PAMS Technical Documentation
NSE–5 Series Transceivers

Troubleshooting

Issue 1 07/99

Contents

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.

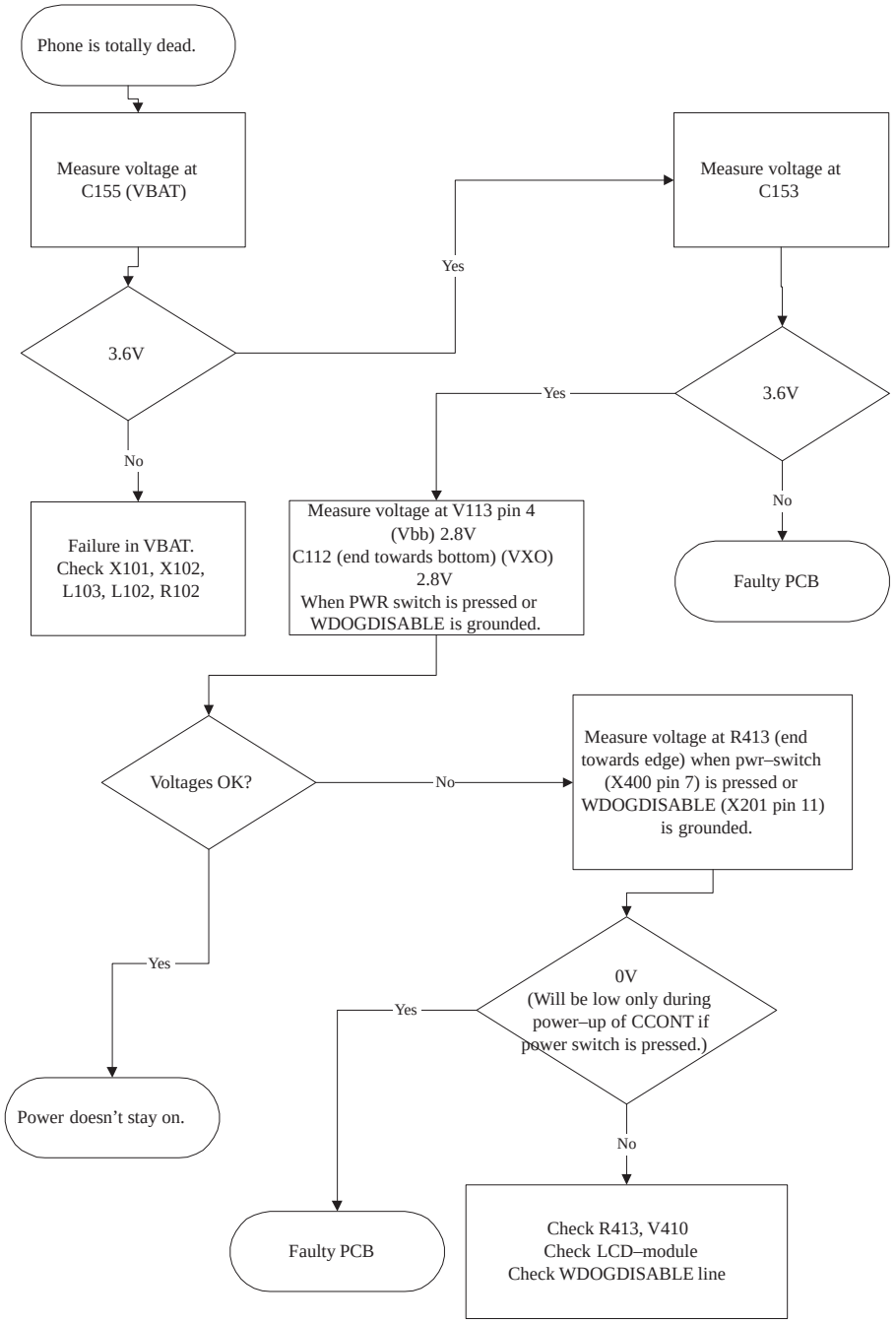


Figure 1.

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

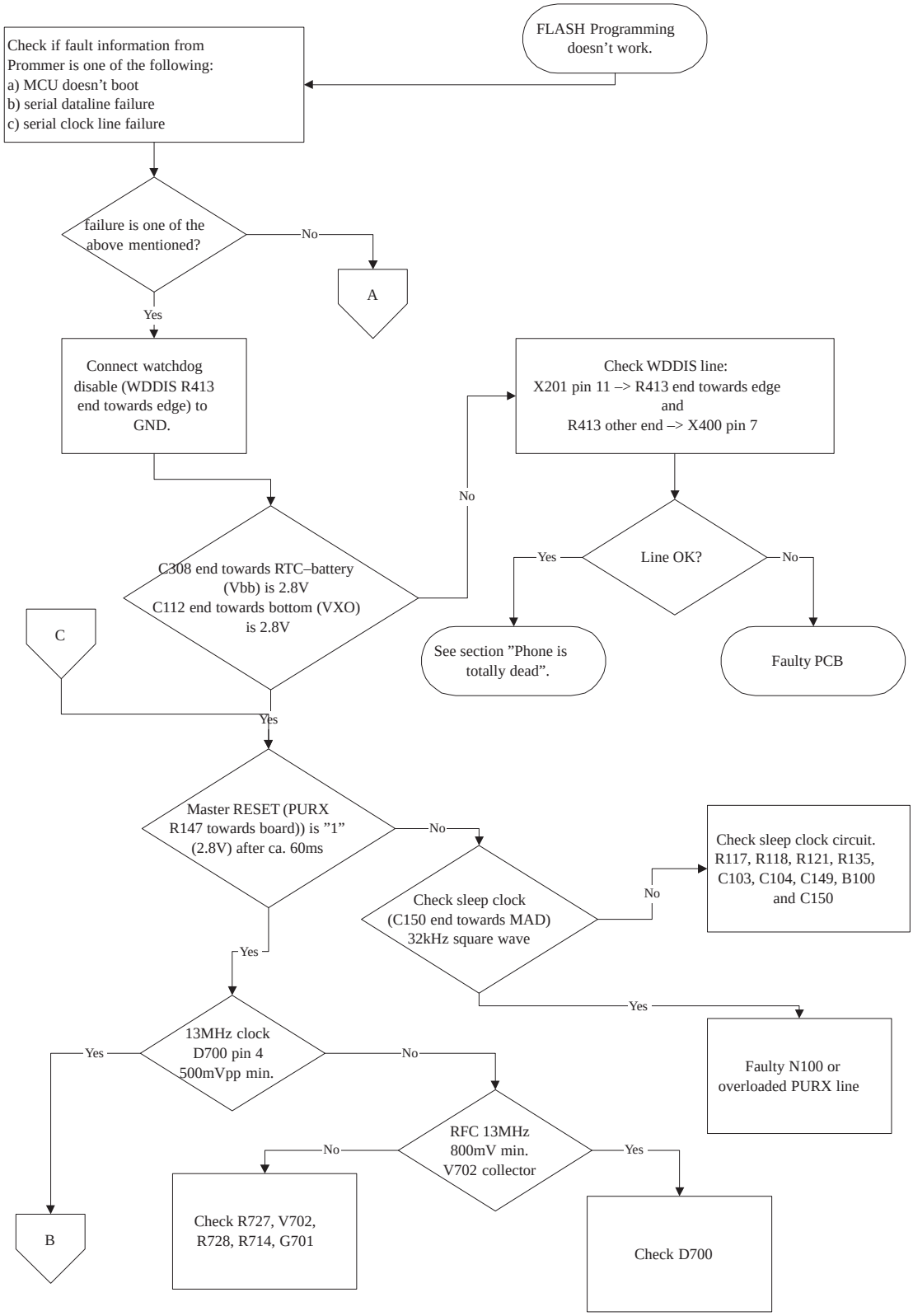

FLASH Programming doesn't work.
Check if fault information from Prommer is one of the following:
a) MCU doesn't boot
b) serial dataline failure
c) serial clock line failure
failure is one of the above mentioned?
No
A
Yes
Connect watchdog disable (WDDIS R413 end towards edge) to GND.
Check WDDIS line:
X201 pin 11 –> R413 end towards edge
and
R413 other end –> X400 pin 7
No
C308 end towards RTC–battery (Vbb) is 2.8V
C112 end towards bottom (VXO) is 2.8V
Yes
Line OK?
Yes
No
See section "Phone is totally dead".
Faulty PCB
C
Yes
Master RESET (PURX R147 towards board)) is "1" (2.8V) after ca. 60ms
No
Check sleep clock (C150 end towards MAD) 32kHz square wave
No
Check sleep clock circuit. R117, R118, R121, R135, C103, C104, C149, B100 and C150
Yes
Yes
Faulty N100 or overloaded PURX line
13MHz clock D700 pin 4 500mVpp min.
Yes
No
RFC 13MHz 800mV min. V702 collector
No
Yes
Check R727, V702, R728, R714, G701
Check D700
B

Figure 2.

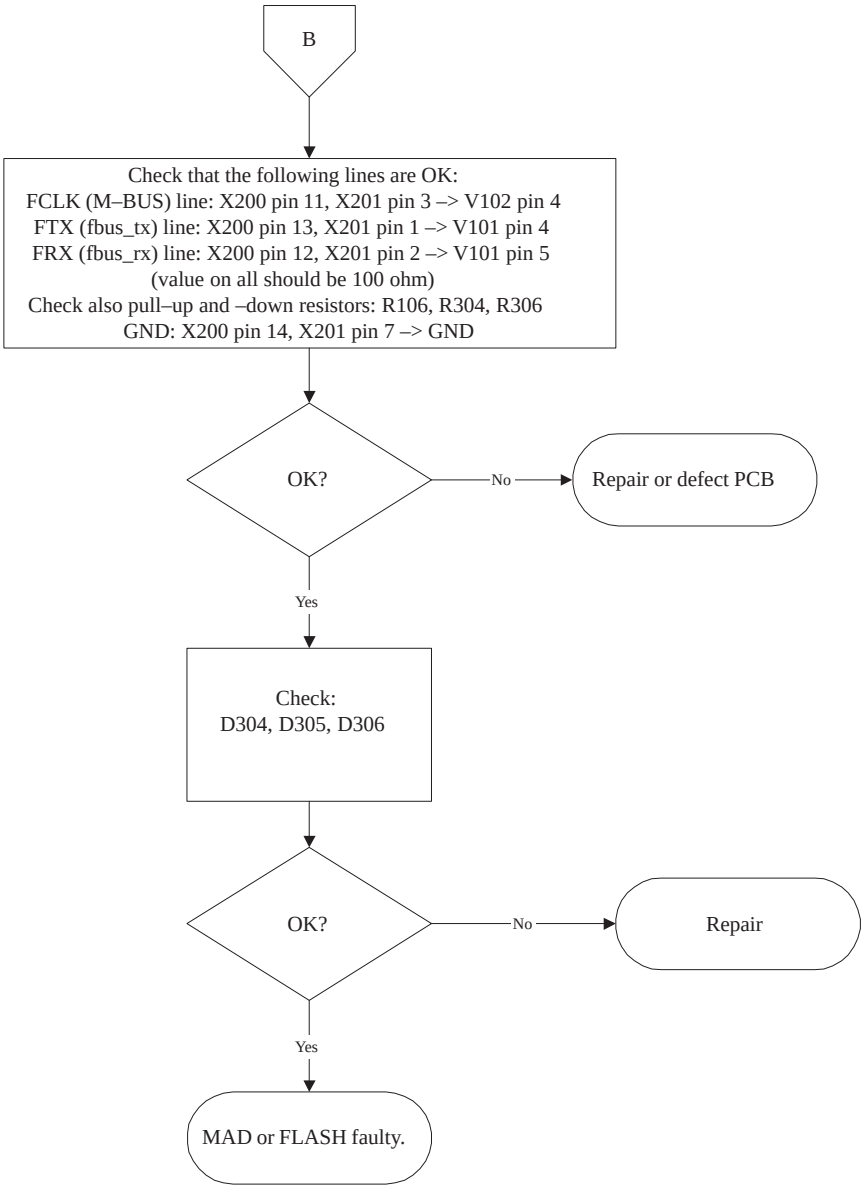

B
Check that the following lines are OK:
FCLK (M–BUS) line: X200 pin 11, X201 pin 3 –> V102 pin 4
FTX (fbus_tx) line: X200 pin 13, X201 pin 1 –> V101 pin 4
FRX (fbus_rx) line: X200 pin 12, X201 pin 2 –> V101 pin 5
(value on all should be 100 ohm)
Check also pull–up and –down resistors: R106, R304, R306
GND: X200 pin 14, X201 pin 7 –> GND
OK?
No
Repair or defect PCB
Yes
Check:
D304, D305, D306
OK?
No
Repair
Yes
MAD or FLASH faulty.

Figure 3.

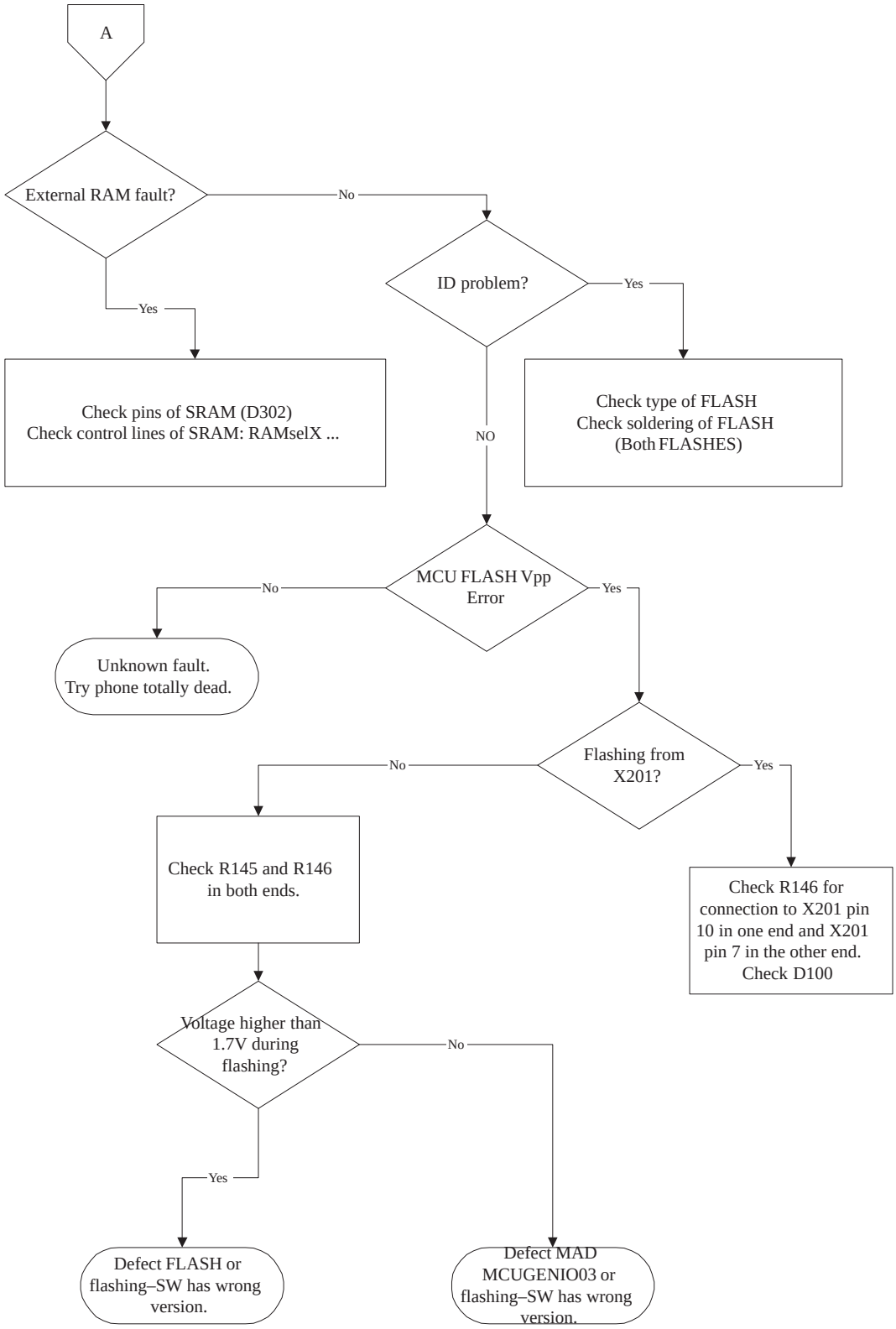

A
External RAM fault?
No
Yes
ID problem?
Yes
Check pins of SRAM (D302)
Check control lines of SRAM: RAMselX ...
NO
Check type of FLASH
Check soldering of FLASH
(Both FLASHES)
MCU FLASH Vpp Error
No
Yes
Unknown fault.
Try phone totally dead.
Flashing from X201?
No
Yes
Check R145 and R146 in both ends.
Check R146 for connection to X201 pin 10 in one end and X201 pin 7 in the other end.
Check D100
Voltage higher than 1.7V during flashing?
No
Yes
Defect FLASH or flashing–SW has wrong version.
Defect MAD MCUGENIO03 or flashing–SW has wrong version.

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.

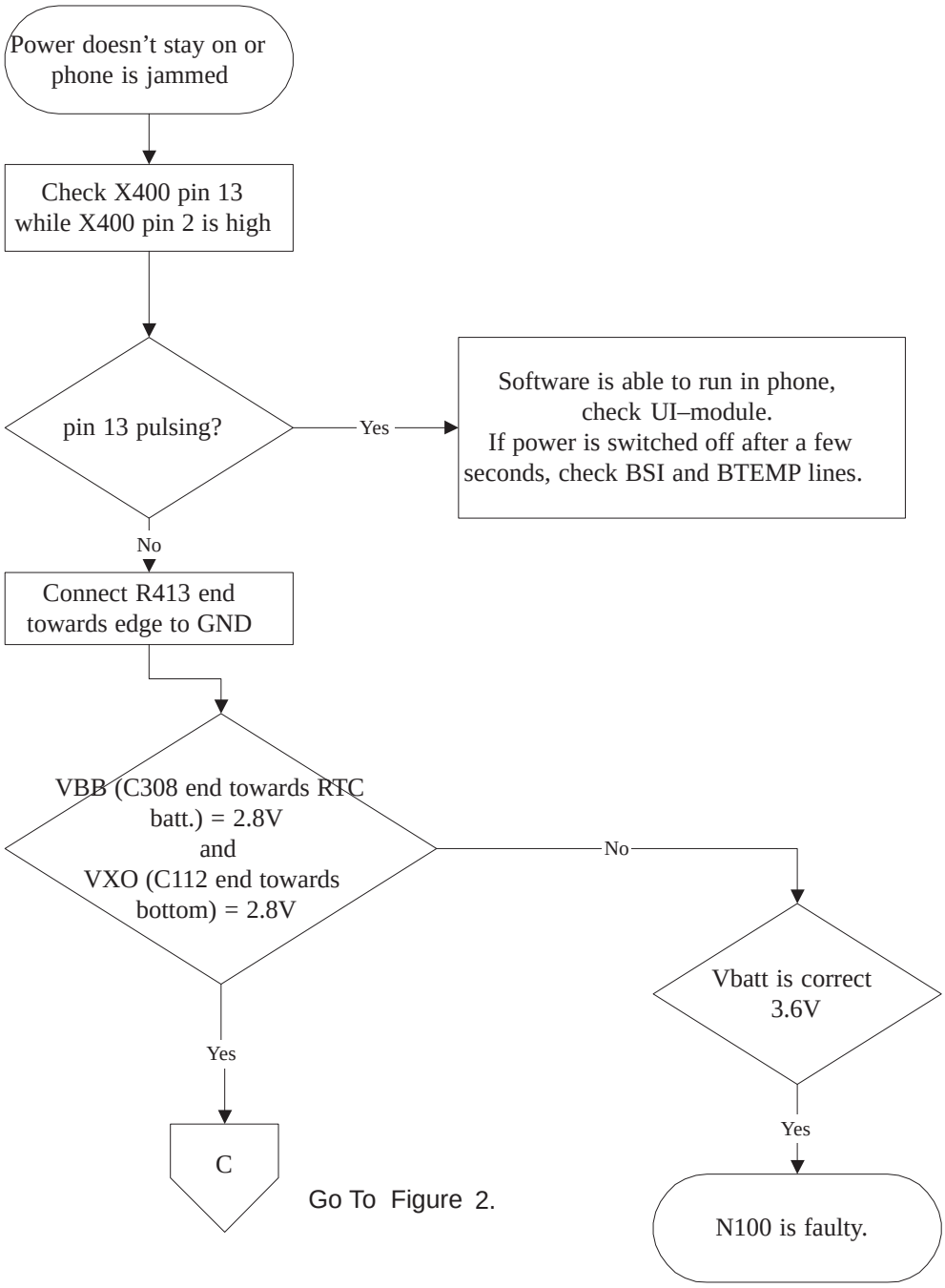

Power doesn't stay on or phone is jammed
Check X400 pin 13 while X400 pin 2 is high
pin 13 pulsing?
Yes
Software is able to run in phone, check UI–module. If power is switched off after a few seconds, check BSI and BTEMP lines.
No
Connect R413 end towards edge to GND
VBB (C308 end towards RTC batt.) = 2.8V and VXO (C112 end towards bottom) = 2.8V
No
Vbatt is correct 3.6V
Yes
Yes
C
Go To Figure 2.
N100 is faulty.

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

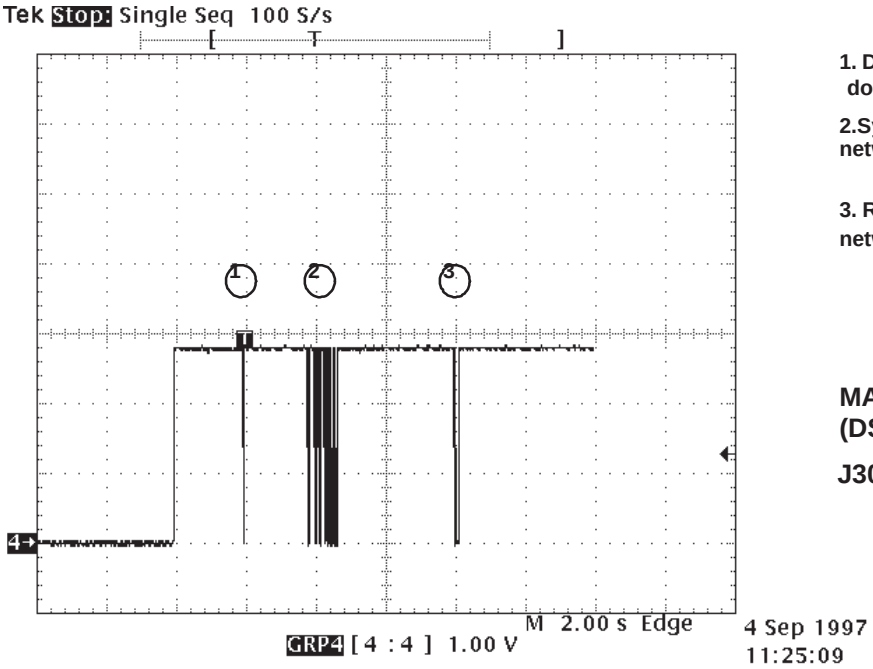
5. The phone doesn't register to the network or phone doesn't make a call

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.).

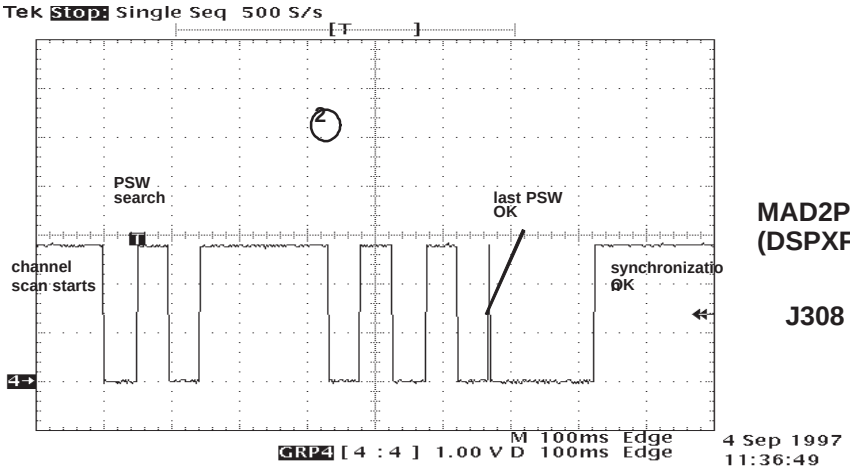
The DSP software is constructed so that operation states of DSP (MAD2Pr1) can be seen in external flag (DSPXF) output pin J308.

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.

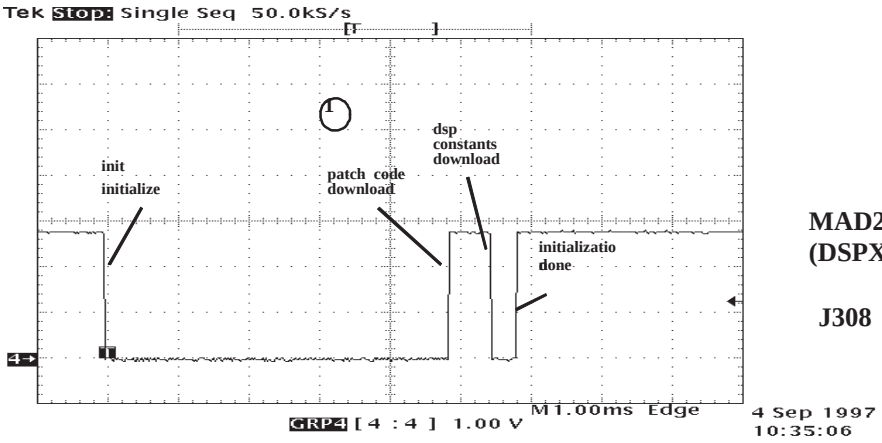


MAD2Pr1 pin D8 (DSPXF)

J308

The states of DSP after power on

Figure 7.

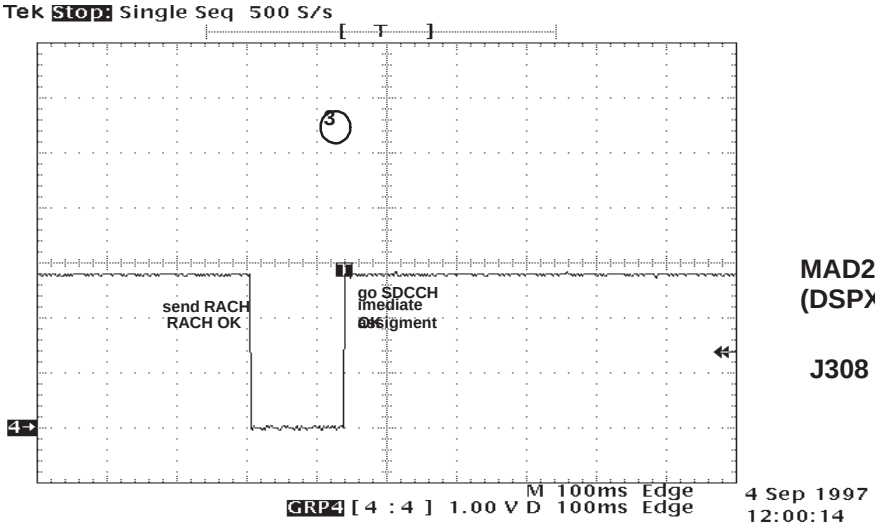


MAD2Pr1 pin D8 (DSPXF)

J308

The states of DSP after power on

Figure 8.



MAD2Pr1 pin D8 (DSPXF)

J308

The states of DSP after power on

Figure 9.

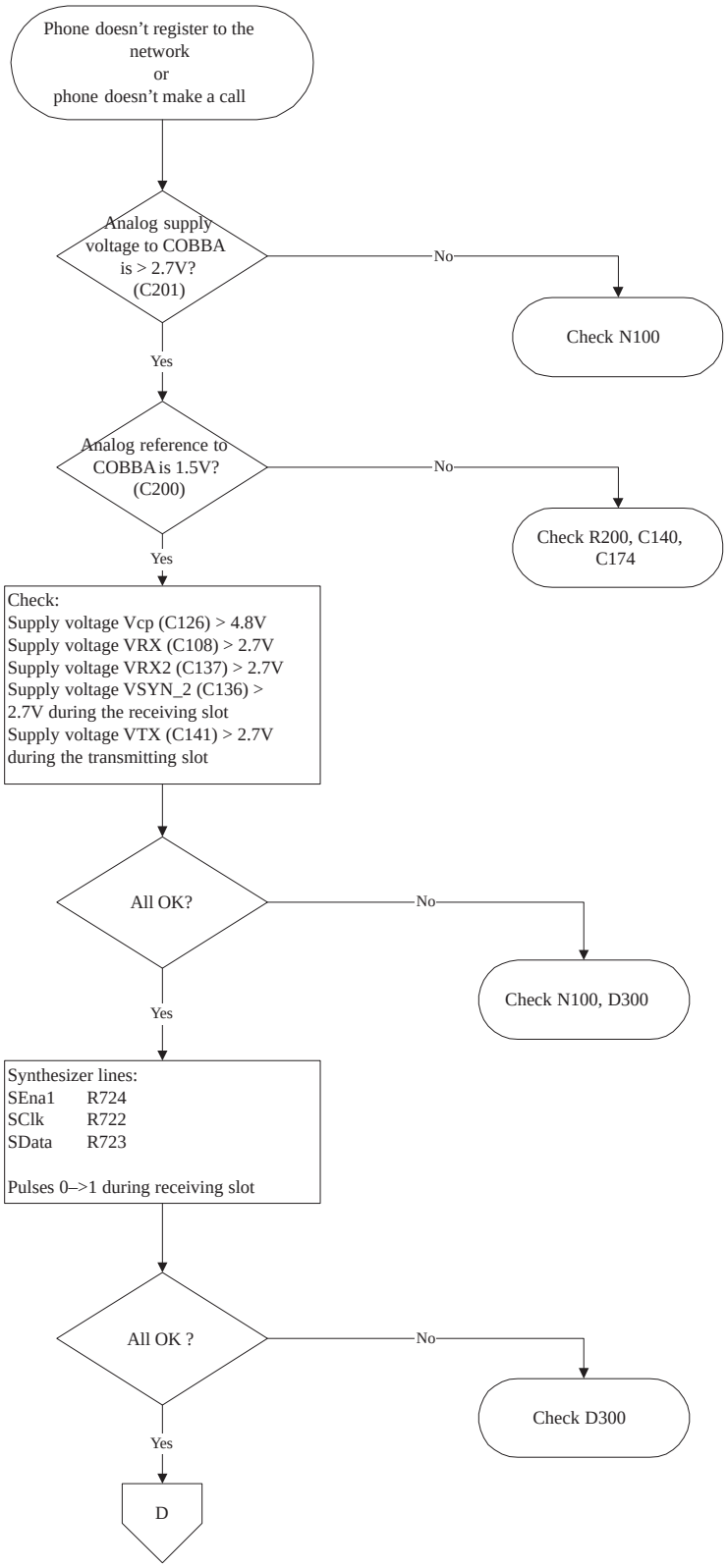

Phone doesn't register to the network or phone doesn't make a call
Analog supply voltage to COBBA is > 2.7V? (C201)
No
Check N100
Yes
Analog reference to COBBA is 1.5V? (C200)
No
Check R200, C140, C174
Yes
Check:
Supply voltage Vcp (C126) > 4.8V
Supply voltage VRX (C108) > 2.7V
Supply voltage VRX2 (C137) > 2.7V
Supply voltage VSYN_2 (C136) > 2.7V during the receiving slot
Supply voltage VTX (C141) > 2.7V during the transmitting slot
All OK?
No
Check N100, D300
Yes
Synthesizer lines:
SEna1 R724
SClk R722
SData R723
Pulses 0–>1 during receiving slot
All OK ?
No
Check D300
Yes
D

Figure 10.

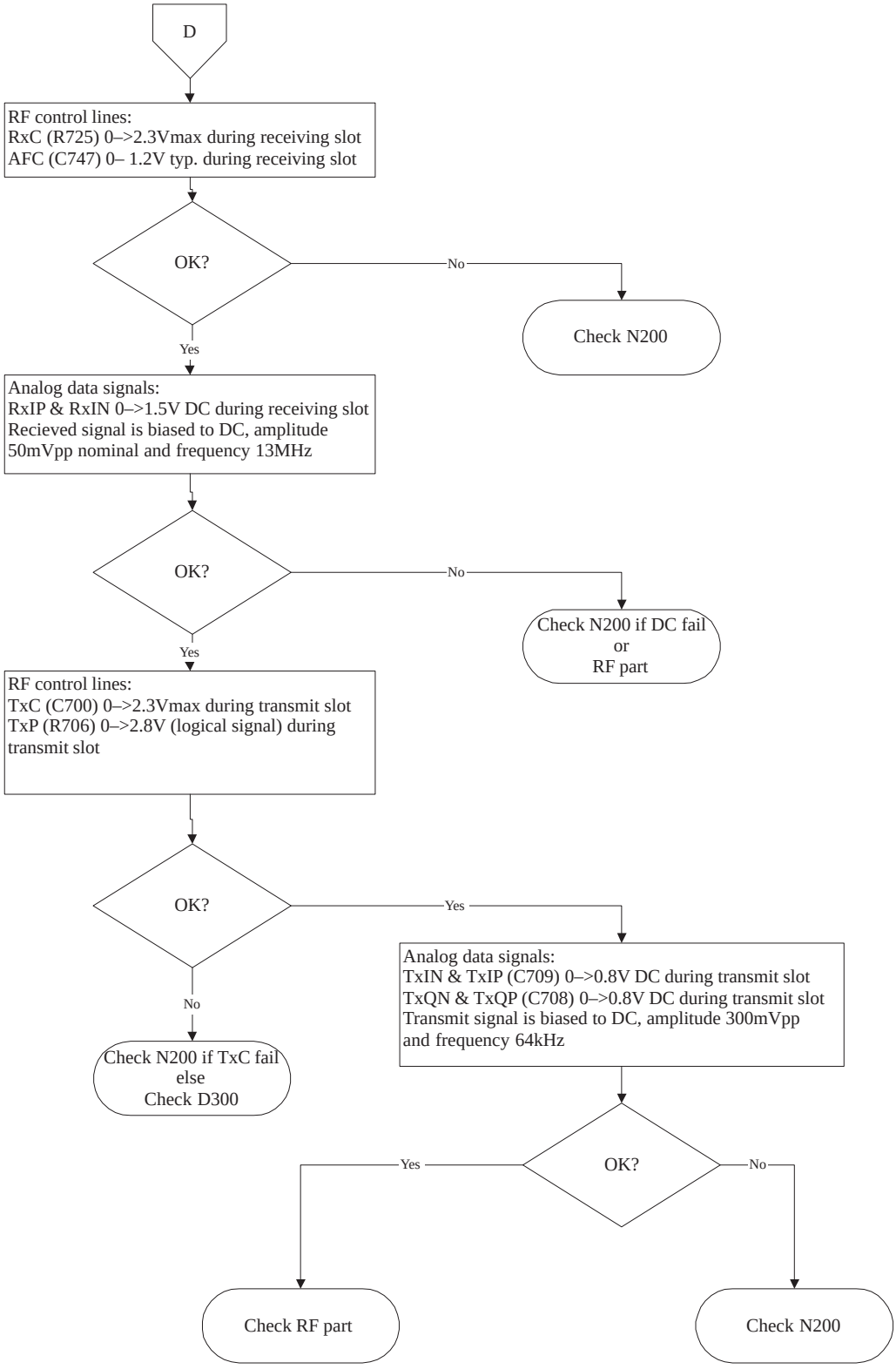

D
RF control lines:
RxC (R725) 0–>2.3Vmax during receiving slot
AFC (C747) 0– 1.2V typ. during receiving slot
OK?
No
Check N200
Yes
Analog data signals:
RxIP & RxIN 0–>1.5V DC during receiving slot
Recieved signal is biased to DC, amplitude
50mVpp nominal and frequency 13MHz
OK?
No
Check N200 if DC fail
or
RF part
Yes
RF control lines:
TxC (C700) 0–>2.3Vmax during transmit slot
TxP (R706) 0–>2.8V (logical signal) during
transmit slot
OK?
Yes
Analog data signals:
TxIN & TxIP (C709) 0–>0.8V DC during transmit slot
TxQN & TxQP (C708) 0–>0.8V DC during transmit slot
Transmit signal is biased to DC, amplitude 300mVpp
and frequency 64kHz
No
Check N200 if TxC fail
else
Check D300
OK?
Yes
No
Check RF part
Check N200

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.

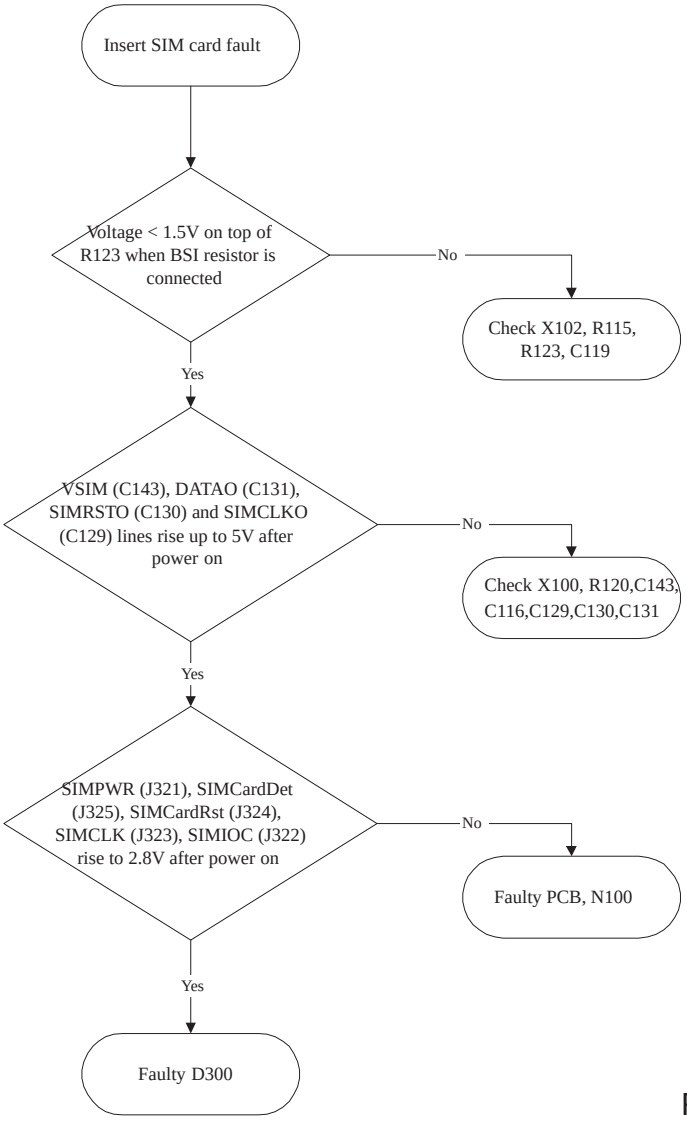


Figure 12.

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).

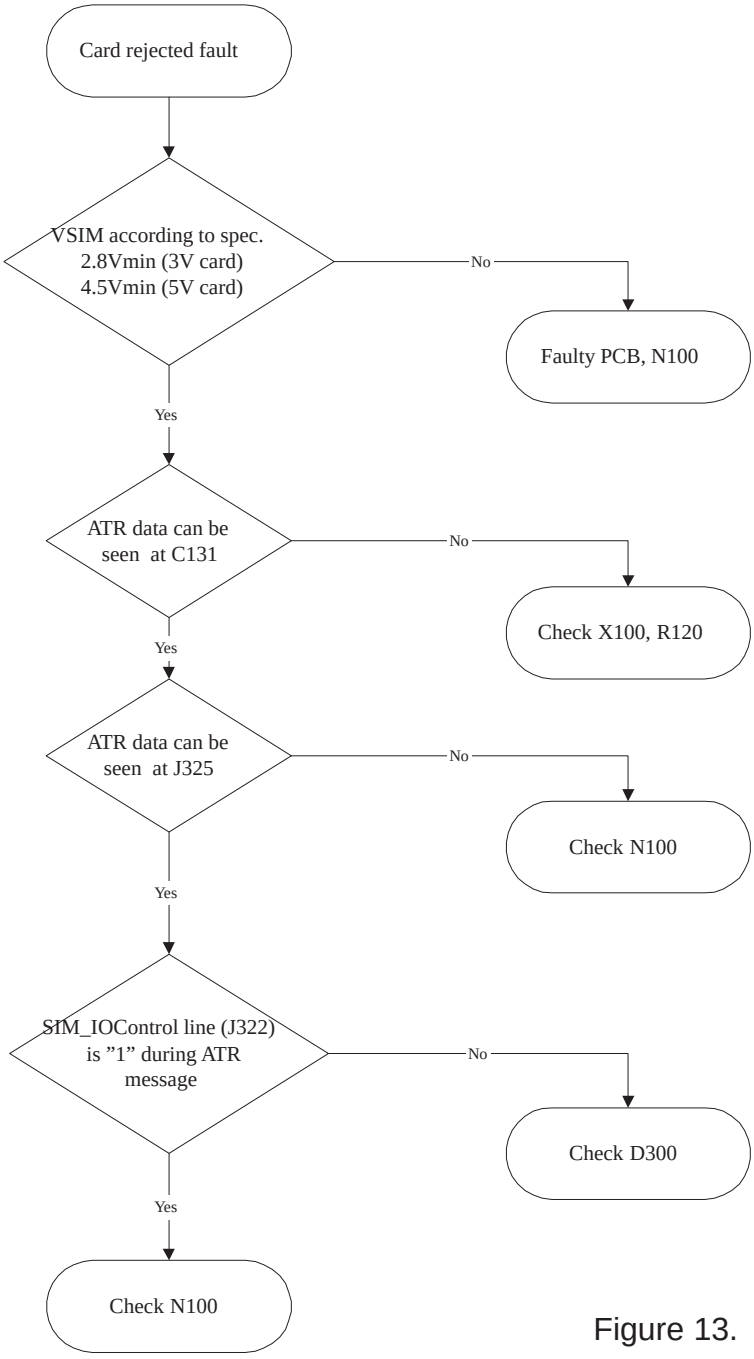

Card rejected fault
VSIM according to spec.
2.8Vmin (3V card)
4.5Vmin (5V card)
No
Faulty PCB, N100
Yes
ATR data can be
seen at C131
No
Check X100, R120
Yes
ATR data can be
seen at J325
No
Check N100
Yes
SIM_IOControl line (J322)
is ”1” during ATR
message
No
Check D300
Yes
Check N100

Figure 13.

7. Audio Faults

7.1 Uplink/Downlink Problem

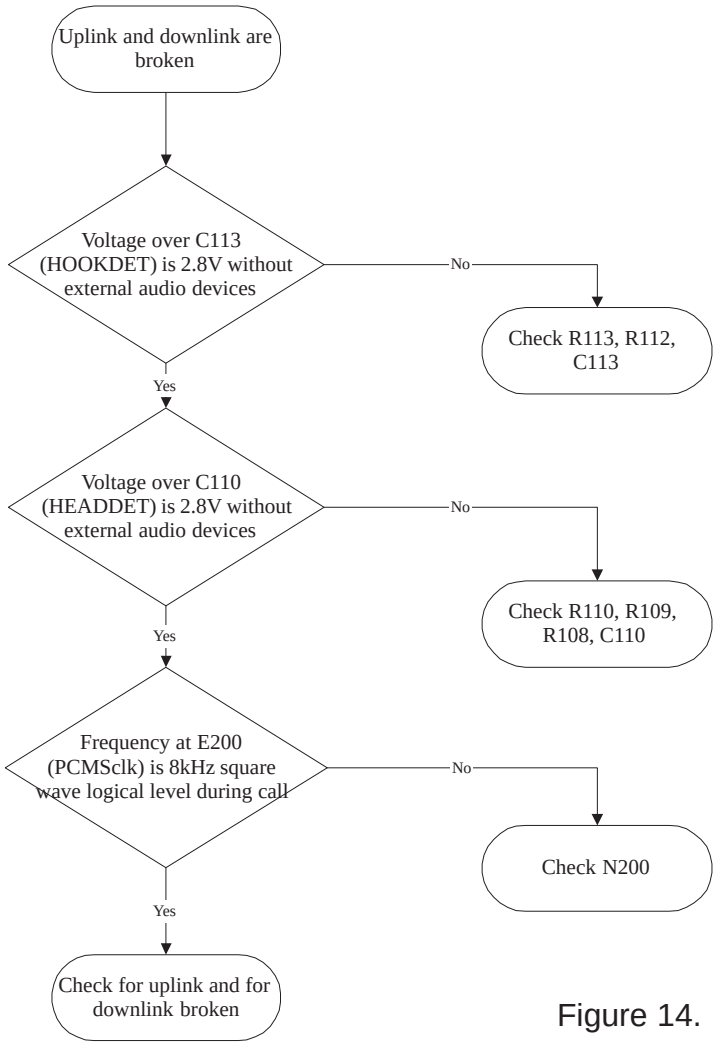


Figure 14.

7.1 Uplink Problem

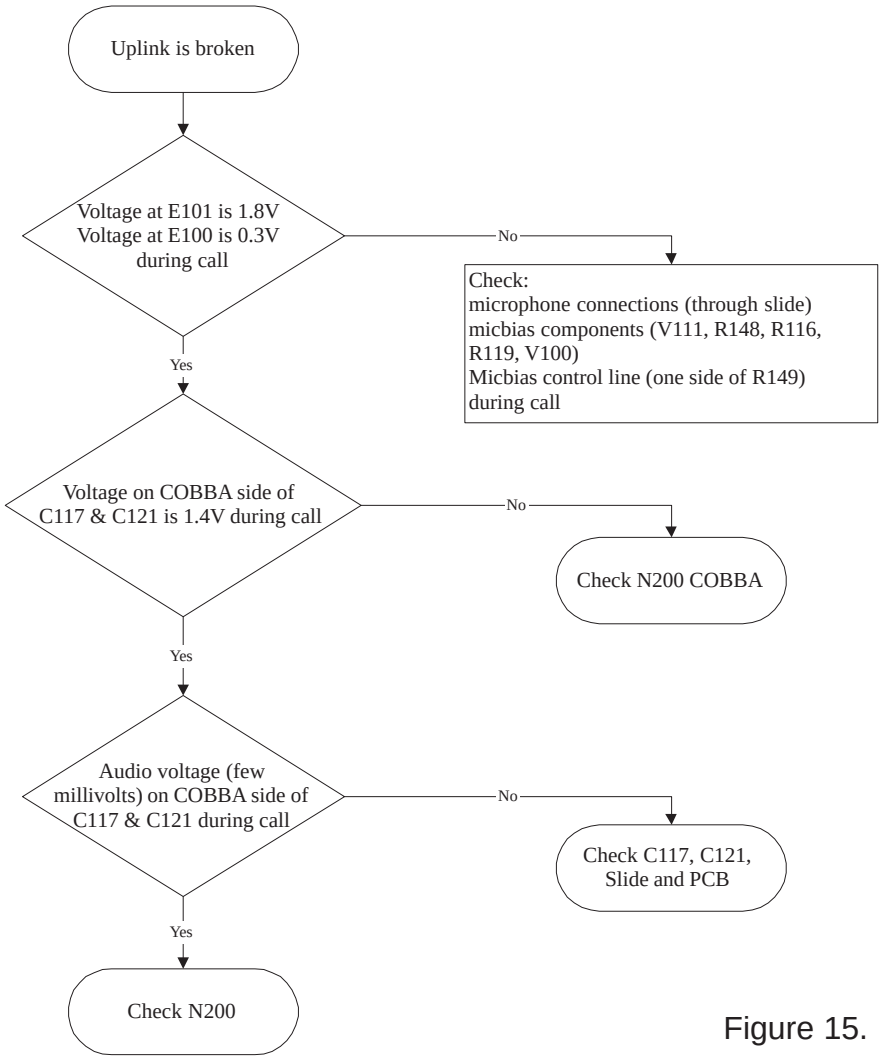


Figure 15.

7.1 Downlink Problem

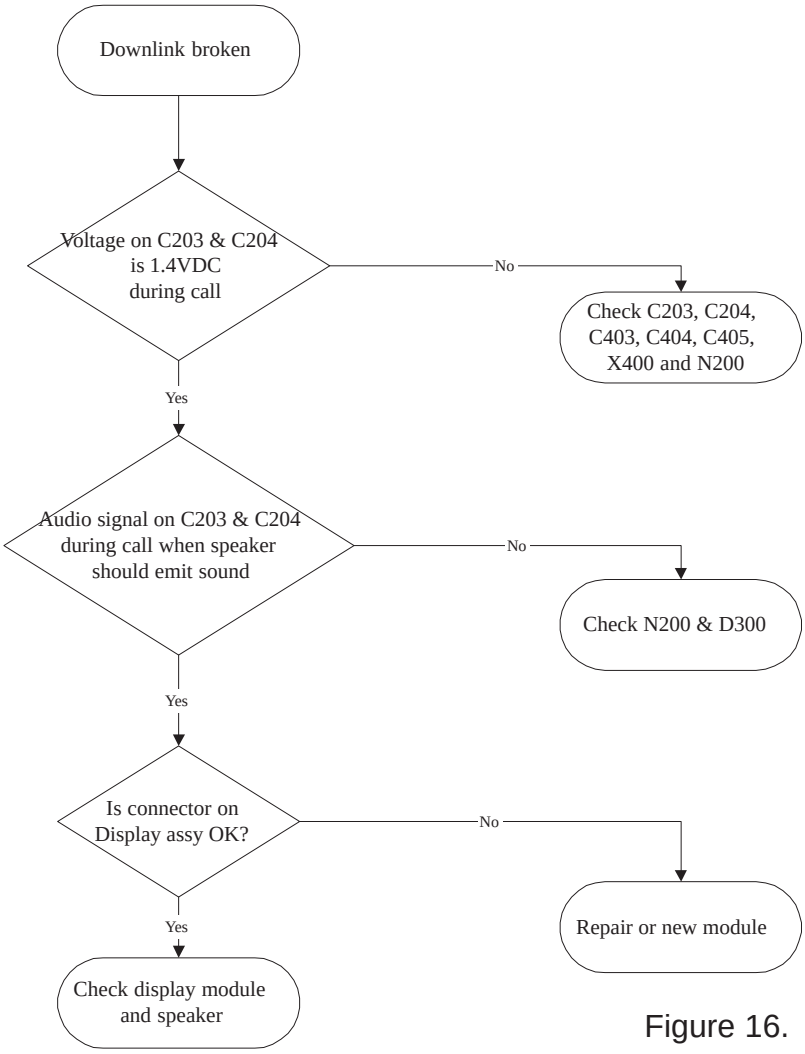


Figure 16.

8. Charging Faults

8.1 Seems Dead

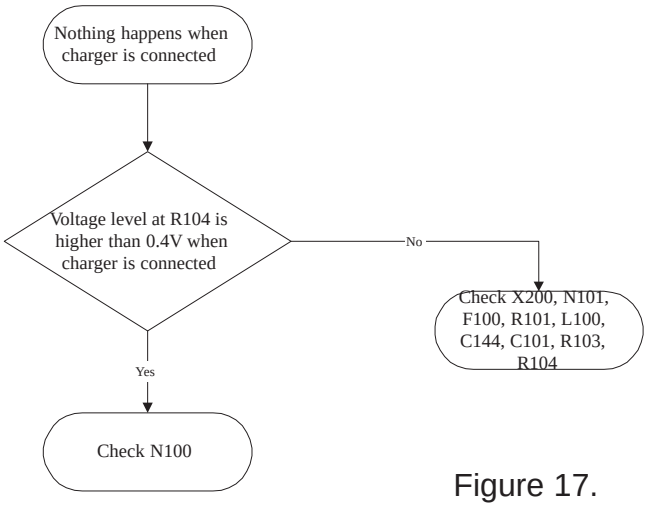


Figure 17.

8.2 Display Problem

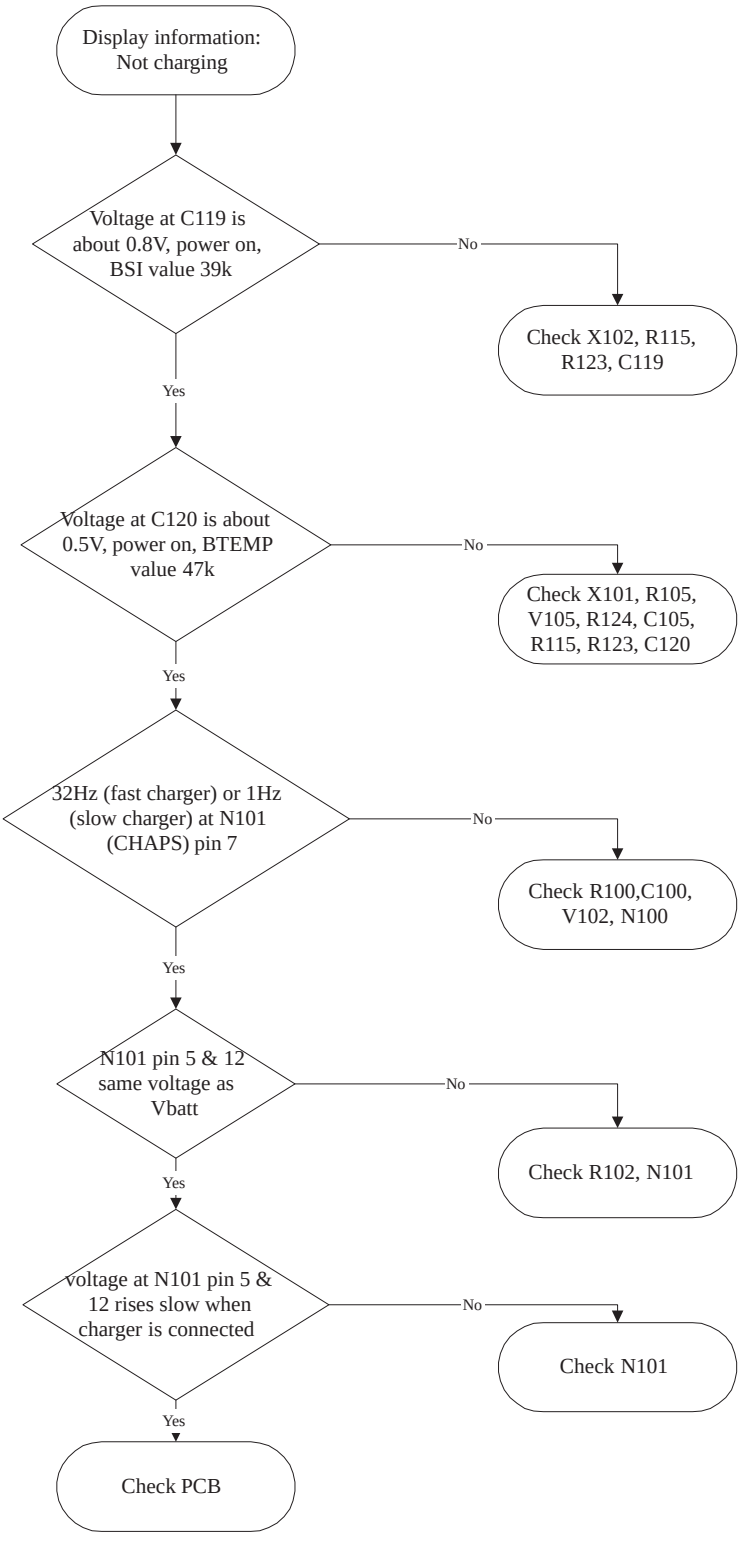


Figure 18.

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.

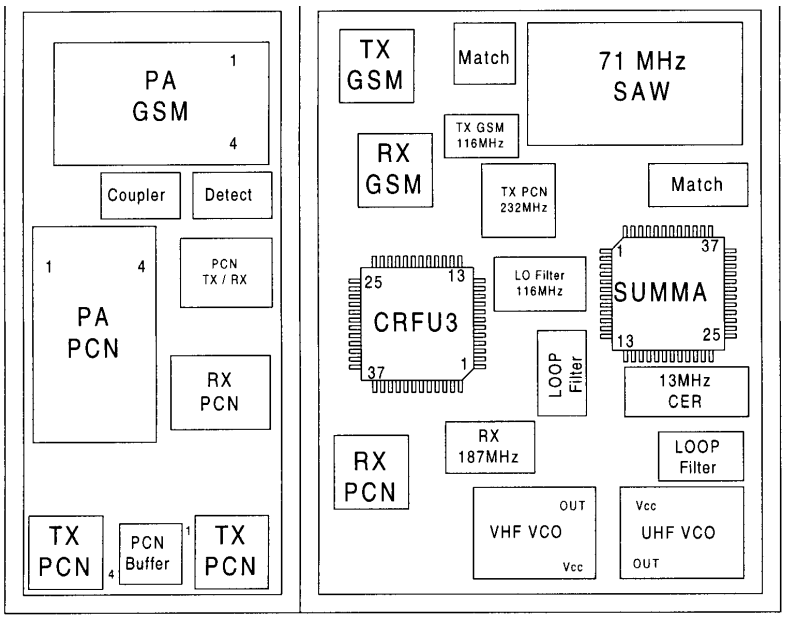


Figure 1. PCB Top View

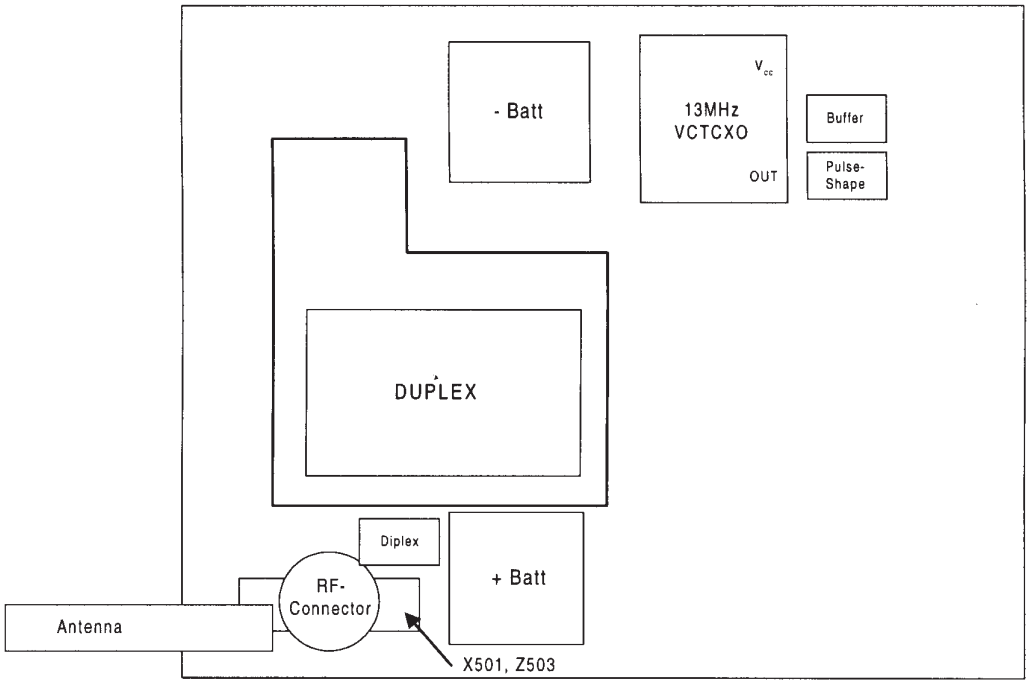


Figure 2. PCB Bottom view

Abbreviations in fault finding charts

BB	Baseband
DC	Direct Current
ESD	Electro Static Dicharge
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.

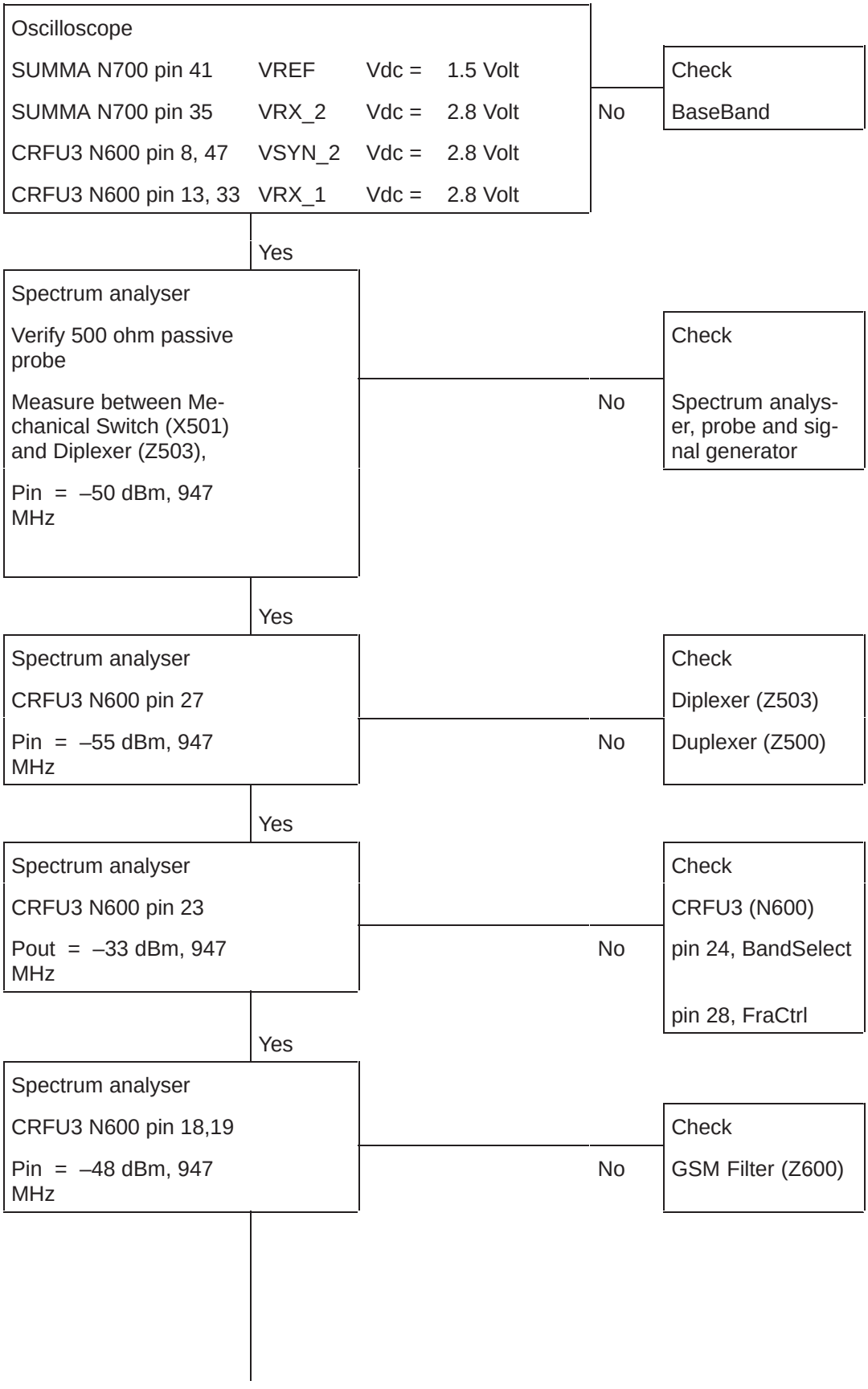
Path of the received GSM signal

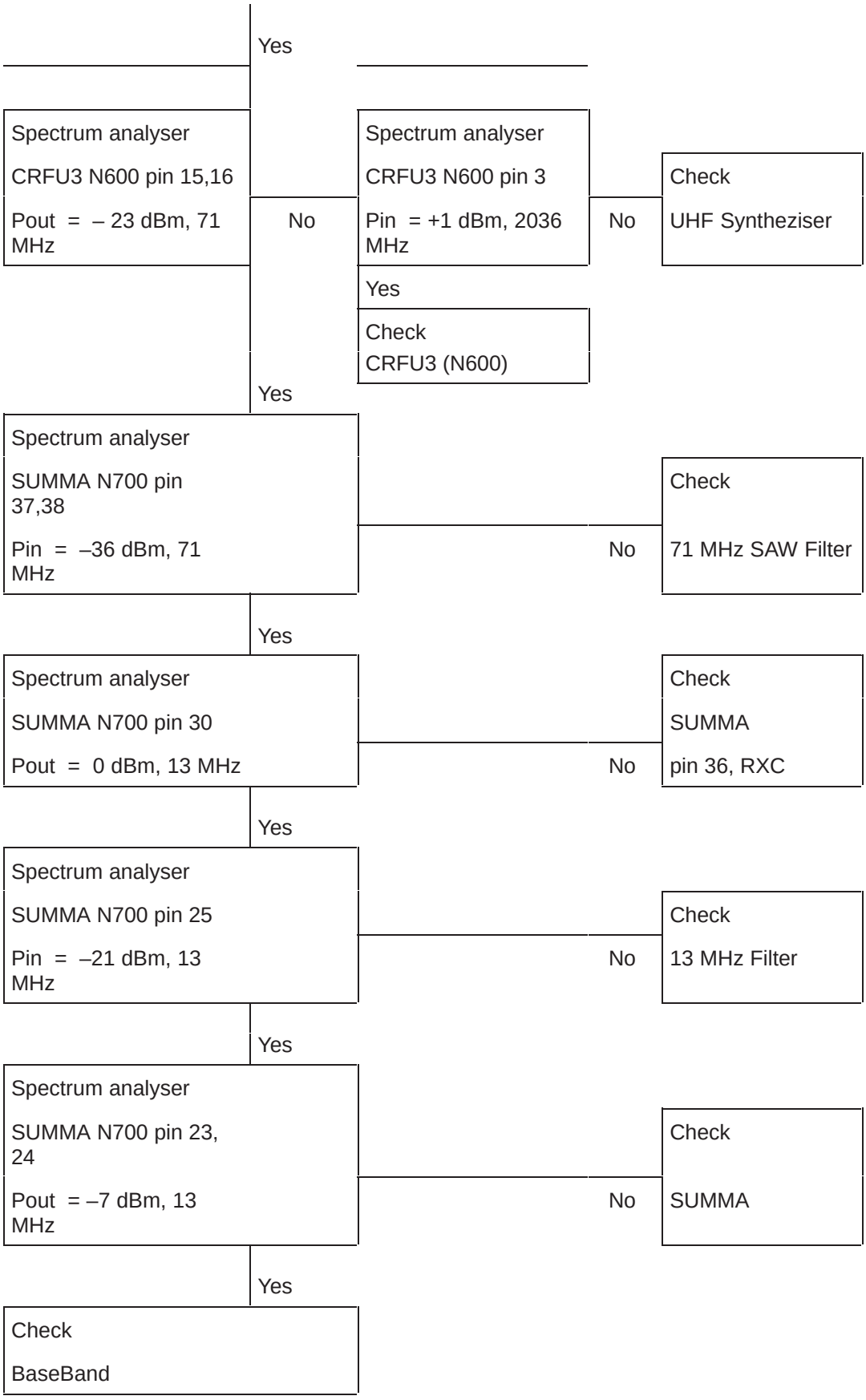
This path defines the general route of the received signal:

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 numbe*r(s) are defined inside (.).*

Fault finding chart for GSM receiver




Yes
Spectrum analyser
CRFU3 N600 pin 15,16
Pout = – 23 dBm, 71 MHz
No
Spectrum analyser
CRFU3 N600 pin 3
Pin = +1 dBm, 2036 MHz
No
Check
UHF Syntheziser
Yes
Check
CRFU3 (N600)
Yes
Spectrum analyser
SUMMA N700 pin 37,38
Pin = –36 dBm, 71 MHz
No
Check
71 MHz SAW Filter
Yes
Spectrum analyser
SUMMA N700 pin 30
Pout = 0 dBm, 13 MHz
No
Check
SUMMA
pin 36, RXC
Yes
Spectrum analyser
SUMMA N700 pin 25
Pin = –21 dBm, 13 MHz
No
Check
13 MHz Filter
Yes
Spectrum analyser
SUMMA N700 pin 23, 24
Pout = –7 dBm, 13 MHz
No
Check
SUMMA
Yes
Check
BaseBand

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.

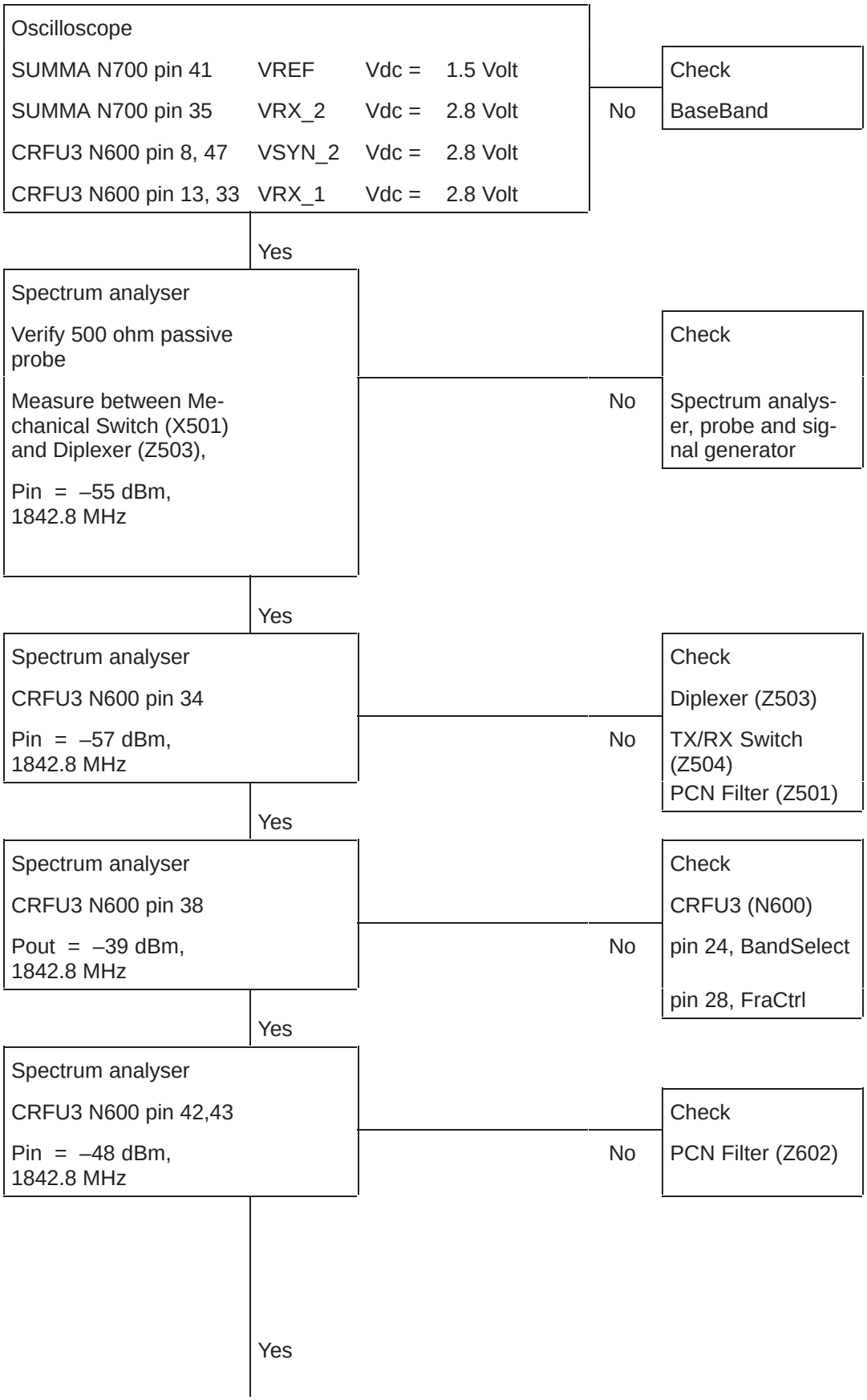
Path of the received PCN signal

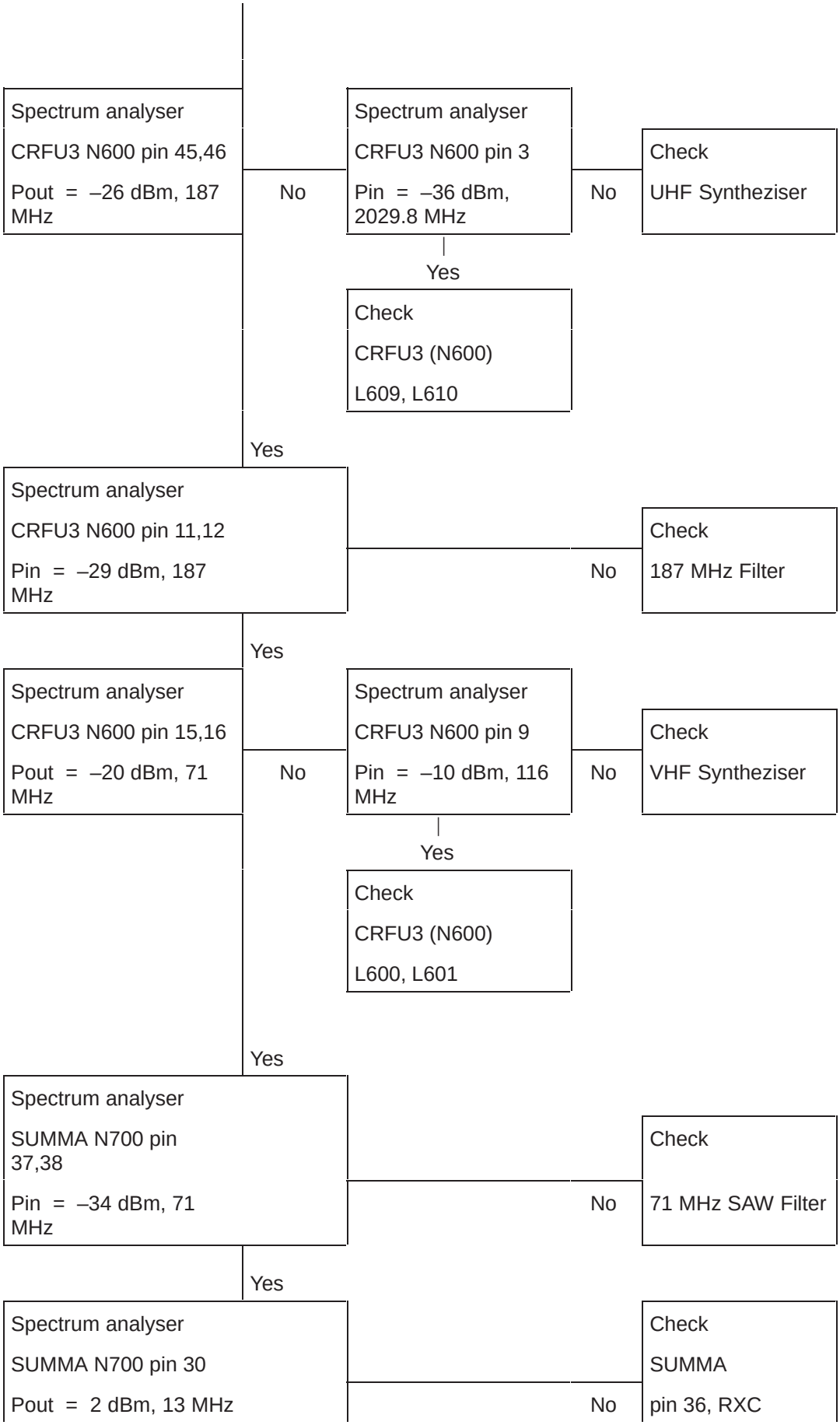
This path defines the general route of the received signal:

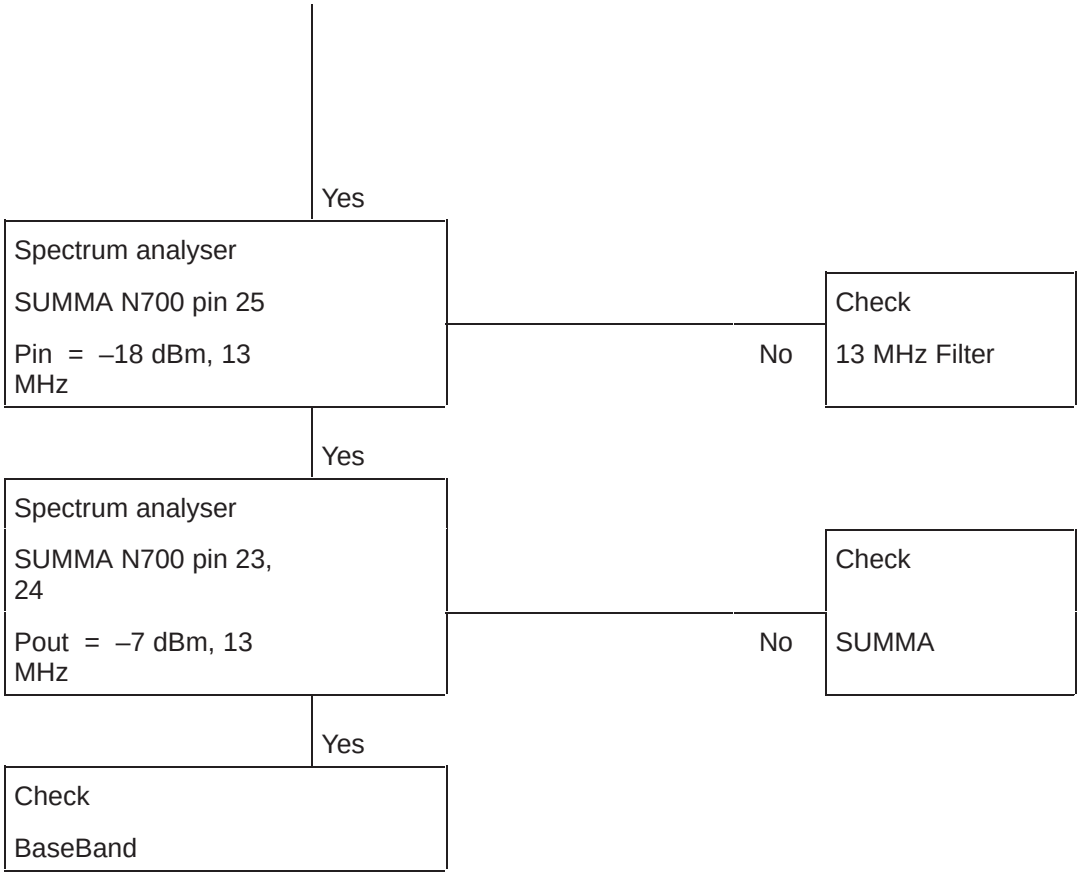
Antenna, Mechanical Switch (X501), Diplexer (Z503), TX/RX Switch (Z504), PCN Filter (Z501), CRFU3 (LNA N600), PCN Filter (Z602), CRFU3 (Mixer N600), LC 187 MHz Filter (L604), CRFU3 (Mixer N600), SAW 71MHz Filter (Z700), SUMMA (N700), 13Mhz Filter (Z701), SUMMA, COBBA_GJP (N200).

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

Fault finding chart for PCN receiver




Spectrum analyser
CRFU3 N600 pin 45,46
Pout = –26 dBm, 187 MHz
No
Spectrum analyser
CRFU3 N600 pin 3
Pin = –36 dBm, 2029.8 MHz
No
Check
UHF Syntheziser
Yes
Check
CRFU3 (N600)
L609, L610
Yes
Spectrum analyser
CRFU3 N600 pin 11,12
Pin = –29 dBm, 187 MHz
No
Check
187 MHz Filter
Yes
Spectrum analyser
CRFU3 N600 pin 15,16
Pout = –20 dBm, 71 MHz
No
Spectrum analyser
CRFU3 N600 pin 9
Pin = –10 dBm, 116 MHz
No
Check
VHF Syntheziser
Yes
Check
CRFU3 (N600)
L600, L601
Yes
Spectrum analyser
SUMMA N700 pin 37,38
Pin = –34 dBm, 71 MHz
No
Check
71 MHz SAW Filter
Yes
Spectrum analyser
SUMMA N700 pin 30
Pout = 2 dBm, 13 MHz
No
Check
SUMMA
pin 36, RXC


Yes
Spectrum analyser
SUMMA N700 pin 25
Pin = –18 dBm, 13 MHz
No
Check
13 MHz Filter
Yes
Spectrum analyser
SUMMA N700 pin 23, 24
Pout = –7 dBm, 13 MHz
No
Check
SUMMA
Yes
Check
BaseBand

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 Continous

TX_Data Type: Random

TX Power Level : BASE

Channel: 60

Path of the transmitted GSM signal

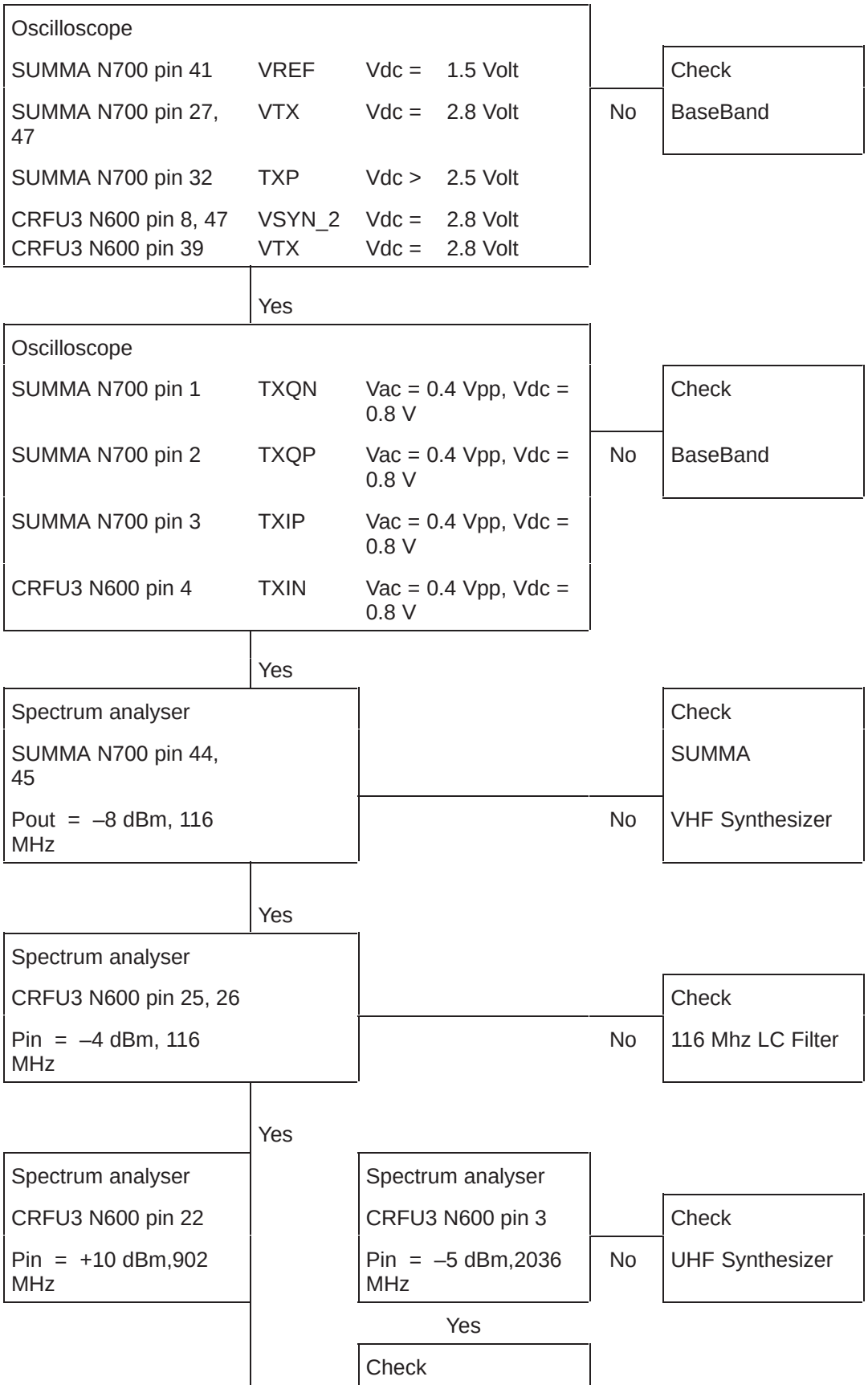
This path defines the general route of the transmitted signal:

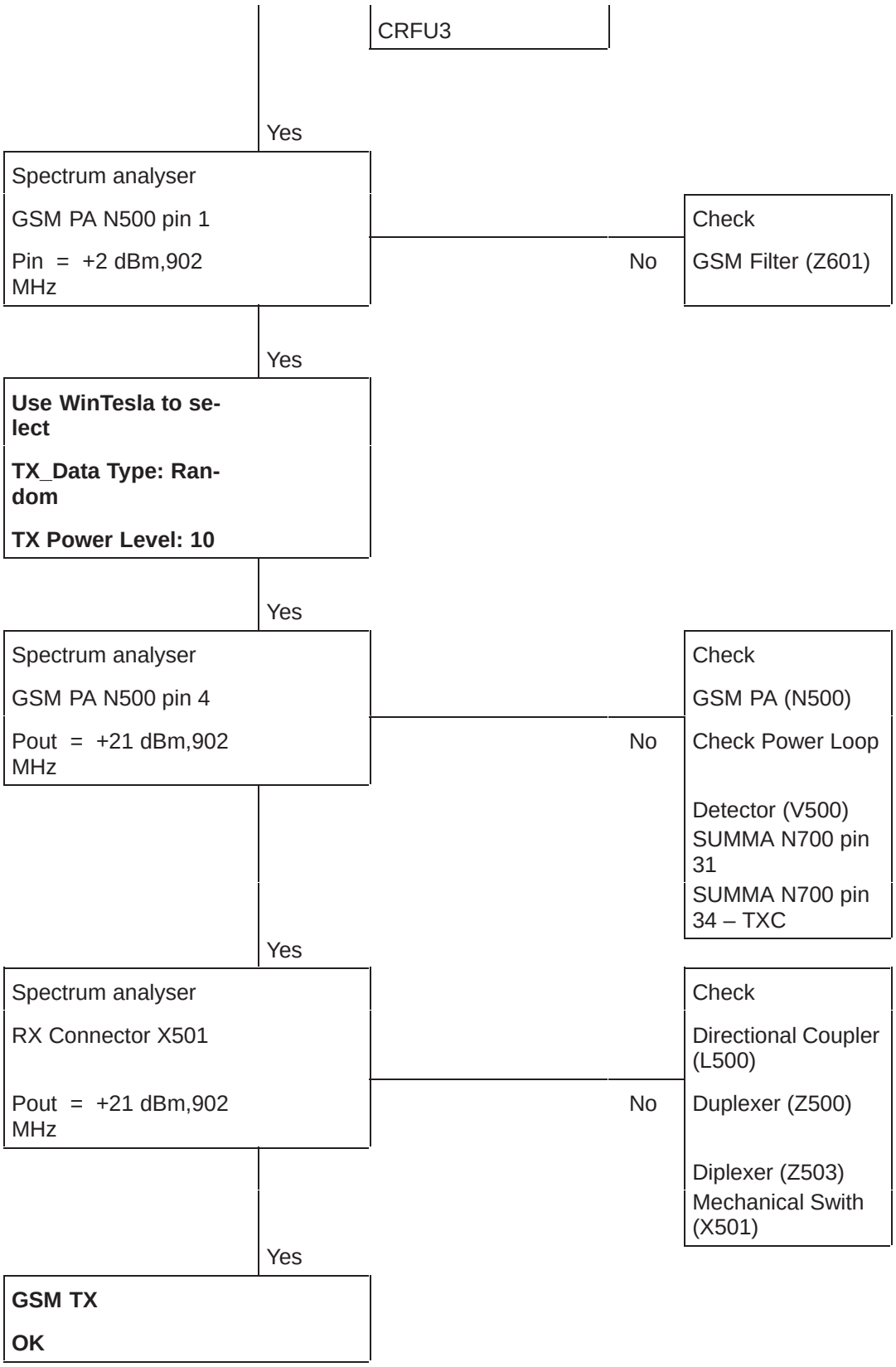
COBBA_GJP (N200), SUMMA(N700), 116 Mhz Filter(L703, L704, L708), CRFU3 (Upconverter N600), GSM Filter (Z601), MMIC PA (N500), Directional Coupler (L500), Duplexer (Z500), Diplexer (Z503), Mechanical Swith (X501), Antenna.

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




CRFU3
Yes
Spectrum analyser
GSM PA N500 pin 1
Pin = +2 dBm,902 MHz
No
Check
GSM Filter (Z601)
Yes
Use WinTesla to select
TX_Data Type: Random
TX Power Level: 10
Yes
Spectrum analyser
GSM PA N500 pin 4
Pout = +21 dBm,902 MHz
No
Check
GSM PA (N500)
Check Power Loop
Detector (V500)
SUMMA N700 pin 31
SUMMA N700 pin 34 – TXC
Yes
Spectrum analyser
RX Connector X501
Pout = +21 dBm,902 MHz
No
Check
Directional Coupler (L500)
Duplexer (Z500)
Diplexer (Z503)
Mechanical Swith (X501)
Yes
GSM TX
OK

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 Continous

TX_Data Type: Random

TX Power Level : BASE

Channel: 700

Path of the transmitted PCN signal

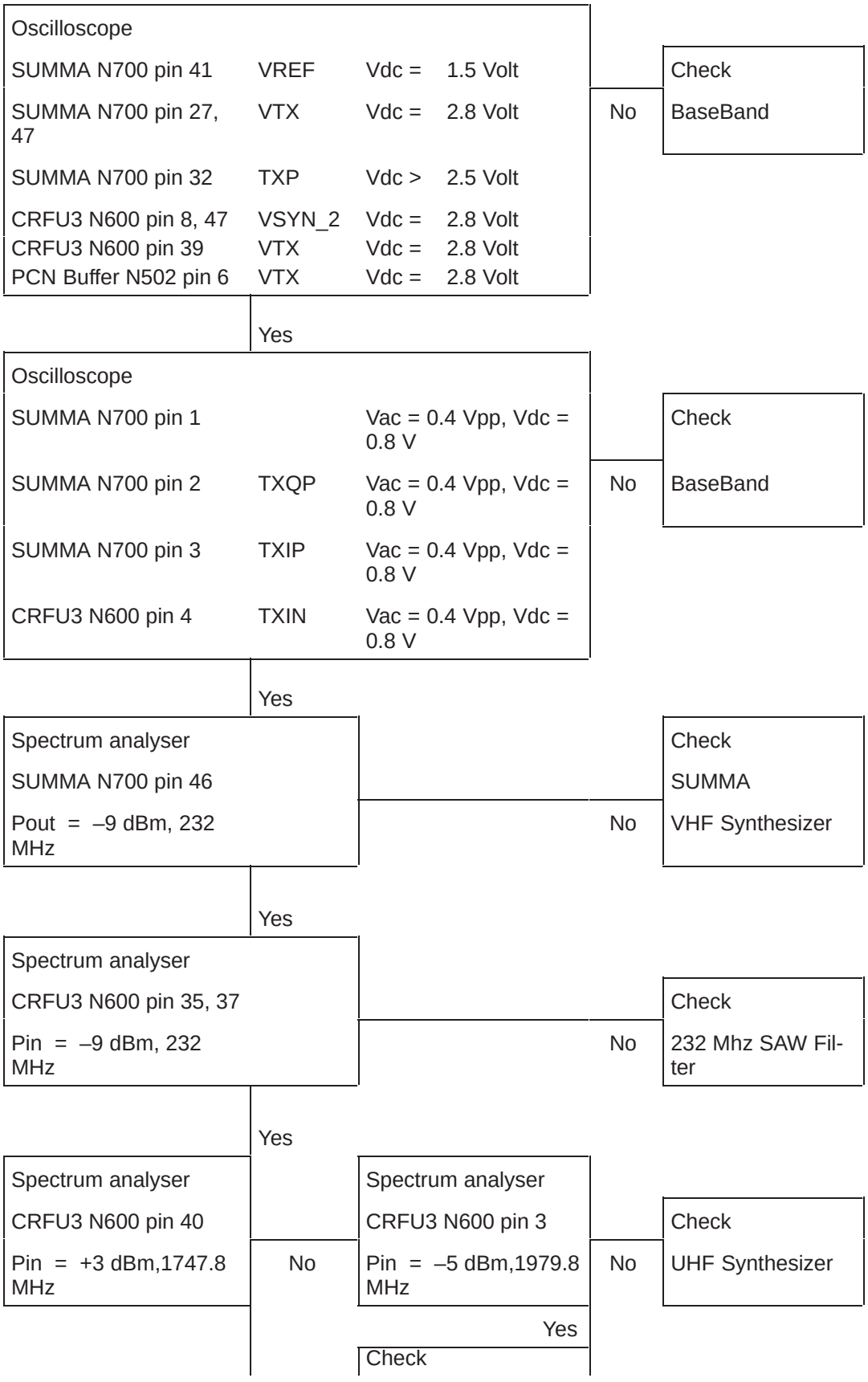
This path defines the general route of the transmitted signal:

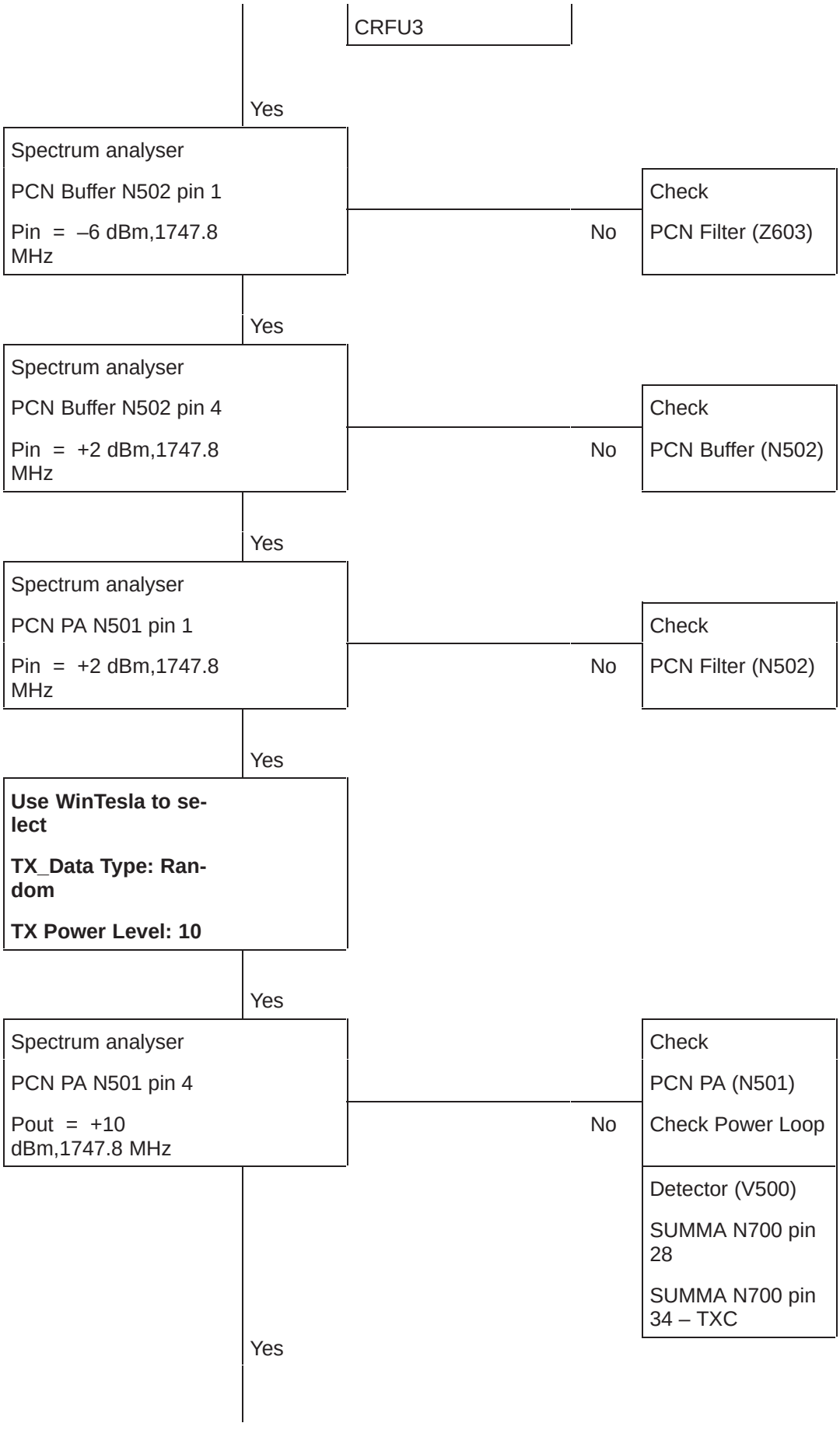
COBBA_GJP (N200), SUMMA(N700), 232 Mhz SAW Filter(Z702), CRFU3 (Upconverter N600), PCN Filter (Z603), PCN Buffer (N502), PCN Filter (Z502), MMIC PA (N501), Directional Coupler (L500), TX/RX Switch (Z504), Diplexer (Z503), Mechanical Swith (X501), Antenna.

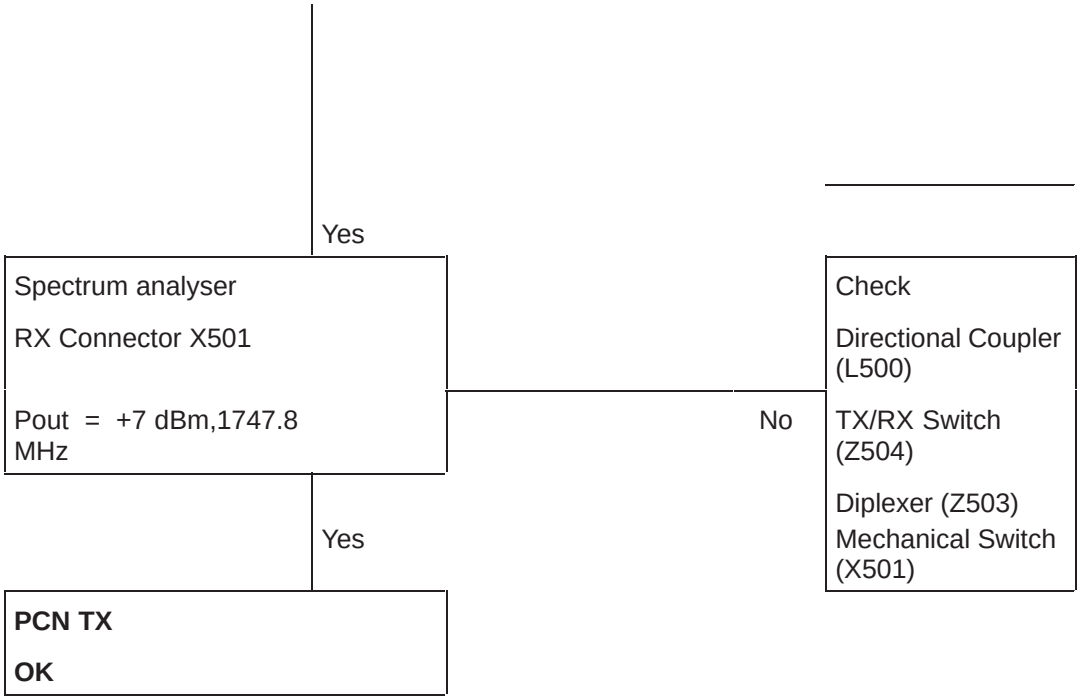
The related component number(s) are defined inside (.).

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

Fault finding chart for PCN transmitter




CRFU3
Yes
Spectrum analyser
PCN Buffer N502 pin 1
Pin = –6 dBm,1747.8 MHz
No
Check
PCN Filter (Z603)
Yes
Spectrum analyser
PCN Buffer N502 pin 4
Pin = +2 dBm,1747.8 MHz
No
Check
PCN Buffer (N502)
Yes
Spectrum analyser
PCN PA N501 pin 1
Pin = +2 dBm,1747.8 MHz
No
Check
PCN Filter (N502)
Yes
Use WinTesla to select
TX_Data Type: Random
TX Power Level: 10
Yes
Spectrum analyser
PCN PA N501 pin 4
Pout = +10 dBm,1747.8 MHz
No
Check
PCN PA (N501)
Check Power Loop
Detector (V500)
SUMMA N700 pin 28
SUMMA N700 pin 34 – TXC
Yes



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:

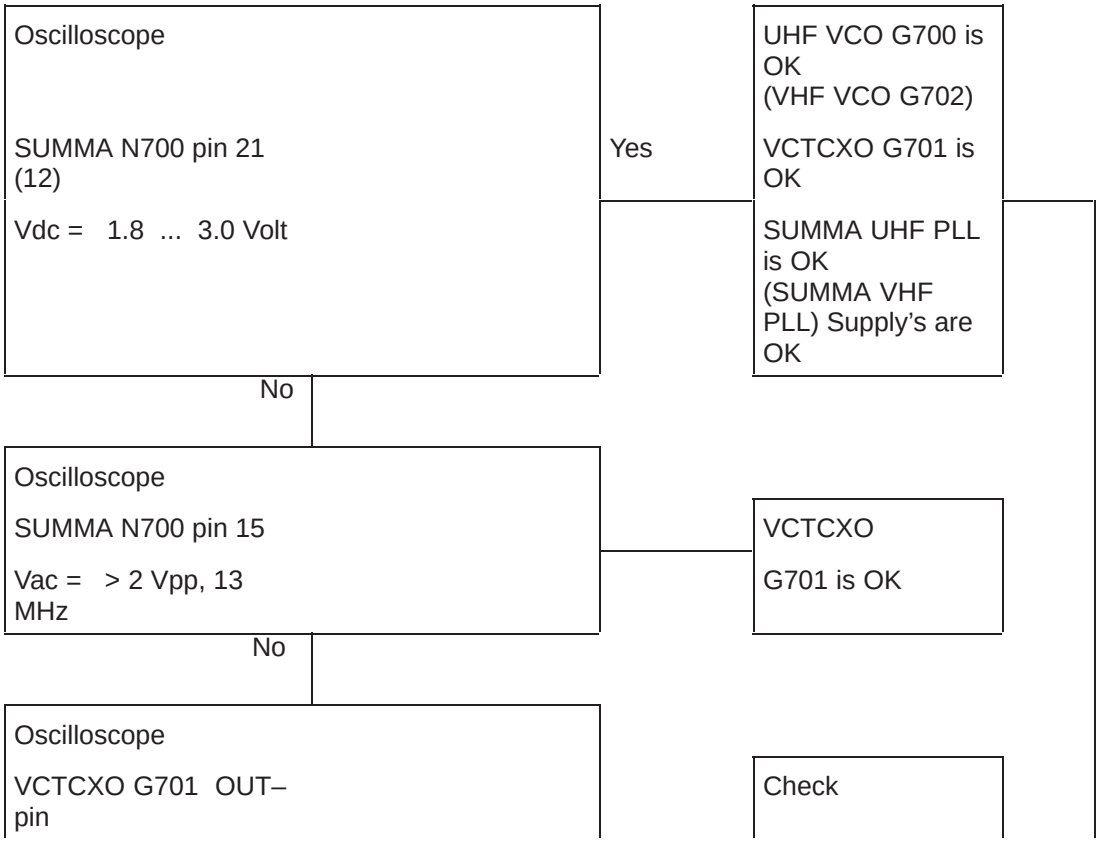
	UHF VCO		VHF VCO	
1	SUMMA N700 pin 21	changed to	SUMMA N700 pin 12	Vdc = 1.8 ... 3.0 Volt
2	UHF VCO G700	changed to	VHF VCO G702	
3	SUMMA UHF PLL	changed to	SUMMA VHF PLL	
4	UHF VCO G700 OUT–pin	changed to	VHF VCO G702 OUT–pin	Pout > –3 dBm

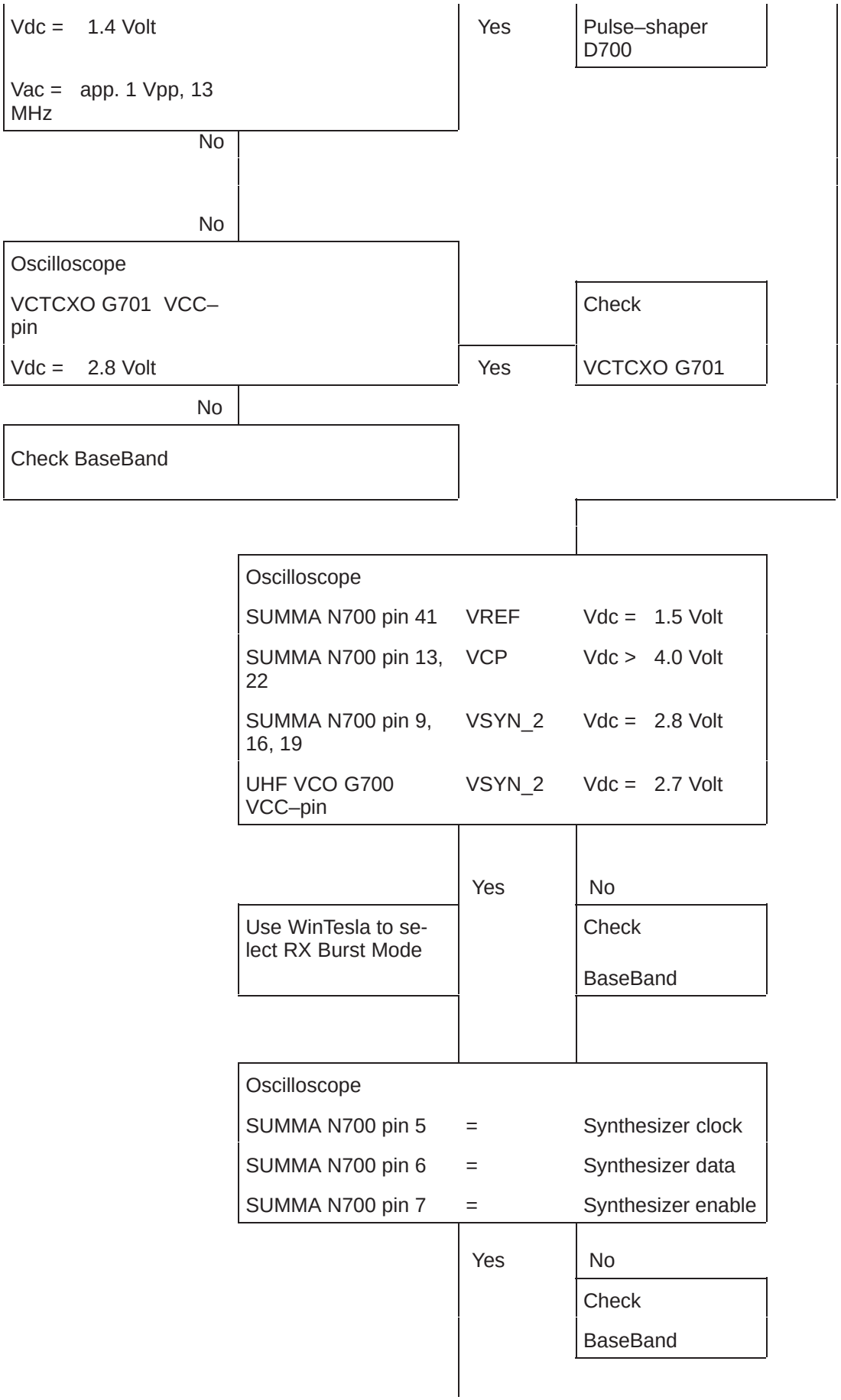
The exceptions will be inside (.) in the fault finding chart for the UHF VCO.

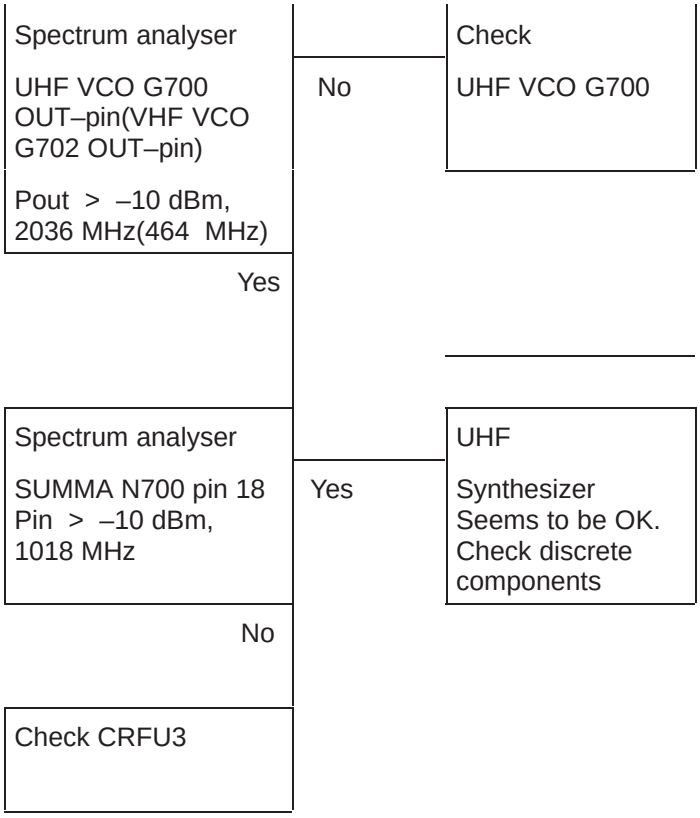
UHF VCO

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




Vdc = 1.4 Volt
Vac = app. 1 Vpp, 13 MHz
Yes
Pulse–shaper D700
No
No
Oscilloscope
VCTCXO G701 VCC–pin
Vdc = 2.8 Volt
Check
Yes
VCTCXO G701
No
Check BaseBand
Oscilloscope
SUMMA N700 pin 41 VREF Vdc = 1.5 Volt
SUMMA N700 pin 13, 22 VCP Vdc > 4.0 Volt
SUMMA N700 pin 9, 16, 19 VSYN_2 Vdc = 2.8 Volt
UHF VCO G700 VCC–pin VSYN_2 Vdc = 2.7 Volt
Yes
No
Use WinTesla to select RX Burst Mode
Check
BaseBand
Oscilloscope
SUMMA N700 pin 5 = Synthesizer clock
SUMMA N700 pin 6 = Synthesizer data
SUMMA N700 pin 7 = Synthesizer enable
Yes
No
Check
BaseBand


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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