RF-connector. This signal is tracked through RX-path and will make the troubleshooting of the RX easier.

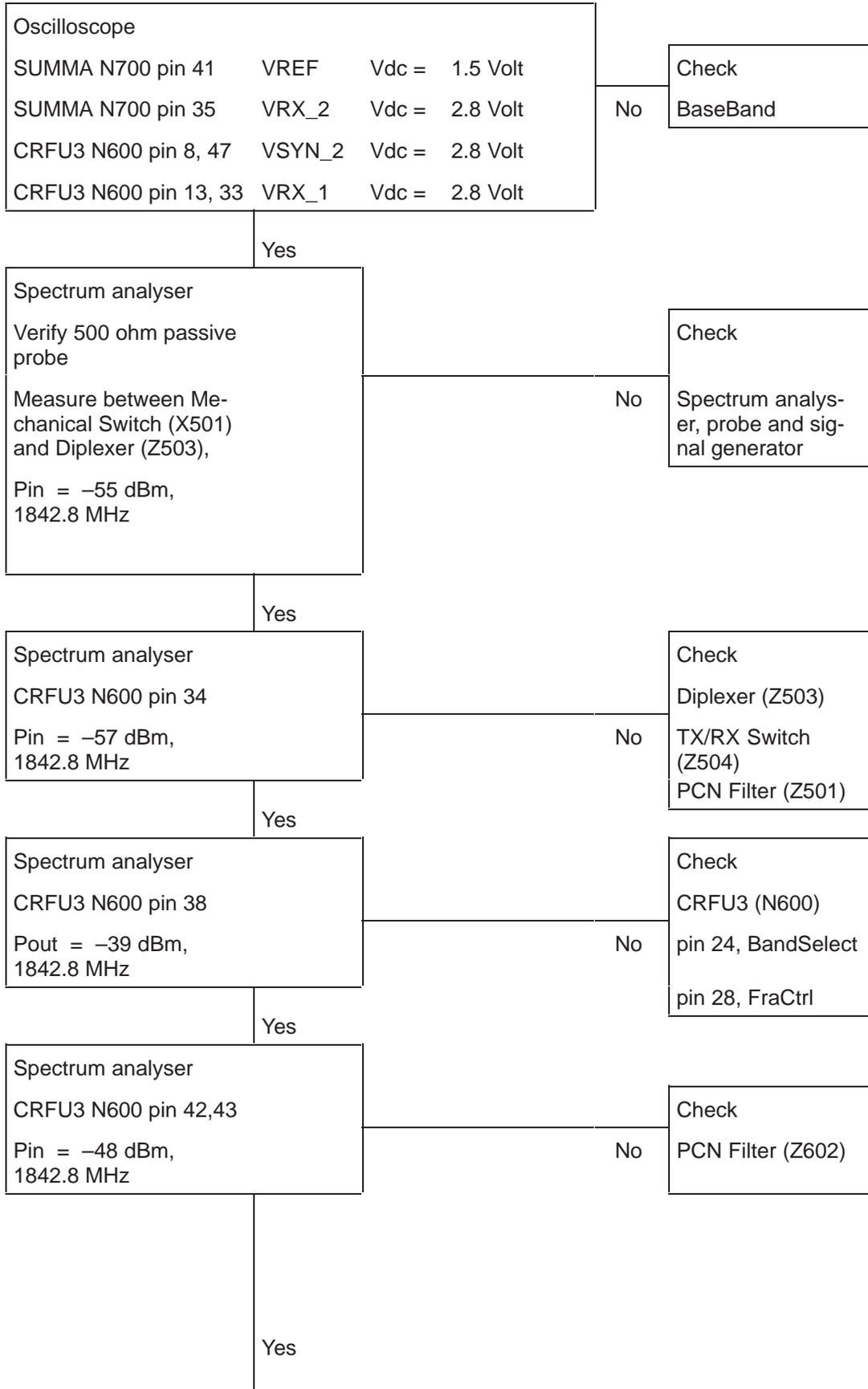
**Path of the received PCN signal**

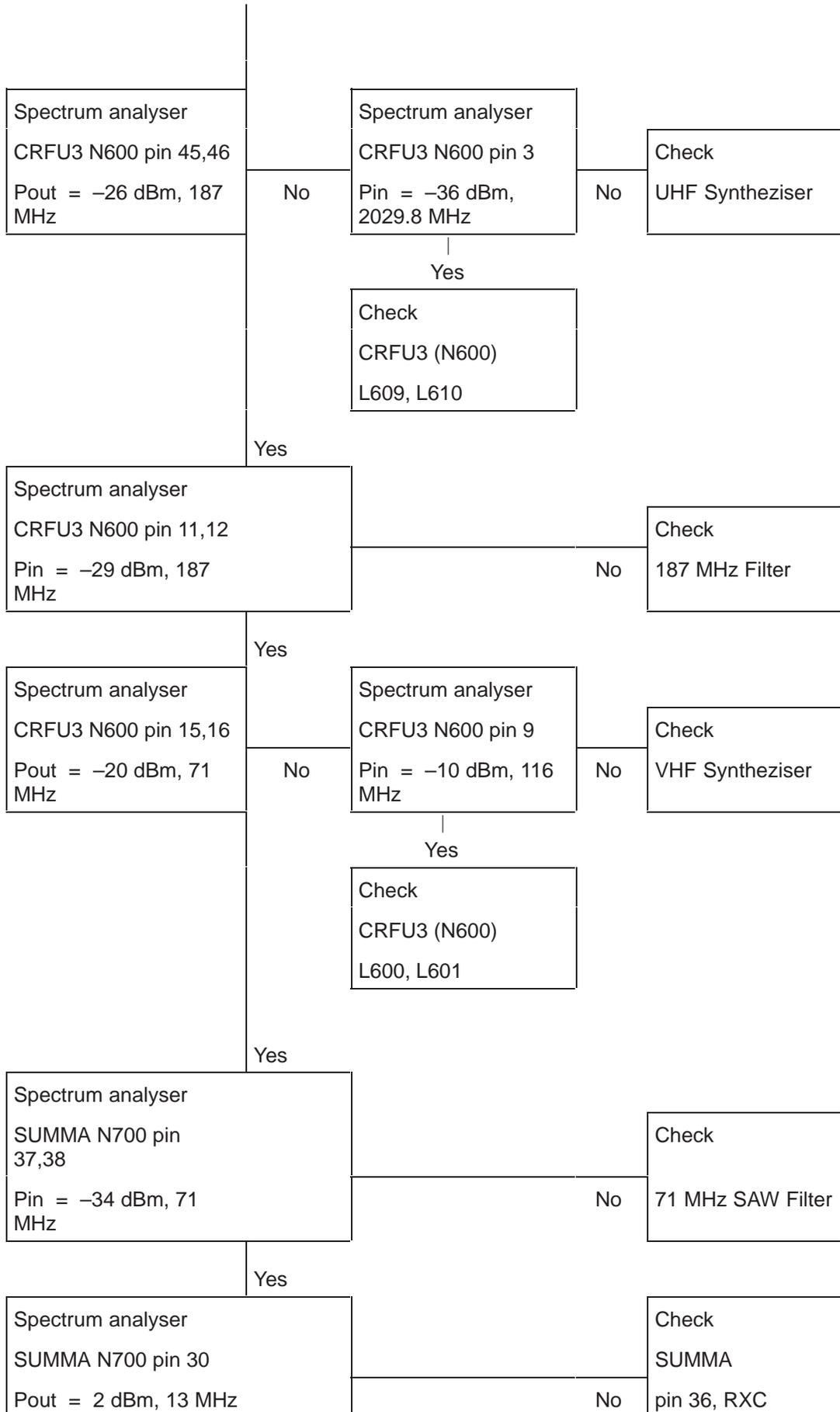
This path defines the general route of the received signal:

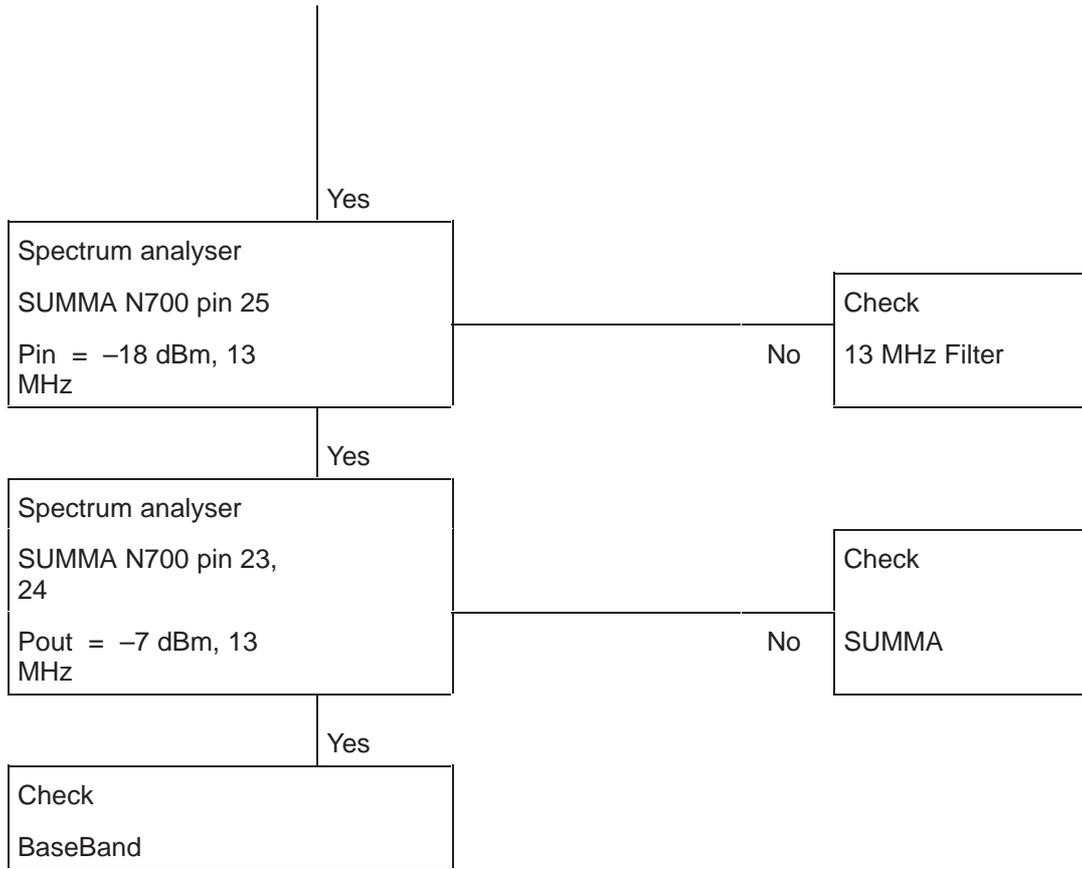
Antenna, Mechanical Switch (X501), Diplexer (Z503), TX/RX Switch (Z504), PCN Filter (Z501), CRFU3 (LNA N600), PCN Filter (Z602), CRFU3 (Mixer N600), LC 187 MHz Filter (L604), CRFU3 (Mixer N600), SAW 71MHz Filter (Z700), SUMMA (N700), 13Mhz Filter (Z701), SUMMA, COBBA\_GJP (N200).

The related component number(s) are defined inside (.).

**Fault finding chart for PCN receiver**







## GSM Transmitter

Apply a RF-cable to external RF-connector (X501) 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 burn.

Start WinTesla-Service-Software and

Select: Product

Band

GSM

Select: Testing

RF Controls

TX Continuous

TX\_Data Type: Random

TX Power Level : BASE

Channel: 60

### Path of the transmitted GSM signal

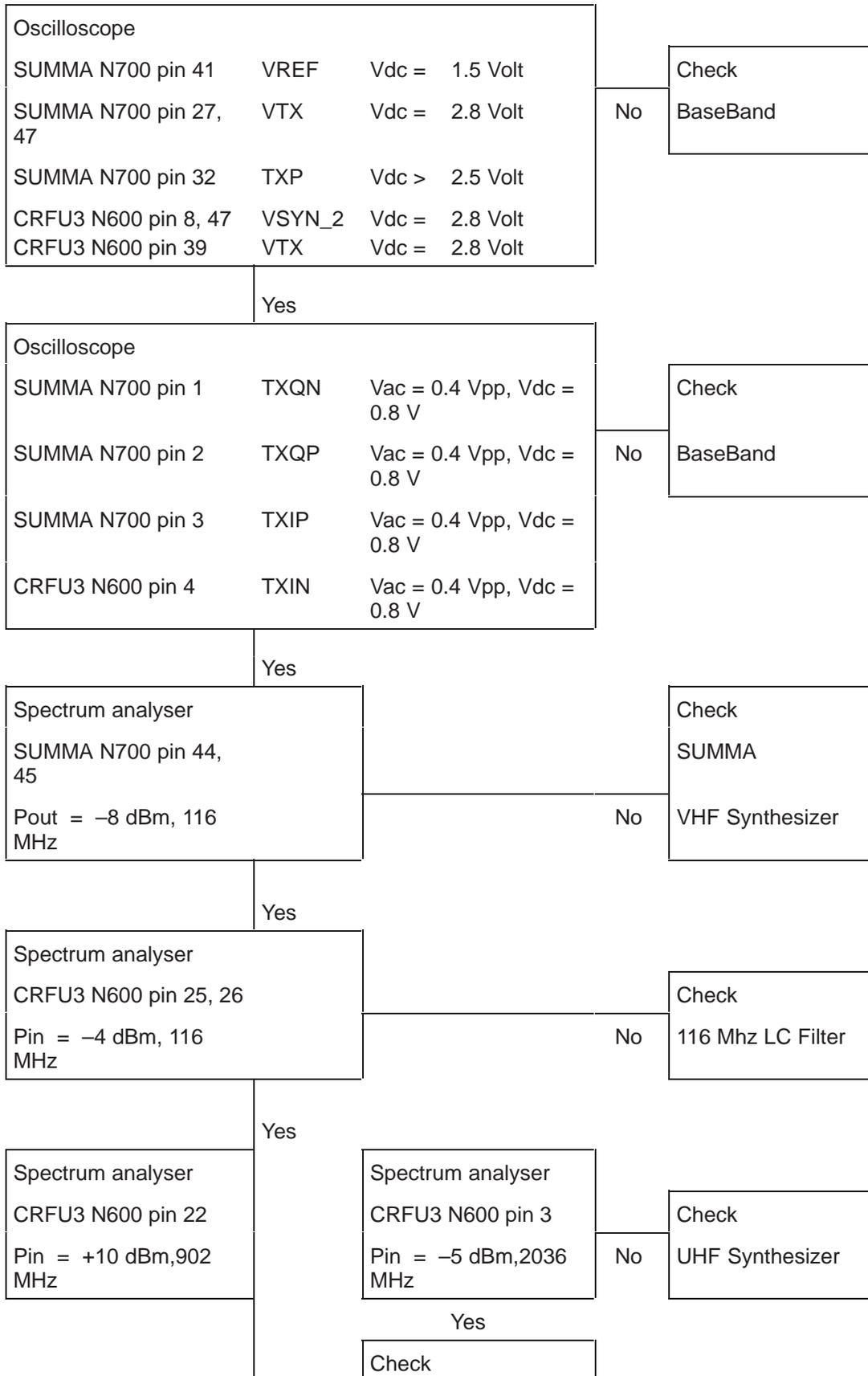
This path defines the general route of the transmitted signal:

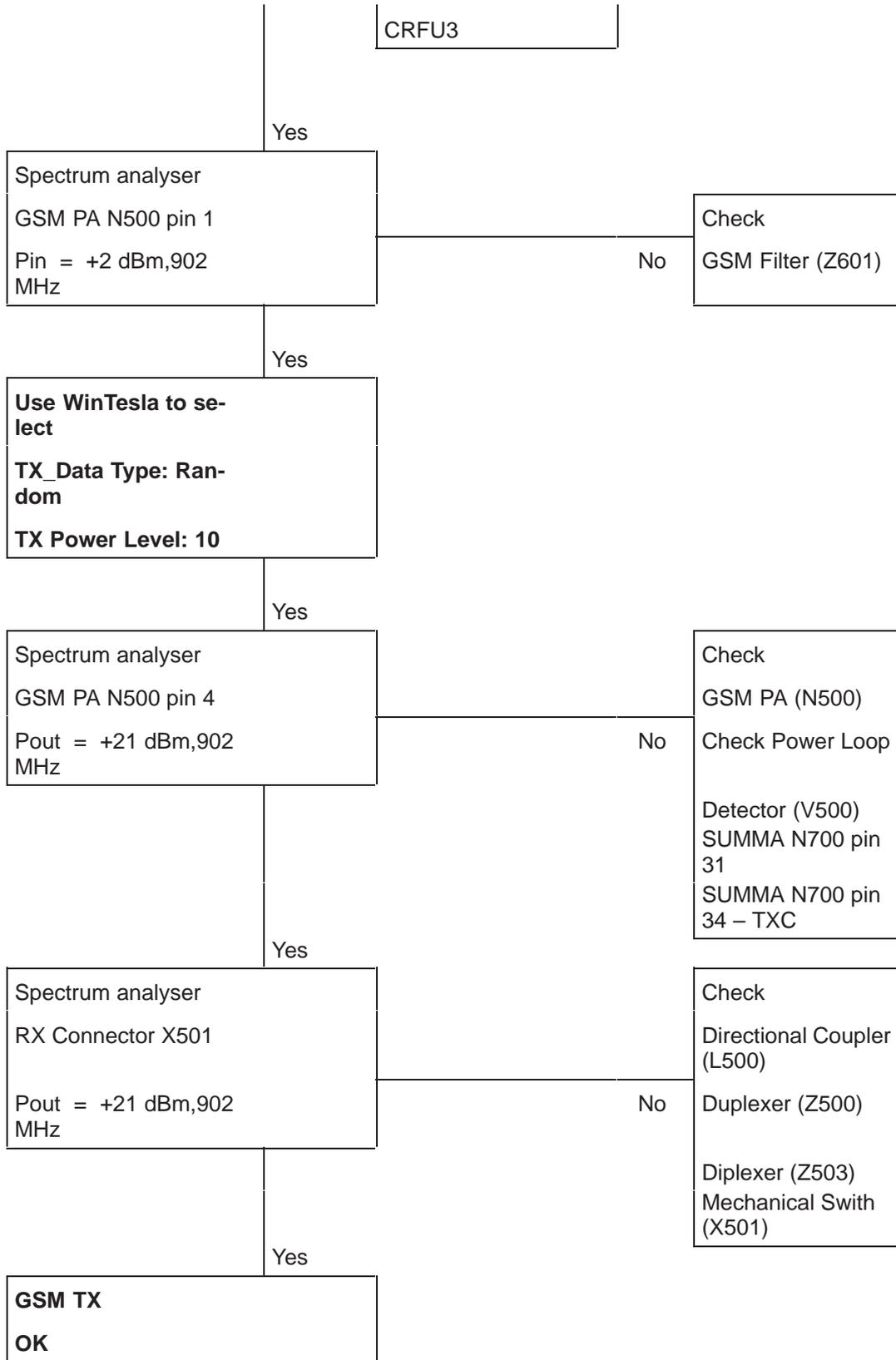
COBBA\_GJP (N200), SUMMA(N700), 116 Mhz Filter(L703, L704, L708), CRFU3 (Upconverter N600), GSM Filter (Z601), MMIC PA (N500), Directional Coupler (L500), Duplexer (Z500), Diplexer (Z503), Mechanical Swith (X501), Antenna.

The related component number(s) are defined inside (.).

There is also power detection (V500) and power control circuits inside SUMMA for transmitter power control.

**Fault finding chart for GSM transmitter**





## PCN Transmitter

Apply a RF-cable to external RF-connector (X501) 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 burn.

Start WinTesla-Service-Software and

Select: Product

Band

PCN

Select: Testing

RF Controls

TX Continuous

TX\_Data Type: Random

TX Power Level : BASE

Channel: 700

### Path of the transmitted PCN signal

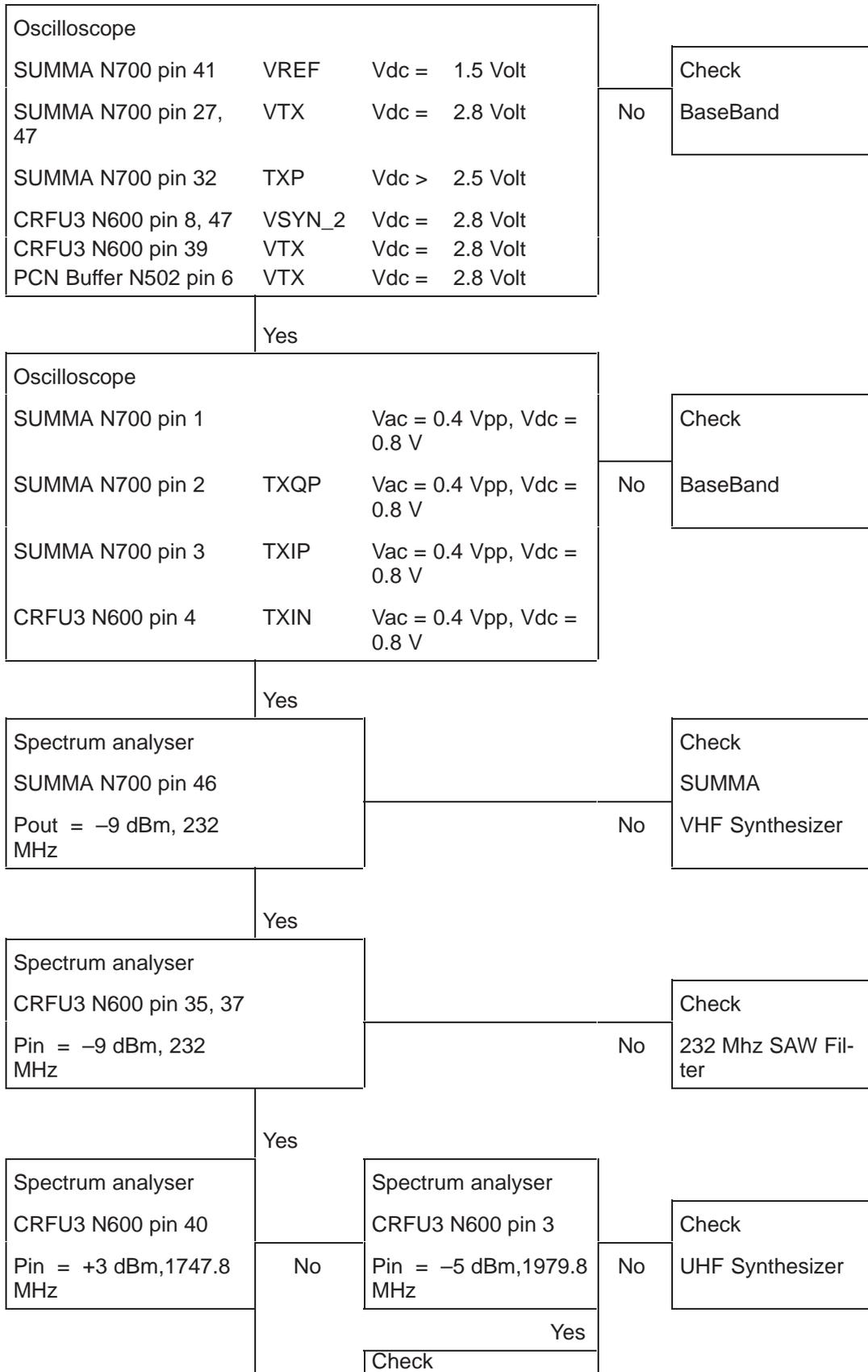
This path defines the general route of the transmitted signal:

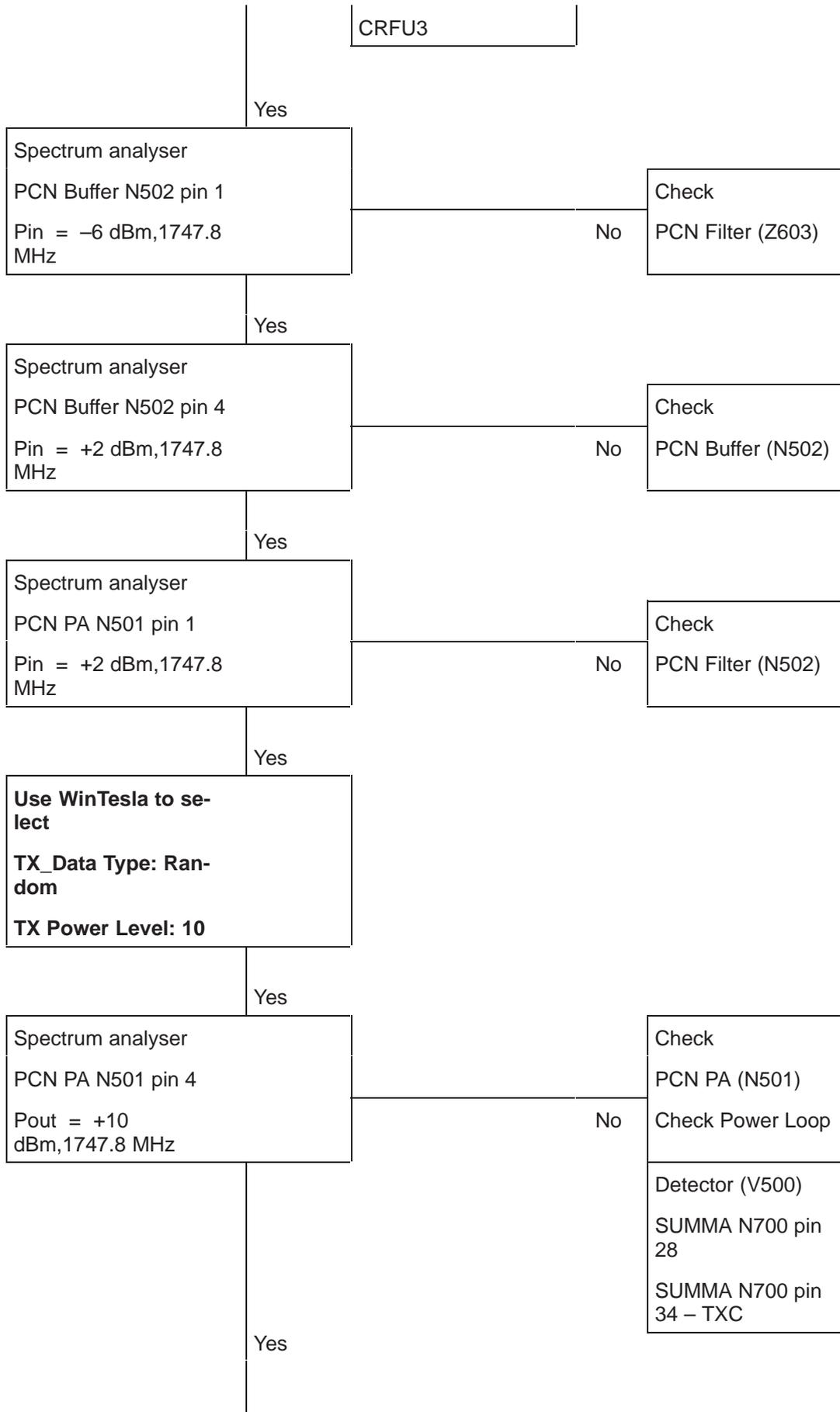
COBBA\_GJP (N200), SUMMA(N700), 232 Mhz SAW Filter(Z702), CRFU3 (Upconverter N600), PCN Filter (Z603), PCN Buffer (N502), PCN Filter (Z502), MMIC PA (N501), Directional Coupler (L500), TX/RX Switch (Z504), Diplexer (Z503), Mechanical Swith (X501), Antenna.

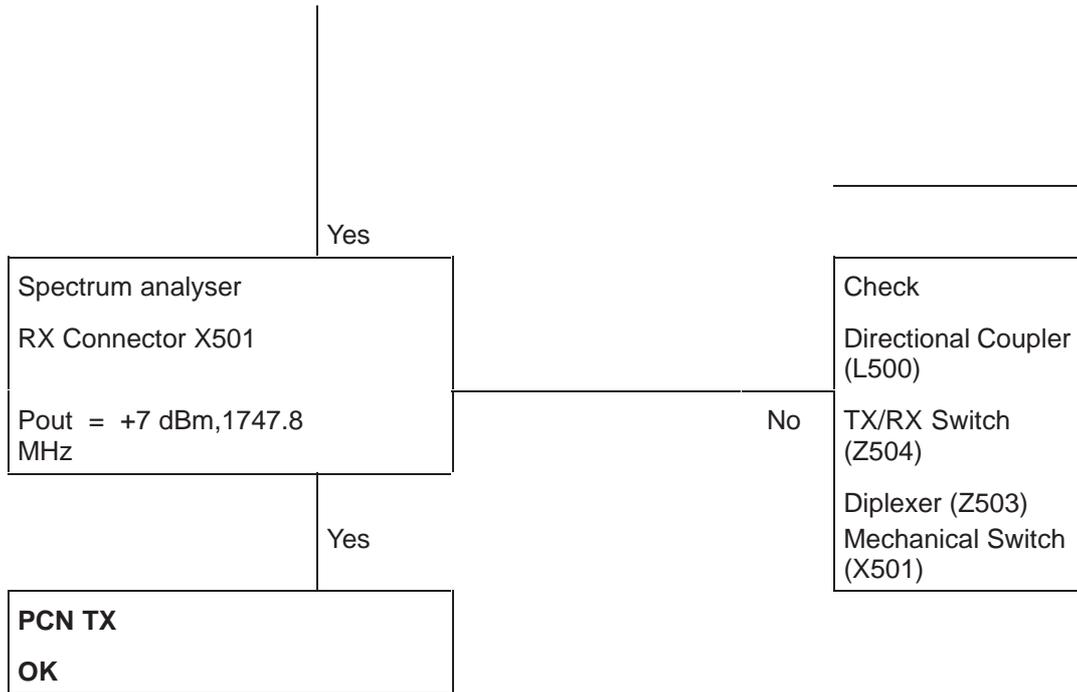
The related component number(s) are defined inside (.).

There is also power detection (V500) and power control circuits inside SUMMA for transmitter power control.

**Fault finding chart for PCN transmitter**







**Synthesizers**

There are three oscillators generating the needed frequencies for RF-section. 13 MHz reference oscillator, 464 MHz VHF VCO and UHF VCO.

The frequency range for UHF VCO is

- GSM TX: 2012.4 ... 2061.6 Mhz,
- PCN TX: 1942.2 ... 2016.8 Mhz,
- GSM RX: 2012.4 ... 2061.6 Mhz,
- PCN RX: 1992.2 ... 2066.8 MHz.

Start WinTesla-Service-Software and

Select: Product

Band

GSM

Select: Testing

RF Controls

RX Continuous

Cont. Mode Ch: 60

**13 MHz reference oscillator**

The 13 MHz oscillator (G701) is controlled by COBBA\_GJP (N200). This 13 MHz signal is pulse-shaped and connected to SUMMA (N700) and it is also buffered, filtered and connected to MAD2 (D300).

**VHF VCO**

The 464 MHz VHF VCO (G702) signal is used to generate the 116 MHz- and 232 MHz signals inside SUMMA. The 116 MHz signal is used in GSM transmitter and in PCN receiver. The 232 MHz signal is used in PCN transmitter.

**Fault finding chart for VHF VCO**

The fault finding is as described for UHF VCO with following exceptions:

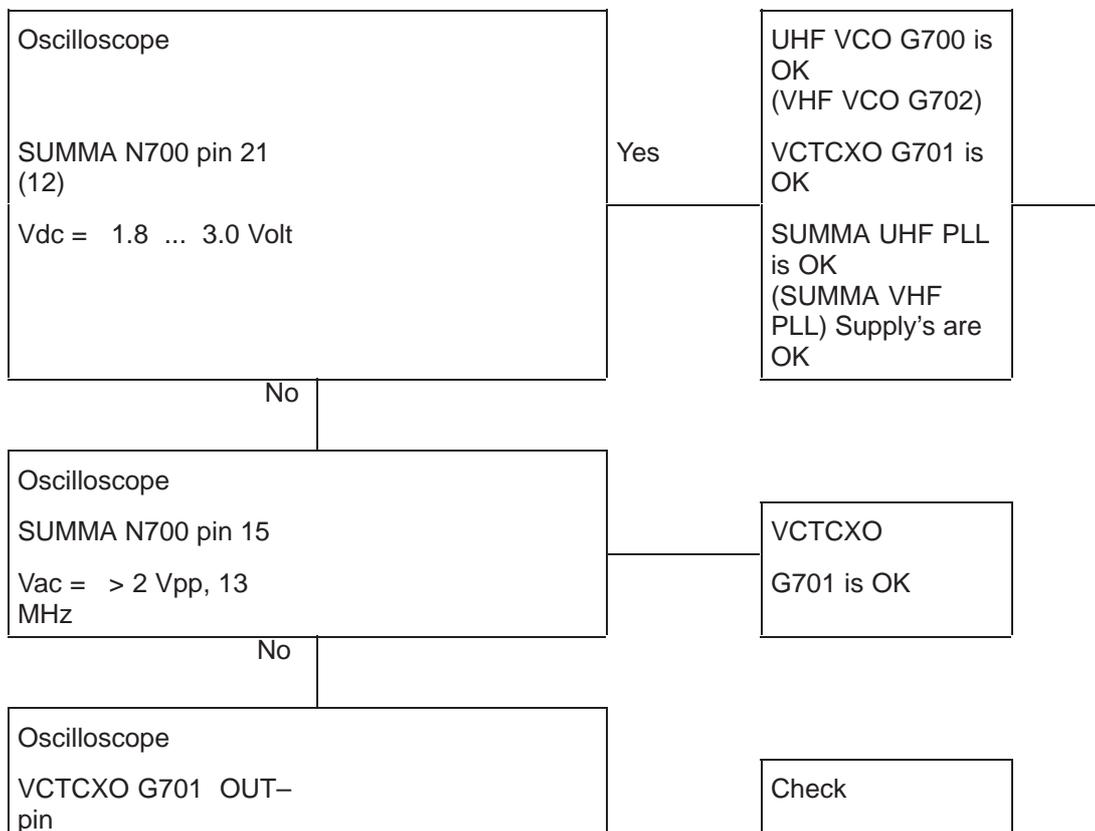
	UHF VCO		VHF VCO	
1	SUMMA N700 pin 21	changed to	SUMMA N700 pin 12	Vdc = 1.8 ... 3.0 Volt
2	UHF VCO G700	changed to	VHF VCO G702	
3	SUMMA UHF PLL	changed to	SUMMA VHF PLL	
4	UHF VCO G700 OUT-pin	changed to	VHF VCO G702 OUT-pin	Pout > -3 dBm

The exceptions will be inside (.) in the fault finding chart for the UHF VCO.

**UHF VCO**

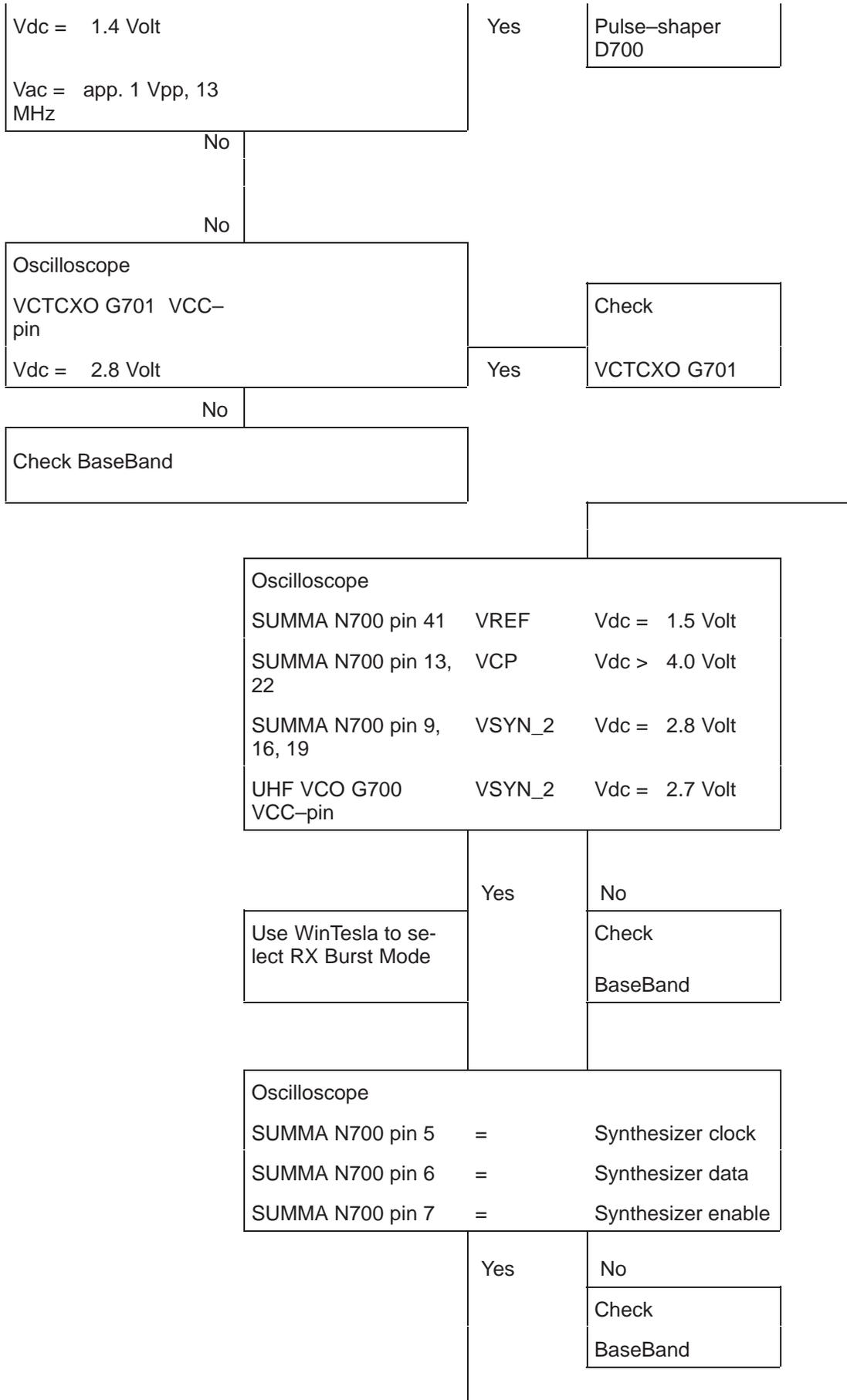
UHF VCO (G700) is used to generate the first injection for RX (GSM 2012.4 ... 2061.6 MHz, PCN 1992.2 ... 2066.8 MHz) and the final injection for TX (GSM 2012.4 ... 2061.6 MHz, PCN 1942.2 ... 2016.8 MHz). The output frequency of the module depends on the DC-control voltage coming from SUMMA.

**Fault finding chart for UHF VCO and 13 MHz reference oscillator**



Troubleshooting

Technical Documentation



Spectrum analyser UHF VCO G700 OUT-pin(VHF VCO G702 OUT-pin)  Pout > -10 dBm, 2036 MHz(464 MHz)	No	Check UHF VCO G700
Yes		_____
Spectrum analyser SUMMA N700 pin 18 Pin > -10 dBm, 1018 MHz	Yes	UHF Synthesizer Seems to be OK. Check discrete components
No		
Check CRFU3		

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