Chapter 8

RPE–1 TROUBLESHOOTING INSTRUCTIONS

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

RPE–1 Troubleshooting Instructions

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RPE–1 Troubleshooting

Baseband troubleshooting

The main target for this document is to keep repair steps as short as possible.

Error hunting is devided into the following error states:
a) the phone is totally dead, Windows UI prompts:
”There may be a problem with the card hardware. Contact your dealer.”
This may a cause of a real hardware problem, but it would be good to check with another PC laptop, too, before proceeding further.
b) the phone does not register to the GSM network, or the phone doesn’t make a call
c) a SIM card is out of order
d) the FLASH memory programming is not working

General information

A reference to the signal line in the GX8 schematic diagrams is marked as ’<name>’, for example ’RESET’ refers to the corresponding line in sheet number 1.

Referred test spots are in Figure 16 and Figure 17 beginning with a J letter.

Utility software are used as control or test software:

– RPE1FLA.EXE is software tool to update the FLASH memory contents. See ”Flash Update Instructions” for more information. In this context RPE1FLA.EXE is also used for testing some hardware lines.

– WinTesla software tool runs on the top of Windows ’95. It is used to run some MCU self–tests.

The RPE–1 specific service adapter JBT–8 and its accessory AX8 are error hunting hardware boards.

As hunting errors an expression ’PCMCIA mode’ refers to the Cellurar Card Phone User Interface running on the top of Windows ’95; JBT–8 has to be in the PCMCIA mode. No RESET function has not to be generated by the user in this mode, because a PC wakes up the system. Accordingly an expression ”non–PCMCIA mode” (=”vertical mode”) refers the phone to be controlled by WinTesla, JBT–8 has to be in the non–PCMCIA mode. A RESET has to be generated manually with an on–board button as inserting the phone onto JBT–8. Look at Figure 21, Figure 22 and Figure 23 for more details of JBT–8 usage setups.

It is assumed that the covers are opened before these steps. The component placement figures of Baseband are later on this document (in Figure 16 and Figure 17).

Use a PC (of course, with Card Shark and its extension board) or PC laptop full dupplex capability in order to be able to do a speech call.

Thus to do Baseband hardware error hunting the following software and hardware are needed:

– Wintesla, Cellular Card Phone UI installed; these are running in Windows ’95.
– RPE1FLA.EXE running on the DOS mode (can be activated also from WIndows ’95).
– A four–channel digital oscilloscope to capture a 13MHz signal as the fastest signal.
– A multimeter
– JBT–8, ACH–6 (AX–8 if needed) and DAU–9P (MBUS & FBUS cable)
– A SIM card
– A failing phone with covers open

In flow charts logical signal levels are referred as follows:
HIGH stands for logic ’1’ : 0.7*Vcc..1.0*Vcc as Vcc is 3.3V±2% (3.23...3.37V) → ***2.3...3.3V*** as using nominal 3.3V for Vcc
LOW stands for logic ’0’ = 0V...0.1*Vcc as Vcc is 3.3V ± 2% (3.23...3.37V) → ***0...0.3V*** as using nominal 3.3V for Vcc

A tip: Do not always follow instructions truly but with a common sense, for example try to make a service time as low as possible by trying the phone with UI in spite of being in the middle of some test flow.

Phone is totally dead

Error hunting in this section:
a) Any short–circuits?
b) Powering up the phone not working.
c) The phone does not communicate with the PC at all.

Short–circuits on module?

Before any tests it is good to check visually mechanical parts, and especially PCB for short–circuits. If any short–circuited component is a part of powering up the card it may cause booting down the PC laptop accidentially, because too low a level of voltage on its power supply line causes it to malfunction. This is risky, too, because an uncontrolled shut–down of the PC laptop may cause its file system to fail.

Test equipment: A multimeter with a short–circuit detection and GX8 module

Test setup: GX8 module without covers and a SIM card.

Test target: Main power supply lines ’VCC’ and ’VCCPOWER’ on the inputs of N422 (pin no. 3 or 4) and V421 (pin no. 1, 2, 3, 6 or 7).

Test result: OK if not any short–circuits.

Powering up the phone not working

Test follow–up: As inserted into the PCMCIA slot UI SW informs that ”There may be a problem with the card hardware. Contact your dealer.”

Test equipment:
– A multimeter, a digital oscillope
– JBT–8 (and AX8), DAU–9P
– ACH–6

Test setup The external power supply ACH–6 supplies all the current needed to the GX8 module without a SIM card.

Test target: System clocks that are needed to power–up the phone. A test flow is described in Figure 1 and Figure 2.

Test results: Look at Figure 3.

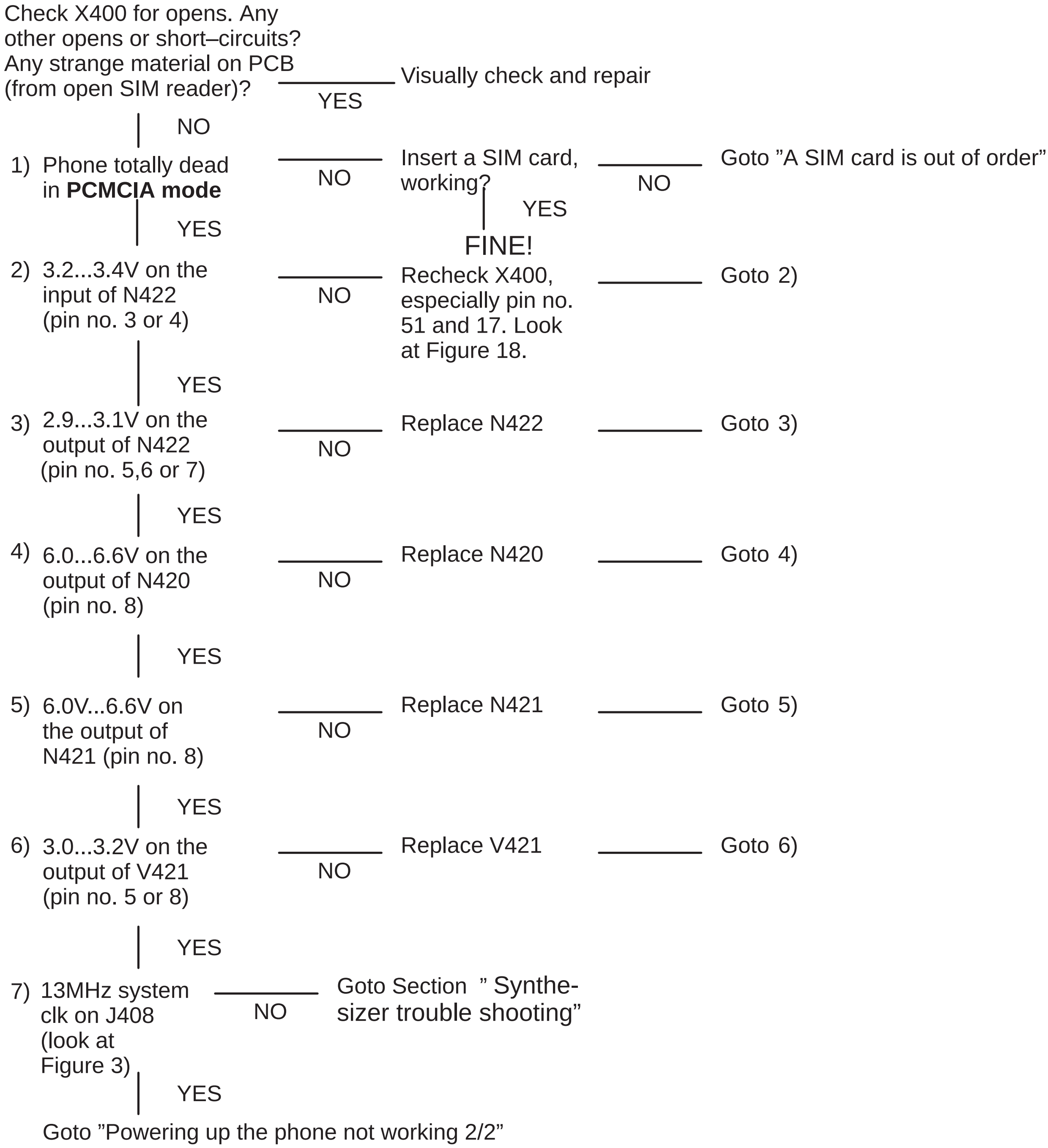

Figure 1. Powering up the phone not working 1/2

8) 13MHz system clk on input of D400 (pin no. 41, look at Figure 3) — NO — Replace C400 — Goto 8)
YES
9) 32kHz sleep clk on J407 (look at Figure 4) — NO — Replace D400 — Goto 9)
YES
10) 13MHz system clk on input of D420 (pin no. 93, look at Figure 3) — NO — Replace C427 — Goto 10)
YES
11) Phone working in **PCMCIA mode** — NO — Goto ”The phone does not communicate with the PC”
YES
12) Insert a SIM card, working? — NO — Goto ”A SIM card is out of order”
YES
FINE!

Figure 2. Powering up the phone not working 2/2

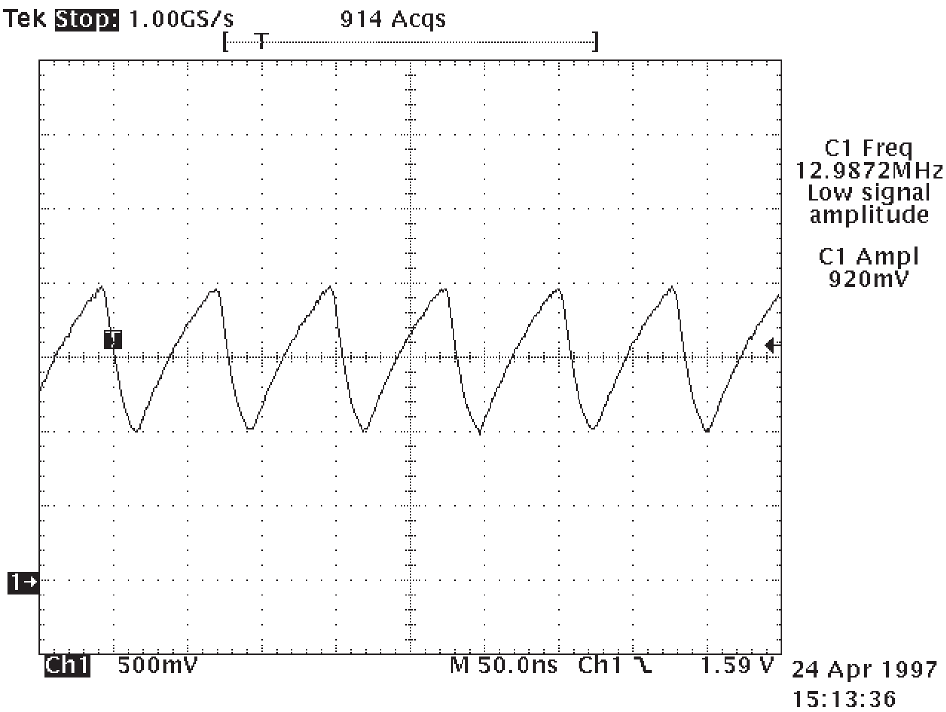

Figure 3. 13MHz system clock

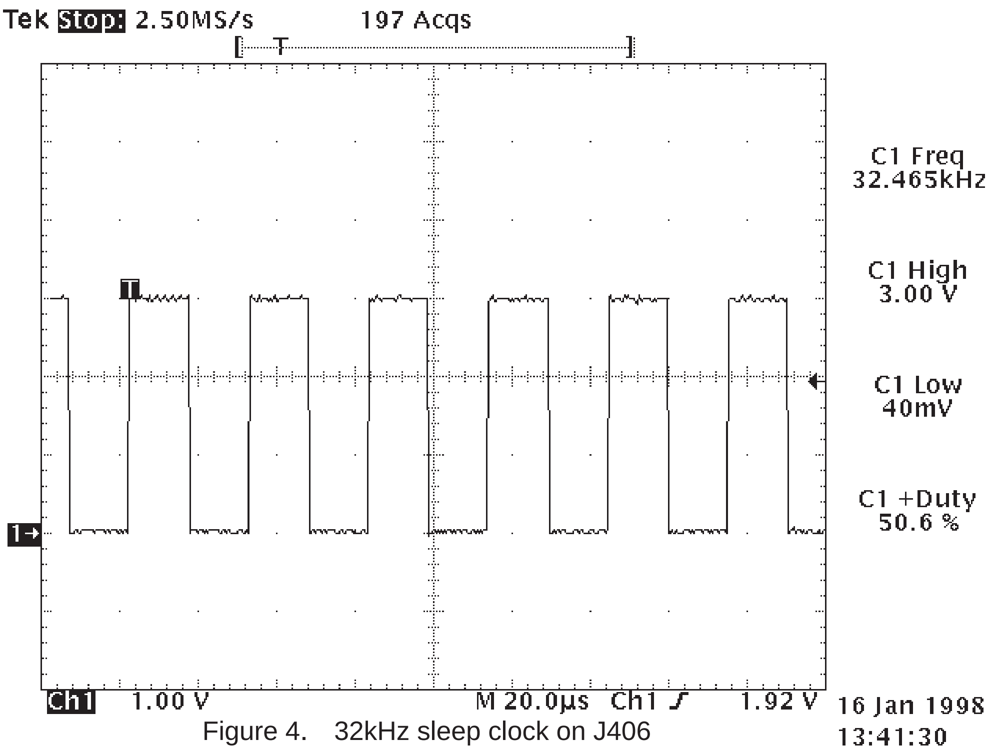

Figure 4. 32kHz sleep clock on J406

Phone does not communicate with the PC laptop

Test follow–up: As inserted into the PCMCIA slot UI SW informs that ”There may be a problem with the card hardware. Contact your dealer.”

Test equipment: – A multimeter, a digital oscillope
– JBT–8 (and AX8), DAU–9P
– ACH–6

Test setup The external power supply ACH–6 supplies all the current needed to the GX8 module without a SIM card. JBT–8 switched between non–PCMCIA and PCMCIA modes during test steps.

Test target: All the control lines during a wake–up, a test flow is described In Figure 5 and Figure 6.

Test results: Look at Figure 7.

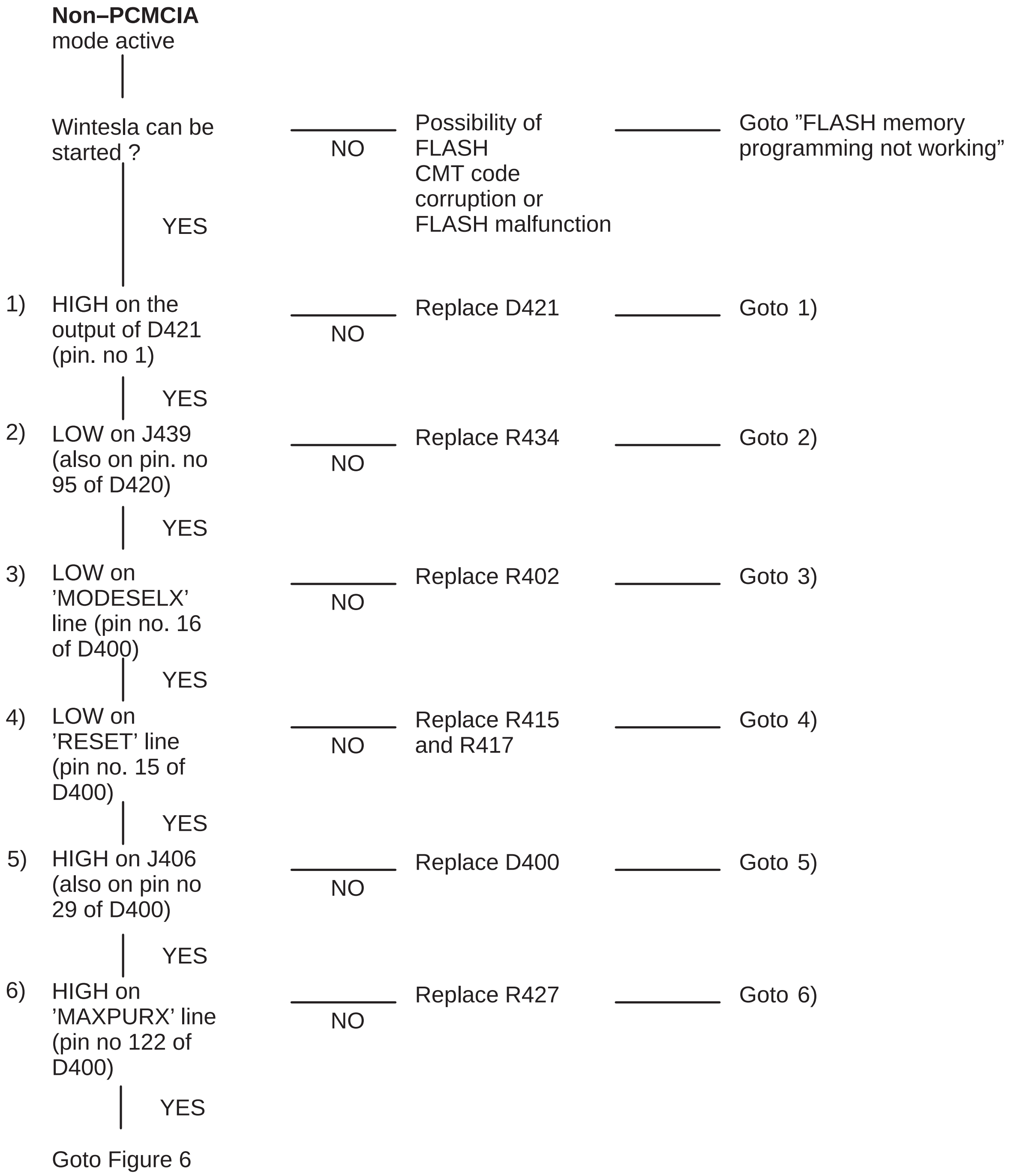

Figure 5. The phone does not communicate with the PC laptop 1/2

Non–PCMCIA mode active

Step	Test	NO	Action	
7)	Reset sequence as in Figure 7	NO	Replace V425 and V424	Goto 7)
	YES — *MAD2 oriented tests begin here.*			
8)	HIGH on ’SELFTEST’ line (on pin. no 17 of D420)	NO	Replace R423	Goto 8)
9)	LOW on ’GENSDIO’ line (on pin. no 118 of D420)	NO	Replace R439	Goto 9)
10)	MAD2 self–test sequence as in Figure 8	NO	Replace D420	Goto 10)
	YES			
11)	External SRAM component test with WinTesla passed	NO	Replace D461	Goto 11)
	YES			
12)	Ext. EEPROM component test with WinTesla passed	NO	Replace D462	Goto 12)
	YES			
13)	ROM code check sum passed	NO	Goto ”The Flash memory programming not working”	
	YES			
14)	Insert **a SIM card**. working in PCMCIA mode	NO	Goto ”A SIM card is out of order”	
	YES			
15)	Synchronized with the GSM network?	NO	Goto ”The phone does not register to the GSM network or does not make a call”	
	YES			

FINE!

Figure 6. The phone does not communicate with the PC laptop 2/2

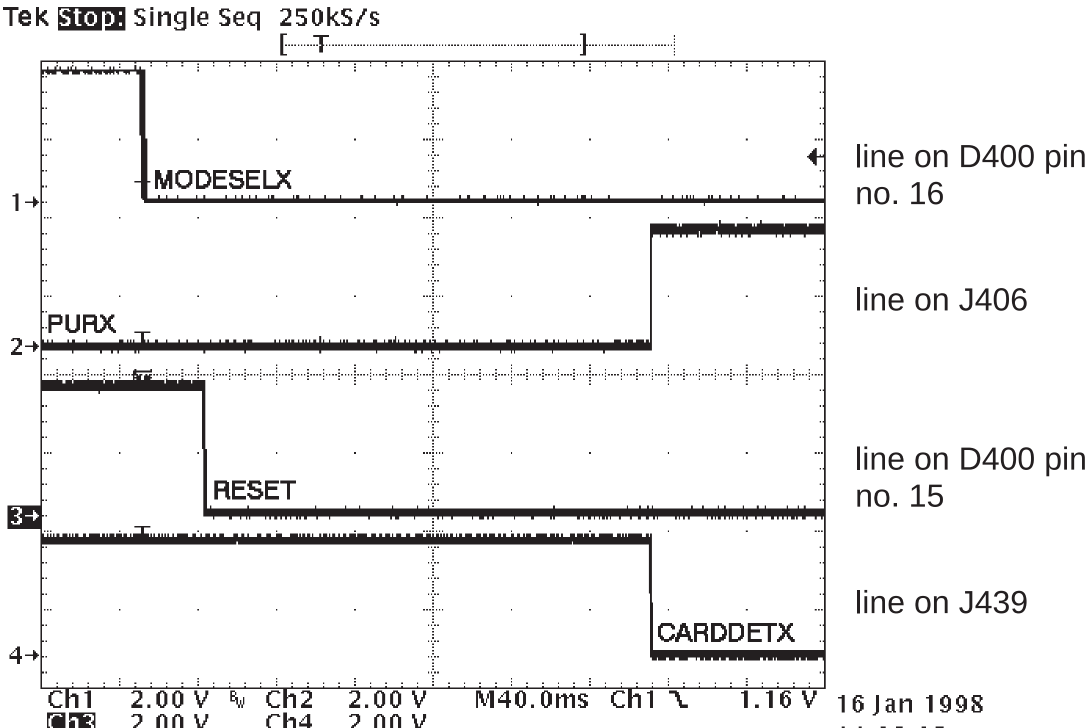

Figure 7. A reset sequence in the non–PCMCIA mode

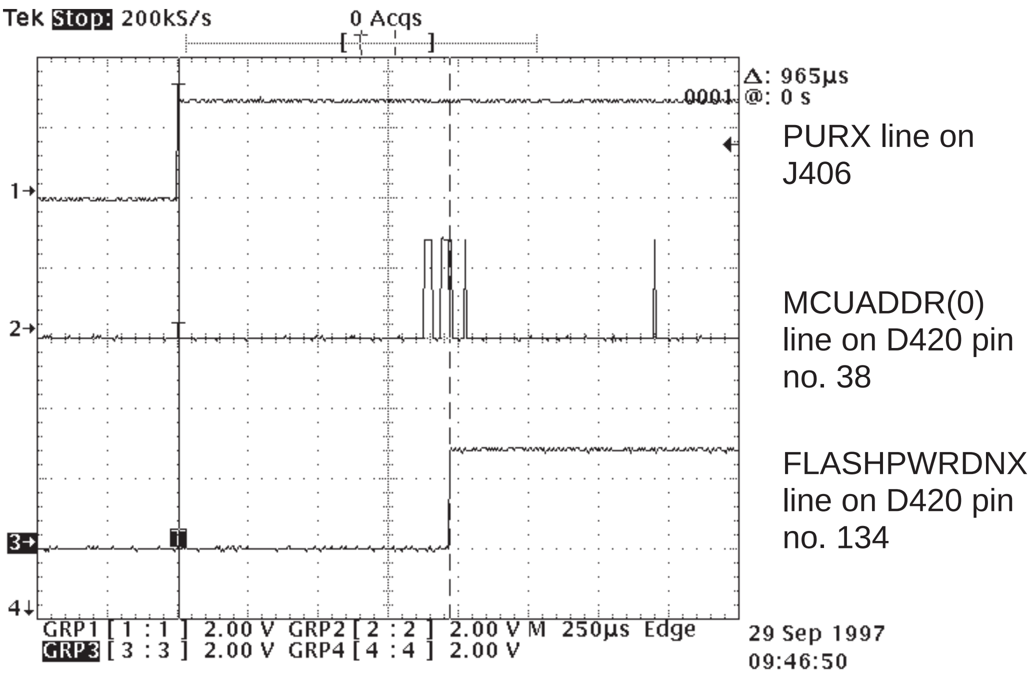

Figure 8. MAD2 (D420) self–test sequence

Phone does not register to the GSM network or phone doesn't make a call

Test follow–up: As inserted into the PCMCIA slot UI SW pops up, but it doesn't show any active operator, or it is not able to create a call.

Test equipment: – A multimeter
– JBT–8 (and AX8), DAU–9P
– ACH–6

Test setup The external power supply ACH–6 supplies all the current needed to the GX8 module with a SIM card.

Test target: RF/BB interface ASIC, PCMCIA ASIC during a speech call

Test results: Look at Figure 9.

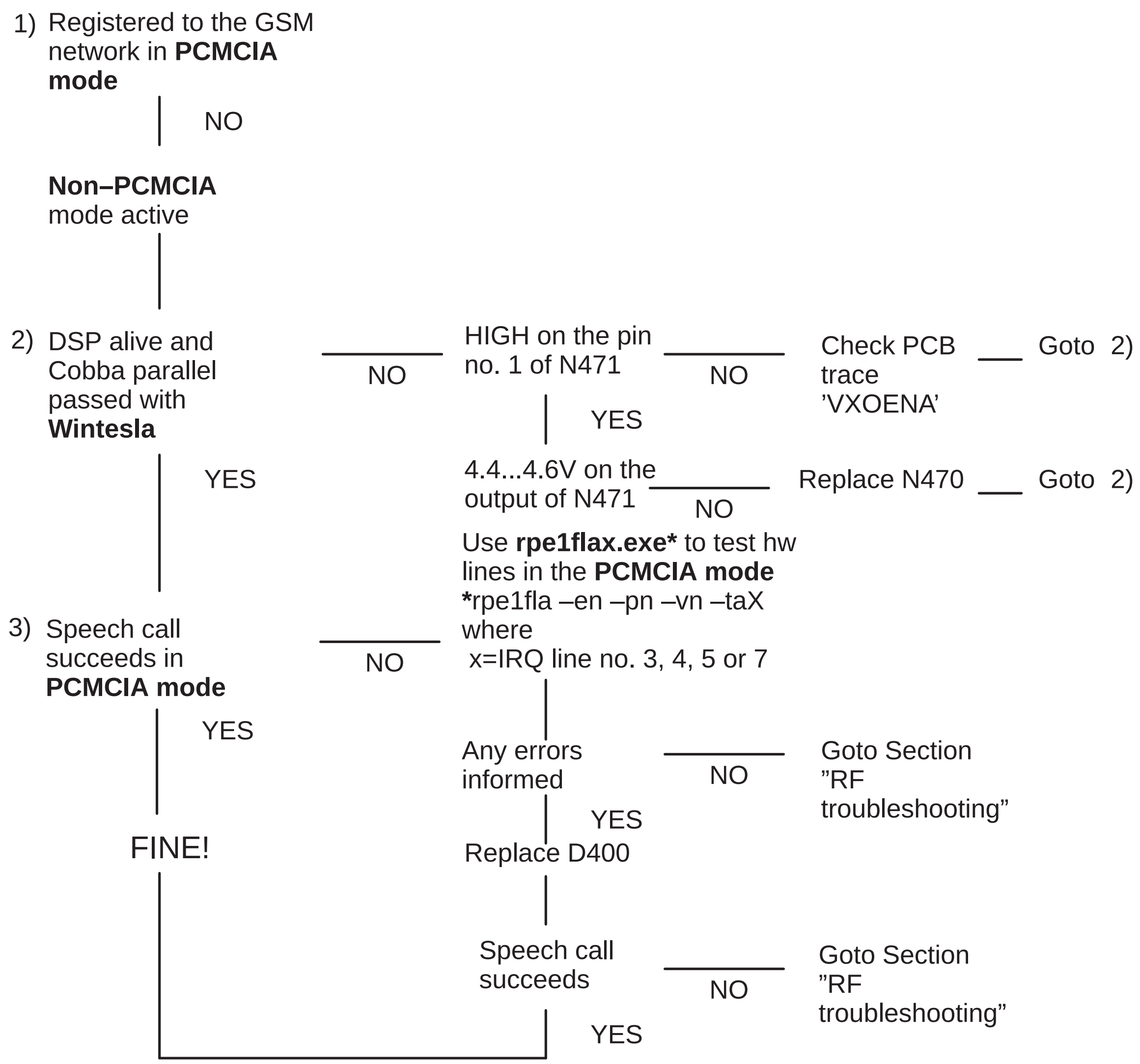

Figure 9. Phone does not register to the GSM network or phone doesn’t make a call

* rpe1fla –en –pn –vn –taX
where X is IRQ line number 3,4,5 or 7

SIM card is out of order

Test follow–up: As inserted into the PCMCIA slot UI SW ”Insert a SIM card” pops up although it’s being inserted.

Test equipment: – A multimeter, a four channel digital oscillope
– JBT–8 (and AX8), DAU–9P
– ACH–6

Test setup The external power supply ACH–6 supplies all the current needed to the GX8 module with a SIM card.

Test target: A SIM card interface.

Test results: Look at Figure 10.

1) SIM interface working in **PCMCIA mode**
   - NO → 2)

2) Springs of SIM reader working, solders ok
   - NO → Replace X401 or re–solder the pads of SIM → Goto 2)
   - YES → 3)

3) 4.9...5.1V on the output of N401 (pin no. 5) during a power–up
   - NO → HIGH on the pin no. 3 of N401
     - NO → Check PCB trace 'SIMCARD PWR' → Goto 2)
     - YES → Replace N401 → Goto 3)
   - YES → 4)

MAD2 ASIC oriented SIM interface tests

4) 'SIMCARDCLK', 'SIMCARDRSTX', 'SIMCARDIOC', and 'SIMCARDDATA' rises to 2.5...3.0V during a power–up as in Figure 11.
   - NO → Replace D420 → Goto 4)
   - YES → 5)

SMART ASIC oriented SIM interface tests

5) 4.5...5V on the pins 25, 26 and 27 of D400 during a power–up as in Figure 12.
   - NO → Replace D400 → Goto 5)
   - YES → 6)

SIM card reader X401 oriented tests

6) 'SIMCLK', 'SIMRST' and 'SIMDATA' on the pins of SIM card rises to 4.5...5.0V during a power–up as in Figure 13.
   - NO → Replace R407, R406 or R414 correspondingly. If none of mentioned rises replace R405. → Goto 6)
   - YES → FINE!

Figure 10. A SIM card is out of order

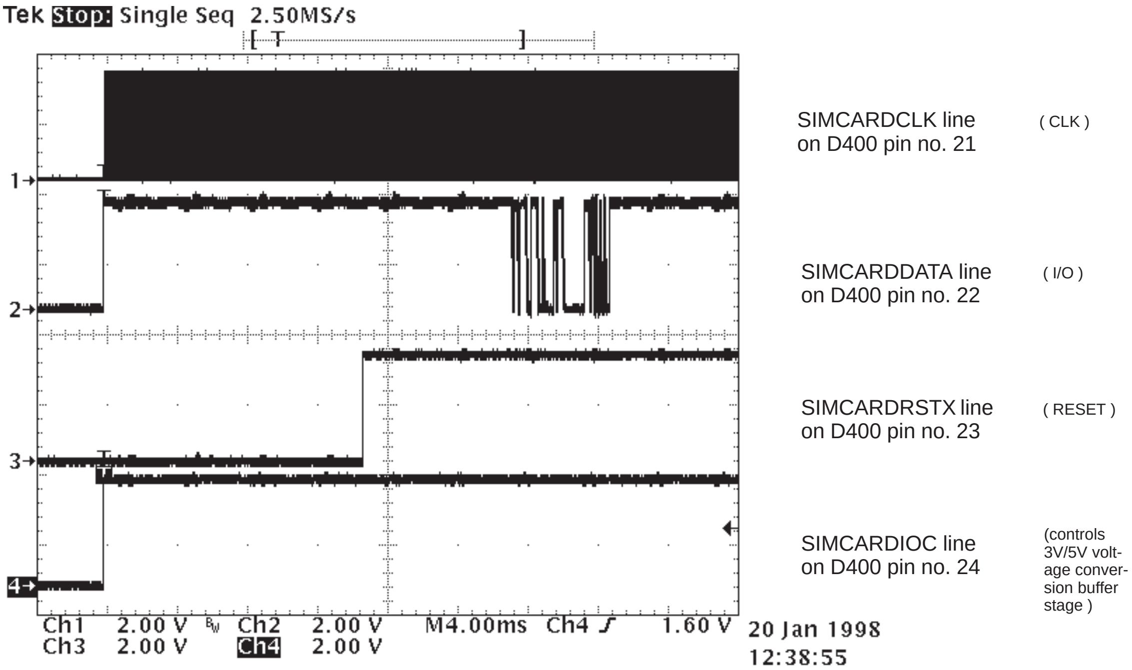

Figure 11. SIM logic lines between D400 and D420

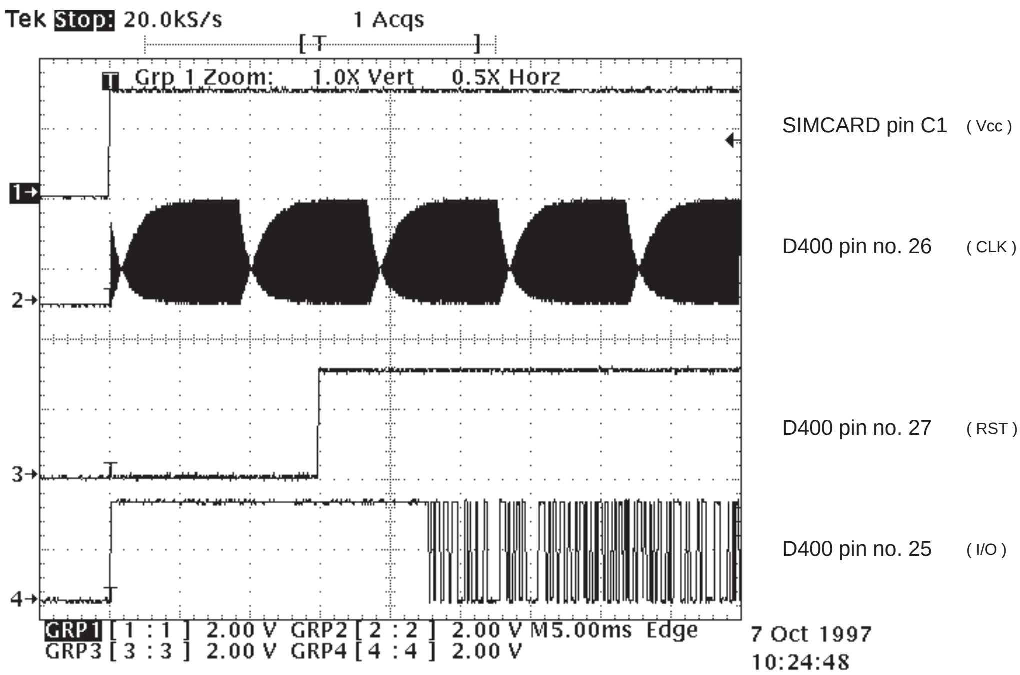

Figure 12. Power Up Sequence on the outputs of D400 (triggered to Vcc)

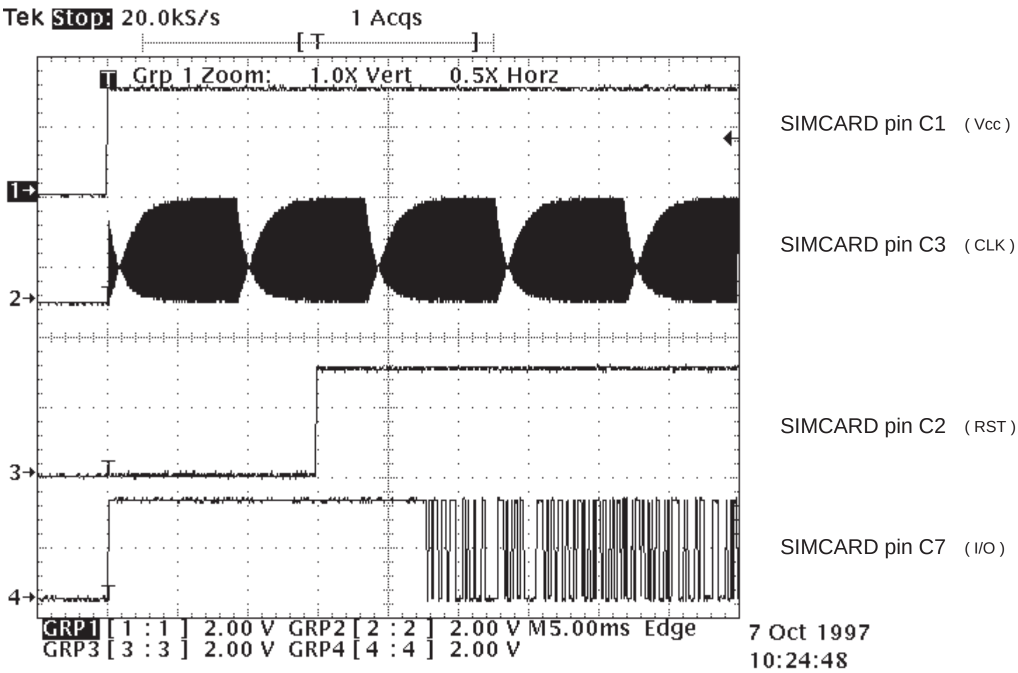

Figure 13. Power Up Sequence on SIM card reader (triggered to Vcc)

FLASH memory programming not working

Test follow–up: SW update fails, or Wintesla service program is not able to access the GX8 module.

Test equipment: – 'RPE1FLA.EXE' SW update tool. Look at "Flash Update Instructions".
– JBT–8 + security devices, DAU–9P
– ACH–6 as an external power supply
– PC with a Card Shark PCMCIA device or PC laptop

Test setup The external power supply ACH–6 supplies all the current needed to the GX8 module without a SIM card.

Test target: To find out a faulty circuit.

Test results: Look at Figure 14 and Figure 15.

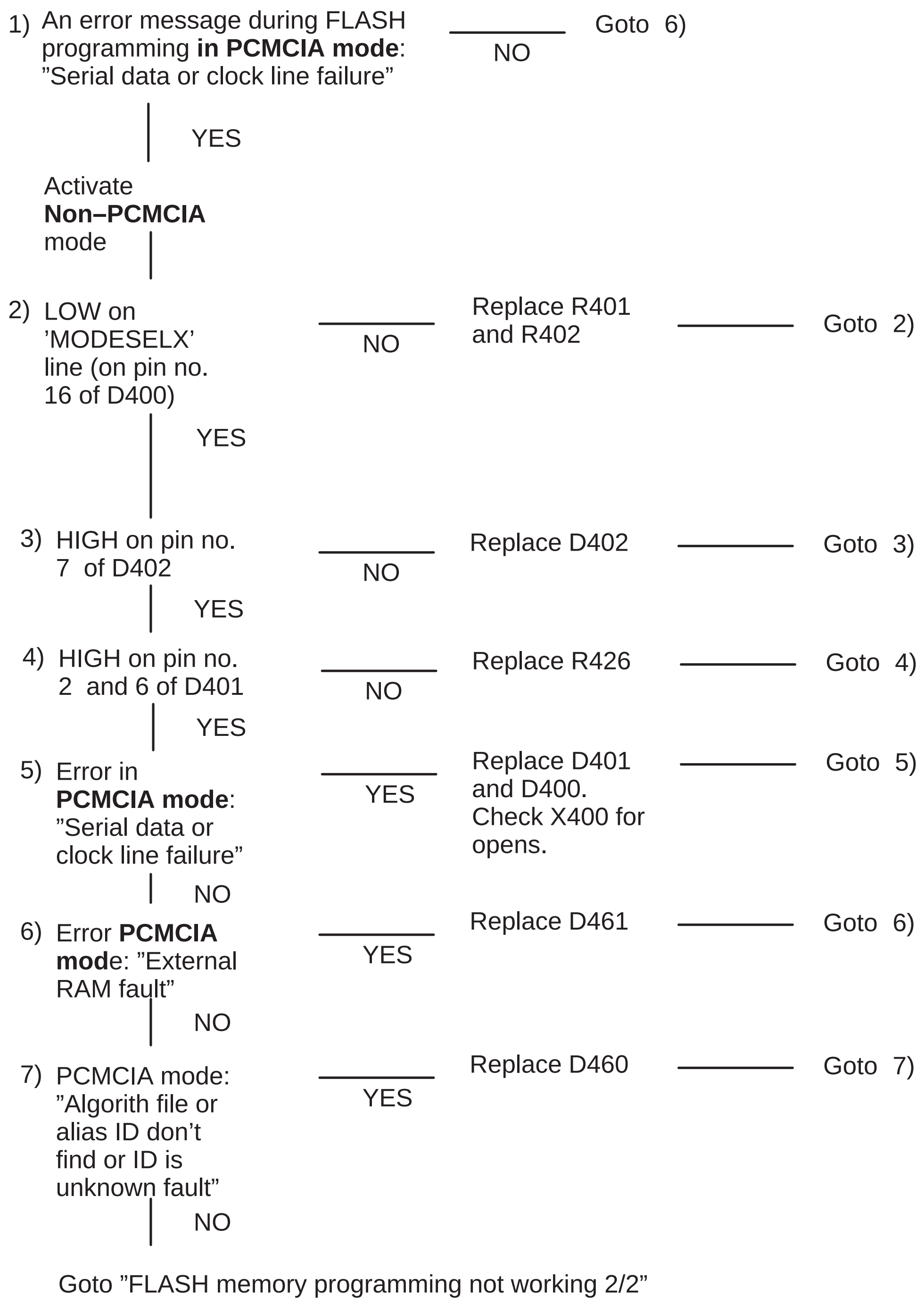

Figure 14. FLASH memory programming not working 1/2

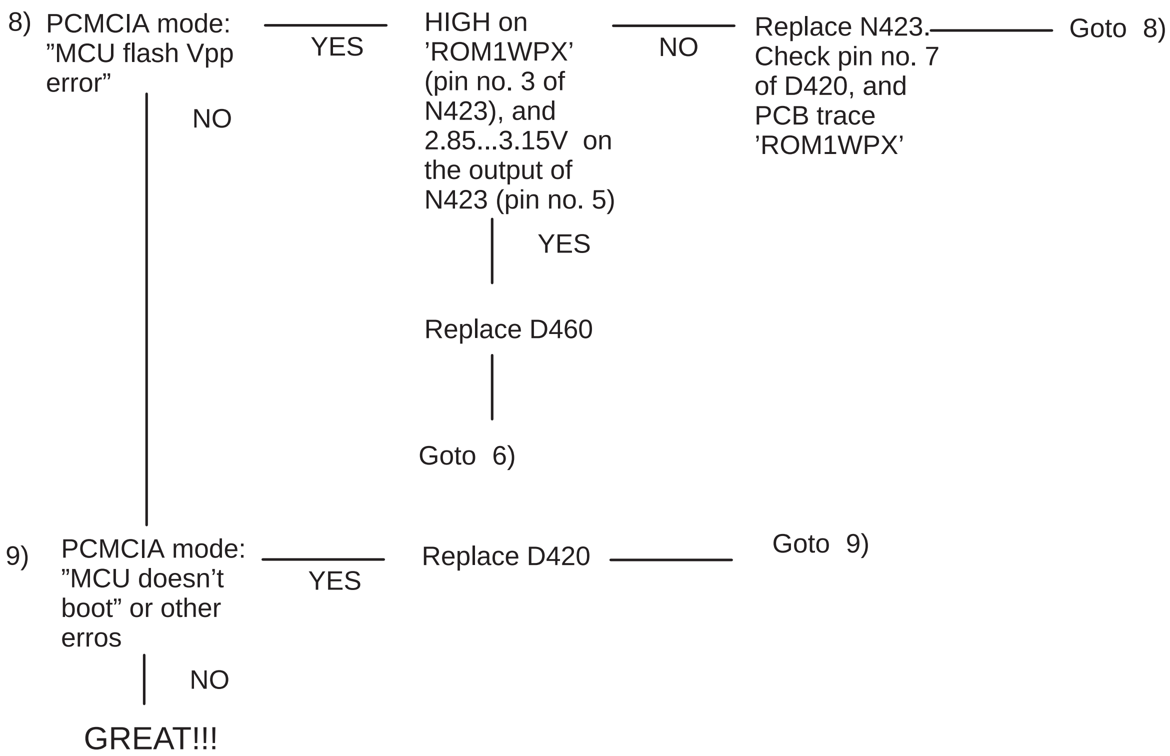

Figure 15. FLASH memory programming not working 2/2

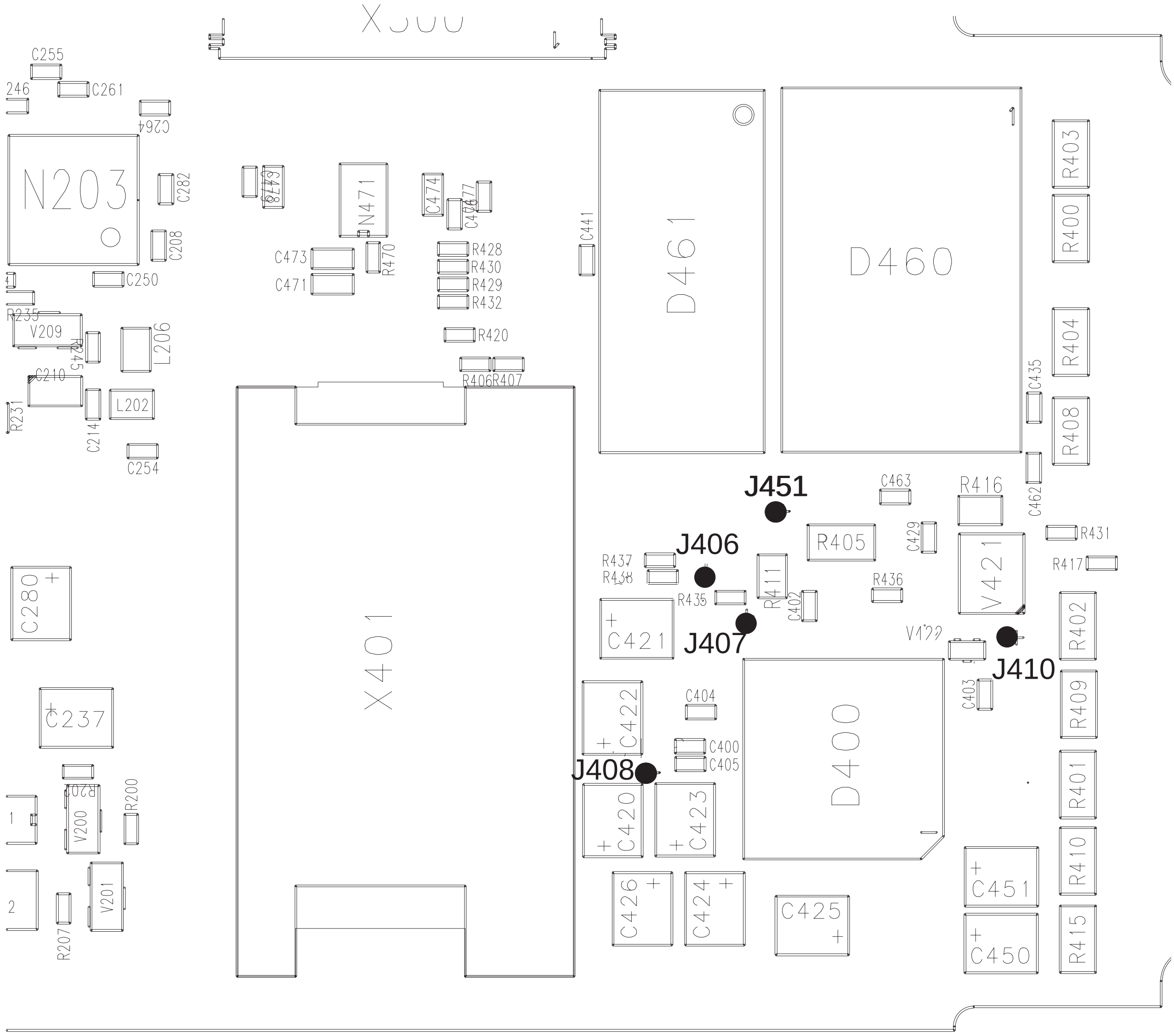

Figure 16. Top side Baseband section

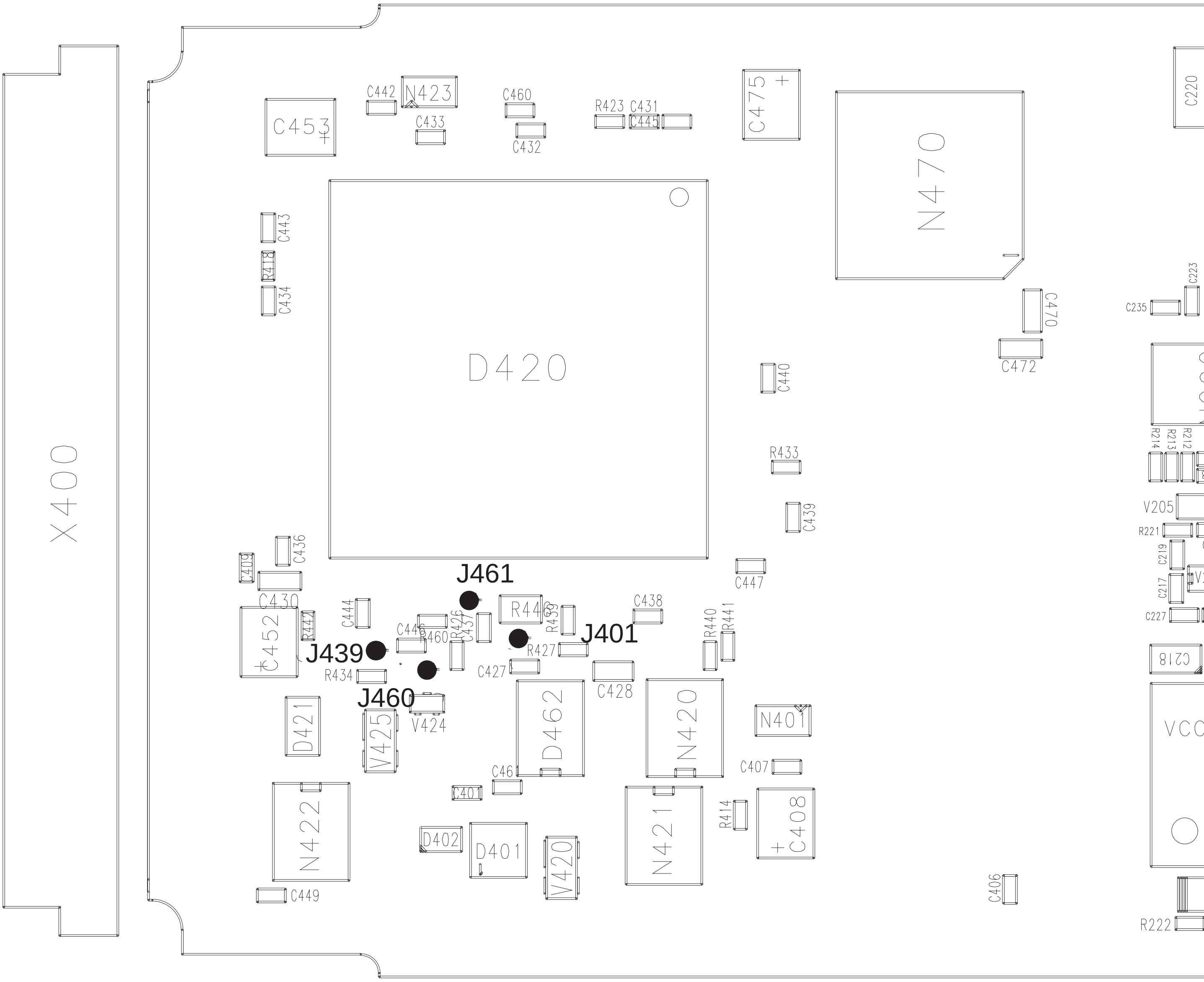

Figure 17. Bottom side Baseband section

A tip: The connector is asymmetric.

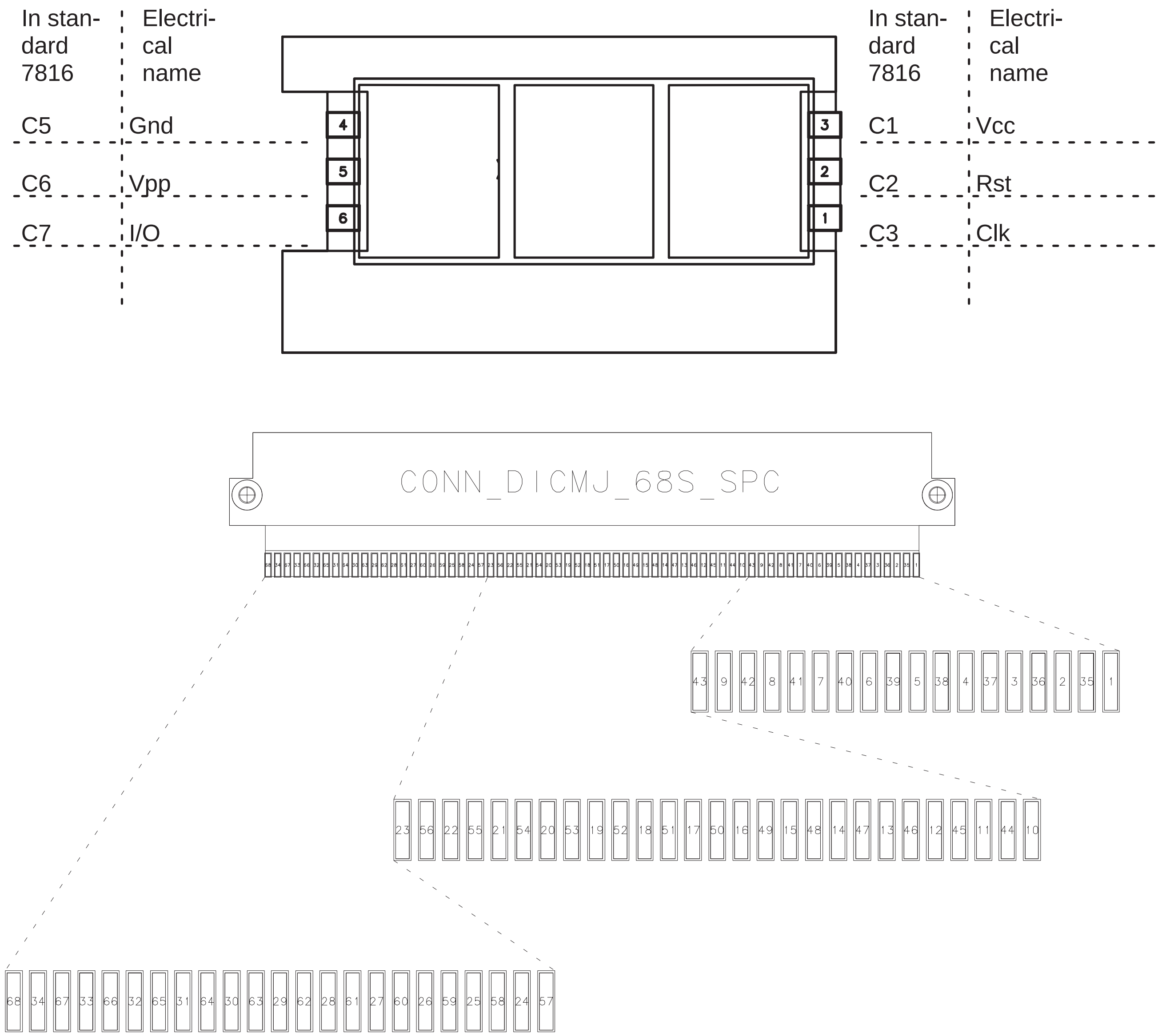

Figure 18. The pinout of SIM and PCMCIA connectors

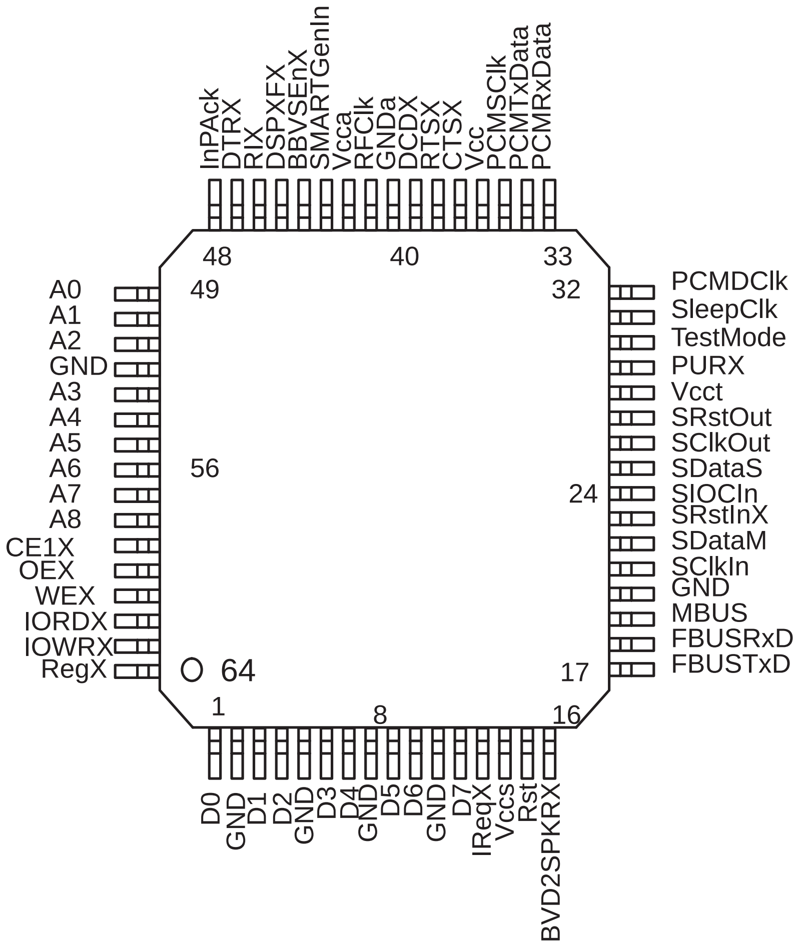

Figure 19. The pinout of SMART ASIC

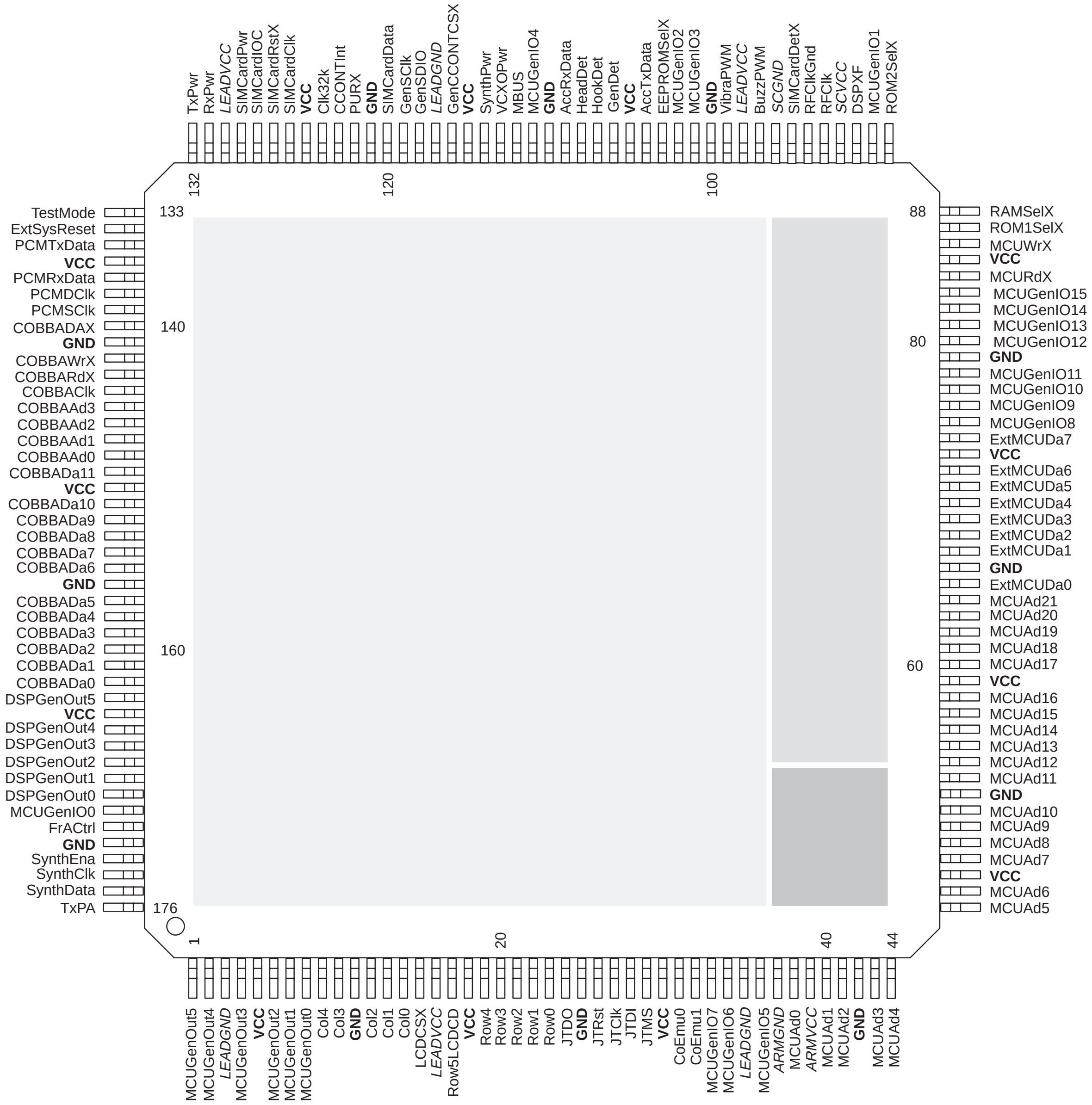

Figure 20. The pinout of MAD2 ASIC

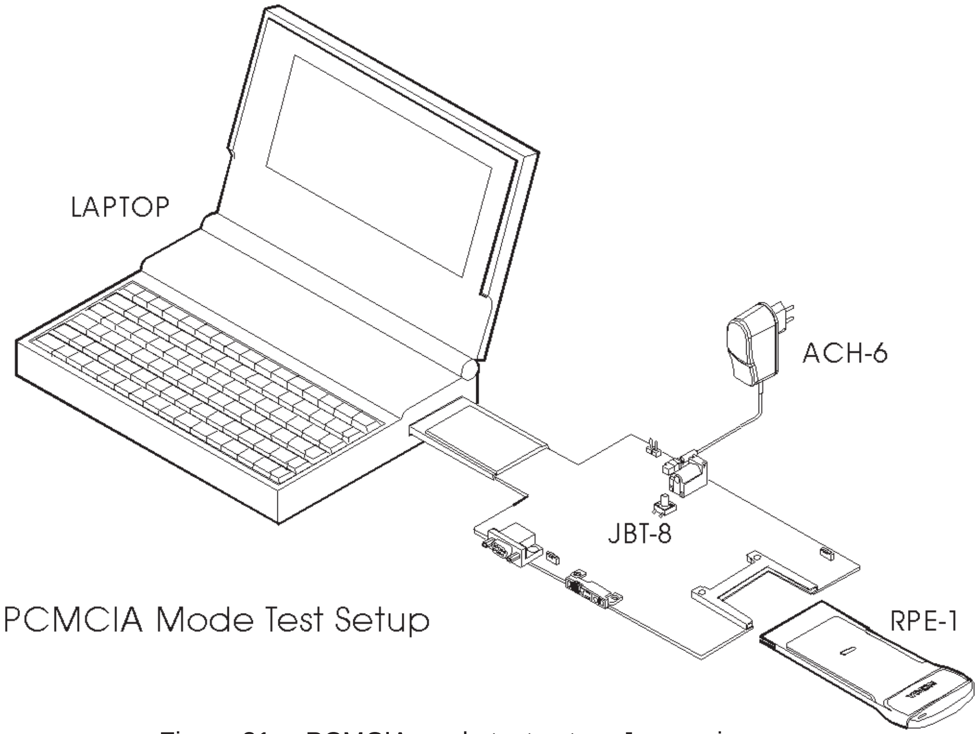

Figure 21. PCMCIA mode test setup. Jumper is open.

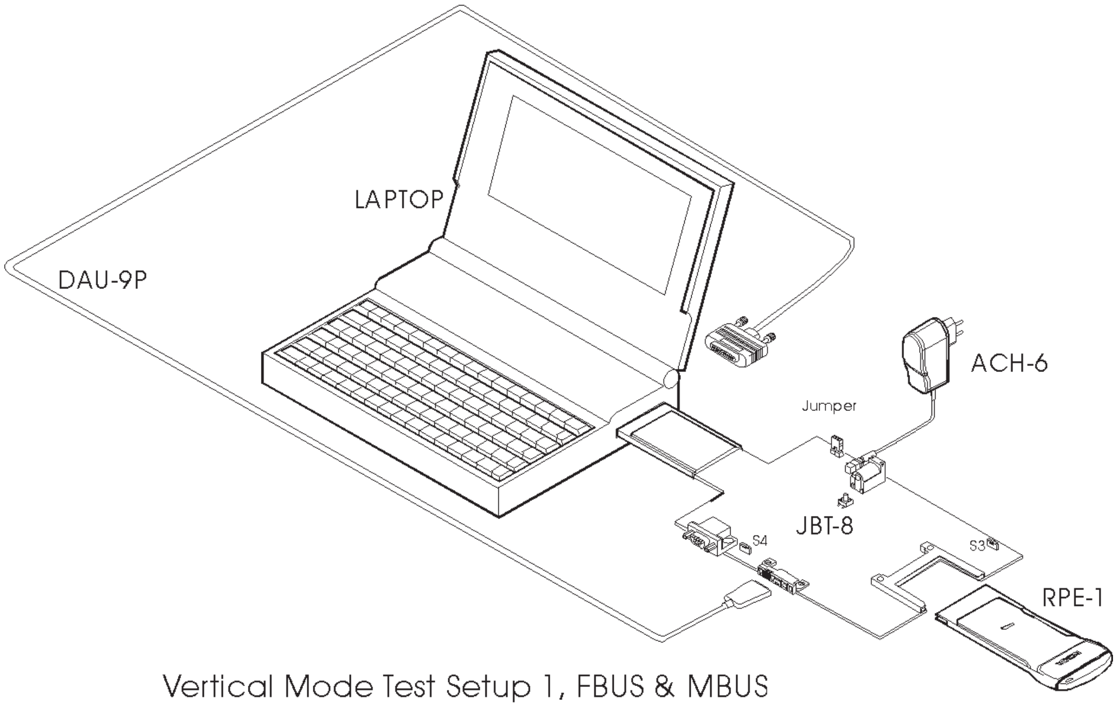

Figure 22. NON–PCMCIA Mode Test Setup 1. Jumper is shorterd.

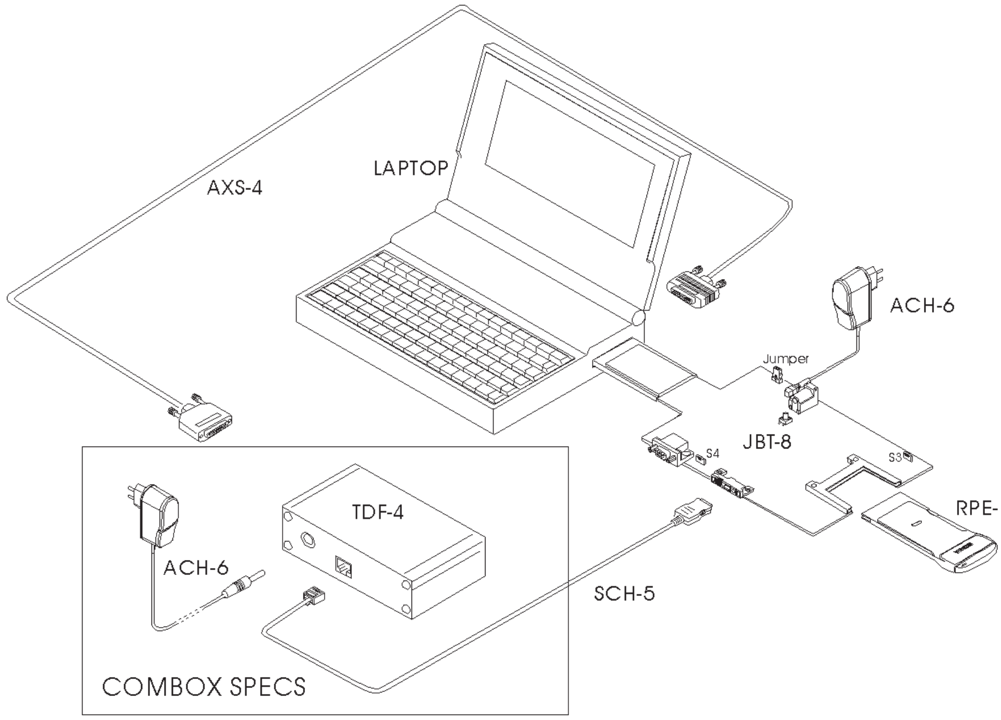

Figure 23. RPE–1 Flashing Setup

RF trouble shooting principles

The idea is to first roughly find out where the problem might be:

– RX?

– TX?

– Common parts to RX and TX, i.e. synthesizer, antenna switch, or antenna?

This is quickly found out using WinTesla, a signal generator, and a spectrum analyzer. After the problem has been located in one of the above said ’main blocks’ the particlular ’main block’ must be examined in more detail.

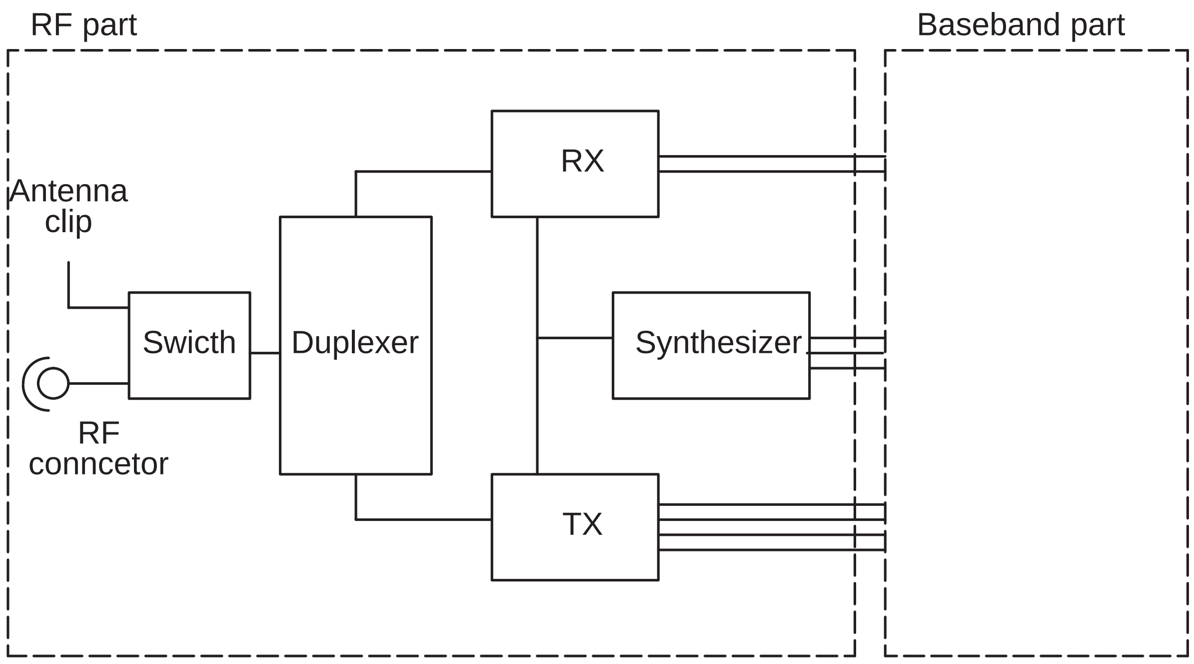

Figure 24. RF big picture ('main blocks')

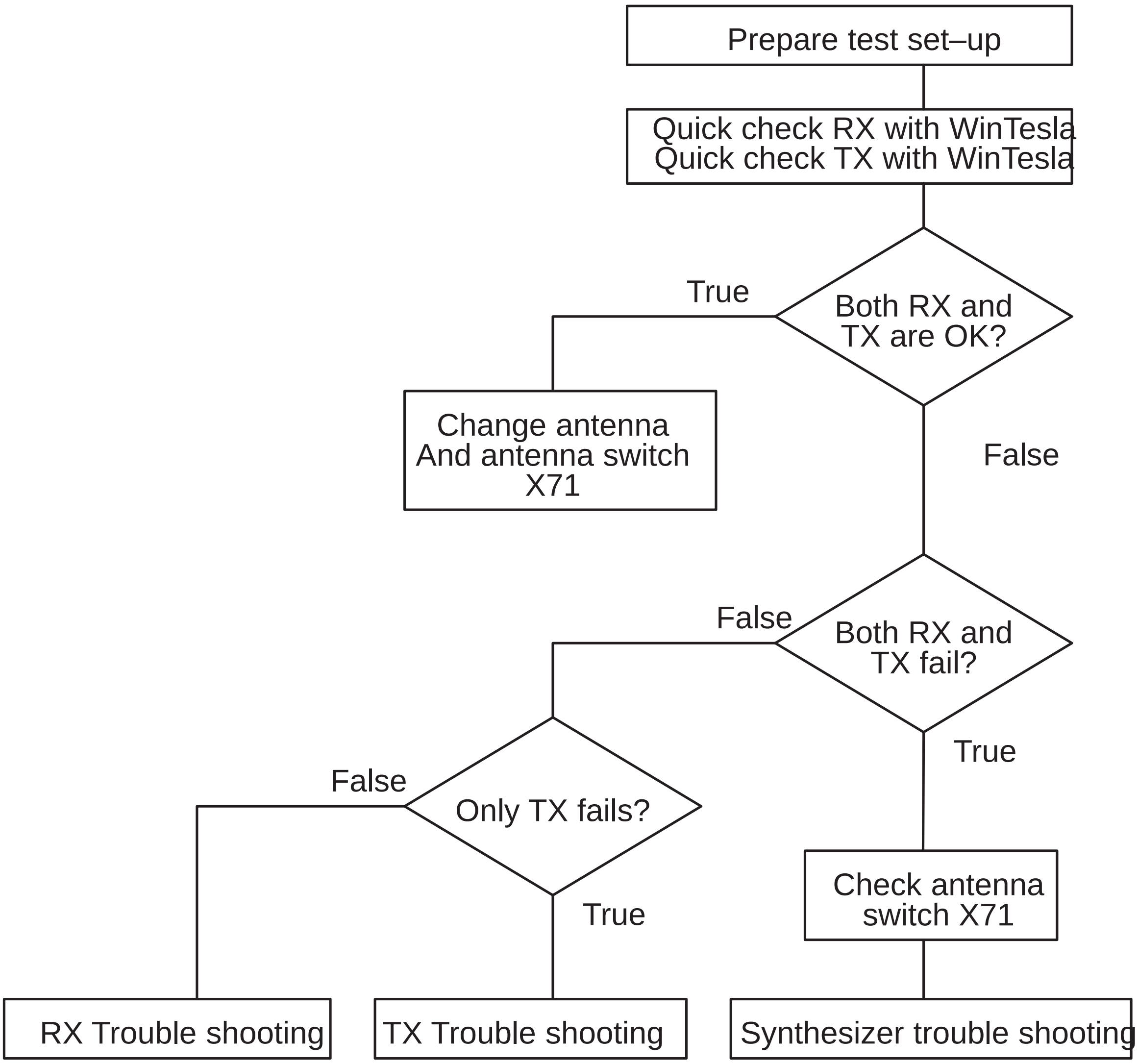

Figure 25. Locating the problem roughly.

Quick check RX with WinTesla

Gather test equipment

- Service adapter JPT 8
- Charger ACH–6E
- PC with WinTesla SW
- Cable DAU–9P
- Security key PKD–1A

– RF cable
– Signal generator (Up to 1 GHz) e.g. R&S SME3

Connect test equipment

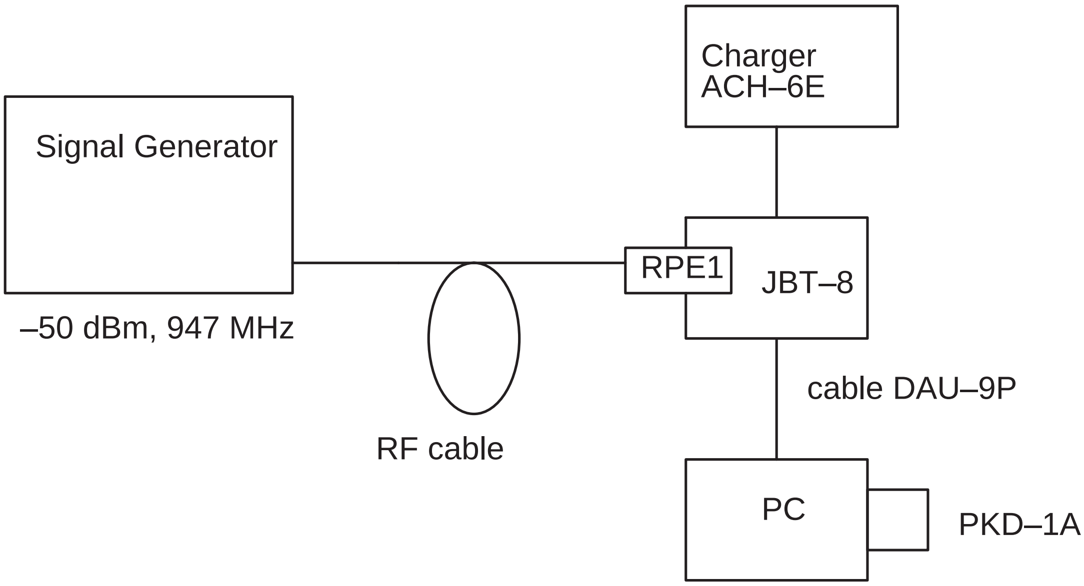

Figure 26. Quick check RX.

Settings

– Service adapter: ’vertical mode’
– Signal generator: RF power –50 dBm, frequency 947 MHz
– Wi ntesla: `Testing > RF controls > Cont mode ch: 60, Operation Mode: Continous > Apply > Close > Testing > RSSI Reading`

Diagnostic

If RSSI reading is –54...48 dBm, then RX is OK.

Quick check TX with WinTesla

Gather test equipment

– Service adapter JPT 8
– Charger ACH–6E
– PC with WinTesla SW

– Cable DAU–9P
– Security key PKD–1A
– RF cable
– Spectrum analyzer
– Attenuator 20 dB e.g. HP8491A

Connect test equipment

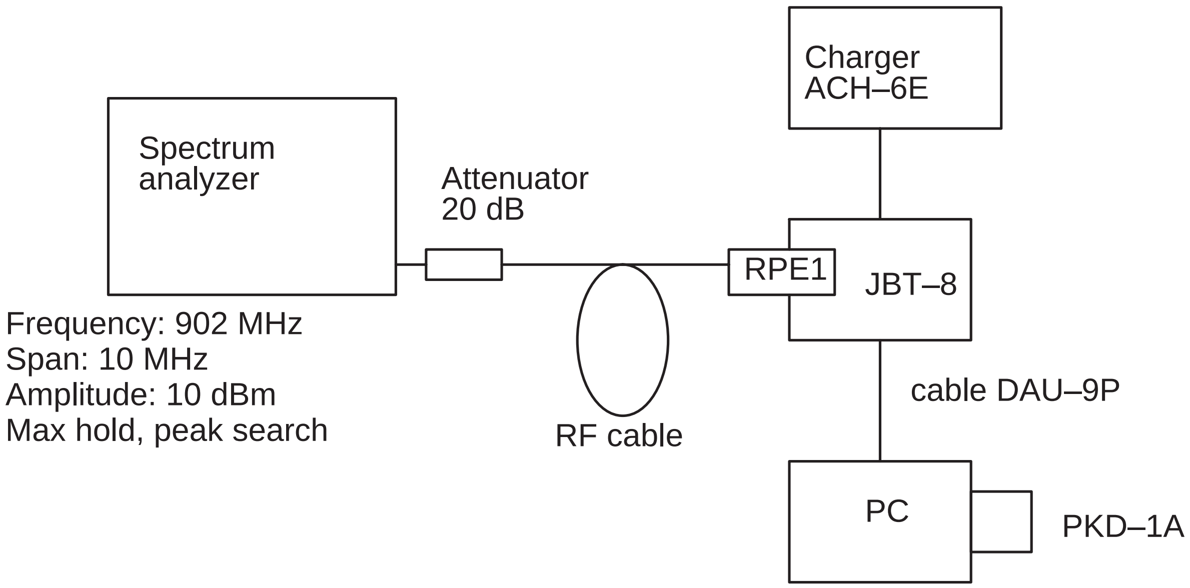

Figure 27. Quick check TX

Settings

– Service adapter: ’vertical mode’
– Wintesla: `Testing > RF controls > Active unit TX, Operation mode Burst, Channel: 60, TX power level: 7 > Apply`
– Spectrum analyzer: Frequency: 902 MHz, Span: 10 MHz, Amlitude: 10 dBm, Trace > MAX HOLD, (Marker) PEAK SEARCH

Diagnostic

If output power reading is at least 6 dBm then TX is OK.

RX trouble shooting

Test equipment

- Service adapter JPT–8
- Cable DAU–9P
- Charger ACH–6E
- PC with WinTesla SW
- Security key PKD–1A
- Spectrum analyzer up to 2 GHz e.g.
- Signal generator e.g. R&S SME 03
- HF–probe 85024A
- RF cable
- Digital multimeter (e.g. Fluke 77 series II)

Test each block separately while the phone is in local mode, RX being active. Measure the RF and IF signal inputs and outputs using the HF–probe. Use the 10:1 adaptor (a –20 dBm attenuator). Measure the operating voltage using voltage meter and the control signals using either voltage meter or, in certain cases, oscilloscope.

Procedure

Take off the metal covers of RPE–1 in order to be able to probe the card, i.e. the GX8–module. Connect test equipment as in Figure 28. Make sure the PCMCIA connector connects properly, since the covers are not forcing proper match between the card and socket!

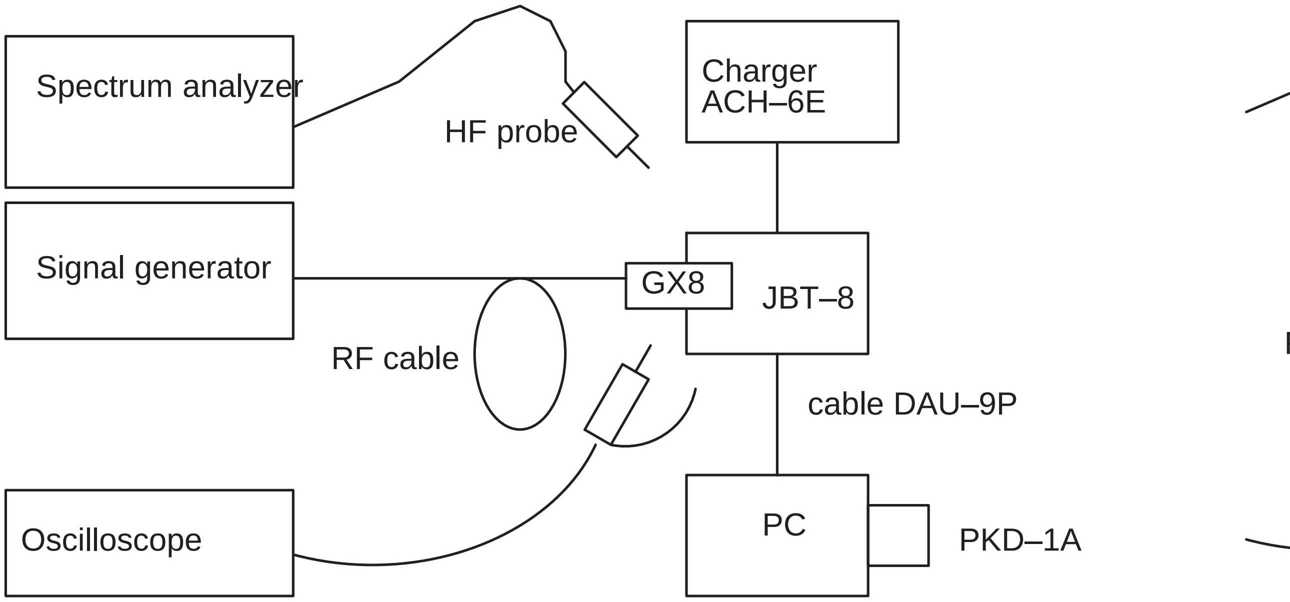

Figure 28. Use HF probe for power measurements and oscilloscope for voltage measurements.

Test points are defined as componet pin numbers wherever possible. In case the components have no pin or terminal numbering (e.g. resistors), the test point is defined as how the terminal is physically oriented compared to the components center as the phone is in front of the viewer *PCMCIA connector to the right*.

You need to refer to the component assembly drawing.

Settings

- Spectrum analyzer: `Center frequency` depends on test, `span 2 MHz, Ampilude REF LVL +10 dBm`
- WinTesla `Testing > RF Controls > Active unit: RX, Operation mode Continous, Continous Mode Ch: 60, ✓ Front End On.`
- Signal Generator `Frequency 947 dBm, LEVEL –20 dBm`
- Service adapter: ’vertical mode’

Note

Use common sense when interpreting your test results. For example, the IF amplifier:

– if signal input is OK and operating volteges are OK, but output is out of spec then the amplifier must be fixed.

– if signal input is OK but operating voltages are not OK then a *regulator* must be fixed

– if signal input is not OK then you must find the fault in the *circuits preceeding* this circuit.

Test duplexer RX side

Table 1.

	test point	nominal	tolerance	notes
RF in	Z106 pin 1 (ANT)	–46 dBm	± 1 dB	947 MHz
RF out1	Z106 pin 3 (RX)	–49 dBm	± 2 dB	947 MHz

Test LNA

Make sure Front End On is ✓–marked (Win Tesla RF Controls) .

Table 2.

	test point	nominal	tolerance	notes
RF in	C113 up	–45 dBm	± 2 dB	947 MHz
RF out	V102 upper right	–20 dBm	± 4 dB	947 MHz
on/off control	V100 pin 4	2.7 V	± 0.2 V	DC
on/off control	R108 up	3.0 V	± 0.3 V	DC
operating voltage	R100 down	2.9 V	± 0.2 V	DC
voltage drop due to operating current	V(R100 down) – V(R100 up)	80 mV	± 30 mV	DC (8 mA)

Test RX RF SAW filter

Table 3.

	test point	nominal	tolerance	notes
RF in	Z103 pin 2	–21 dBm	± 4 dB	947 MHz
RF out	Z103 pin 5	–30 dBm	± 6 dB	947 MHz

Test RF mixer RX side

Table 4.

	test point	nominal	tolerance	notes
RF in	V104 pin 1	–29 dBm	± 6 dB	947.5 MHz
LO in	V105 down	–13 dBm	± 3 dBm	1018 MHz
IF out	C108 left	–28 dBm	± 7 dB	71 MHz

Test IF amplifier

Table 5.

	test point	nominal	tolerance	notes
IF in	C108 left	–28	± 7 dB	71 MHz
IF out	C103 left	–10	± 8 dB	71 MHz
operating voltage	R101 right	2.9 V	± 0.2 V	DC
voltage drop due to operating current	V(R101 right) – V(R101 left)	0.5 V	± 0.2 V	DC (5 mA)

Test 1st IF filter

Table 6.

	test point	nominal	tolerance	notes
IF in	Z101 pin13 (lower left hand corner)	–9 dBm	± 8 dB	71 MHz
IF out	L105 left	–21 dBm	± 10 dB	71 MHz

Test CRFRT RX part

Table 7.

	test point	nominal	tolerance	notes
1st IF in (negative)	CRFRT pin 1	–33 dBm	± 10	71 MHz
1st IF in (positive)	CRFRT pin 2	–31 dBm	± 5	71 MHz
2nd IF out (negat.)	CRFRT pin 12	–11 dBm	± 5	13 MHz
2nd IF out (posit.)	CRFRT pin 13	–11 dBm	± 5	13 MHz
LO2 in	C129 down	–20 dBm	± 3 dB	232 MHz

Table 7. (continued)

	test point	nominal	tolerance	notes
gain control (AGC)	V103 pin 39	1.8 V	± 0.2 V	Pulsed. Measure in **Burst** mode!
operating voltage	CRFRT pin 6	4.7 V	± 0.2 V	DC. Mesure in **Continious** Mode.
reference voltage	CRFRT pin 36	2.46 V	± 50 mV	DC. Mesure in **Continious** Mode.

If output from CRFRT (2nd IF out negative. or positive.) is missing, check first the 2nd IF filter before replacing CRFRT. See section ”Test 2nd IF filter”.

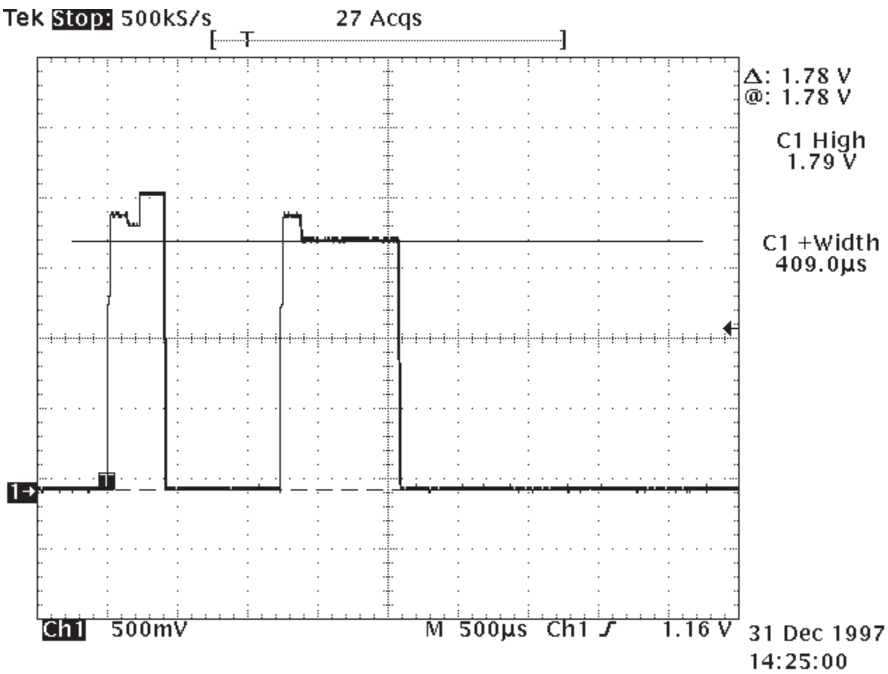

Figure 29. RX AGC in pin 39 of CRFRT (N100).

Test 2nd IF filter

Table 8.

	test point	nominal	tolerance	notes
IF in	Z107 up	–30	± 5	13 MHz
IF out	Z107 down	–34	± 5	13 MHz

TX trouble shooting

Test each block sparately while the phone is in local mode, TX being active.

Otherwise, you can follow similar procedure as in RX rouble shooting. Connect a 20 dB attenuator to the external–antenna–connector.

You need an oscilloscope for measuring to measure e.g. operating voltages and control signals. The authors used a Tektronix TDS 774A ($$).

Test equipment

- Service adapter JPT–8
- Cable DAU–9P
- Charger ACH–6E
- PC with WinTesla SW
- Security key PKD–1A
- Spectrum analyzer
- HF–probe 85024A
- RF cable
- Digital multimeter (e.g. Fluke 77 series II)
- Attenuator 20 dB e.g. HP8491A

Test each block separately while the phone is in local mode, TX being active. Measure the RF and IF signal inputs and outputs using the Hewlett Packard HF–probe HP 85024A. Use the 10:1 adaptor (a –20 dBm attenuator). Measure the operating voltage using voltage meter and the control signals using either voltage meter or, in certain cases, oscilloscope.

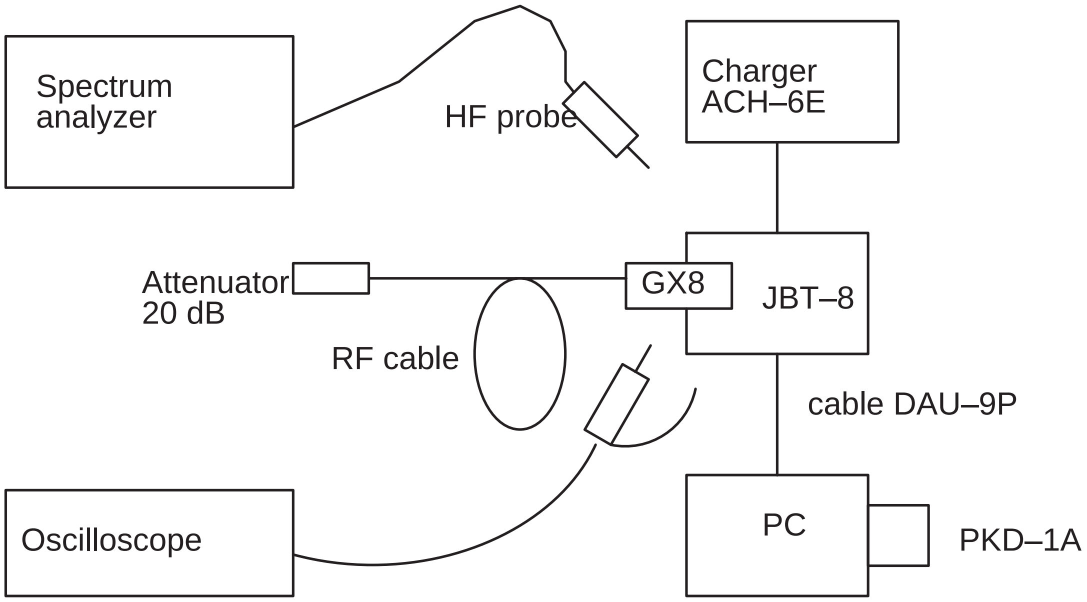

Figure 30. TX trouble shooting.

Settings

- WinTesla `Testing > RF Controls > Active unit; TX, Operation mode Burst, Channel: 60, TX data type: Rand, TX power level: 7.`
- Service adapter: 'vertical mode'

Test CRFRT TX part

Table 9.

	test point	nominal	tolerance	notes
I & Q, (positive & negative) in	CRFRT pins 21...24	see Figure 31	–	use oscilloscope
IF (MOD0) out	CRFRT pin 28	–29 dBm using probe. See also oscilloscope view Figure 32.	± 2 dB	Spectrum analyzer settings Frequency 116 MHz, Span 10 MHz, Max hold.
LO2 in	C129 down	–20 dBm	± 3 dB	232 MHz
TX IF gain control in (AGC)	V103 pin 4	see Figure 33	–	use oscilloscope
VTX in (operating voltage)	C140 left	4.8 V (peak)	± 0.2 V	pulsed

Table 9. (continued)

	test point	nominal	tolerance	notes
TXC in (Analogue power control input voltage from RFI2 to CRFRT)	C141 down	2.3 V (see Figure 34)	± 0.7 V	pulsed
TXGX in (Analogue power control onput voltage from CRFRT)	R120 right	3.8 V (see Figure 35)	± 1 V	pulsed
Accurate reference voltage in	CRFRT pin 36	2.50 V	± 50 mV	DC

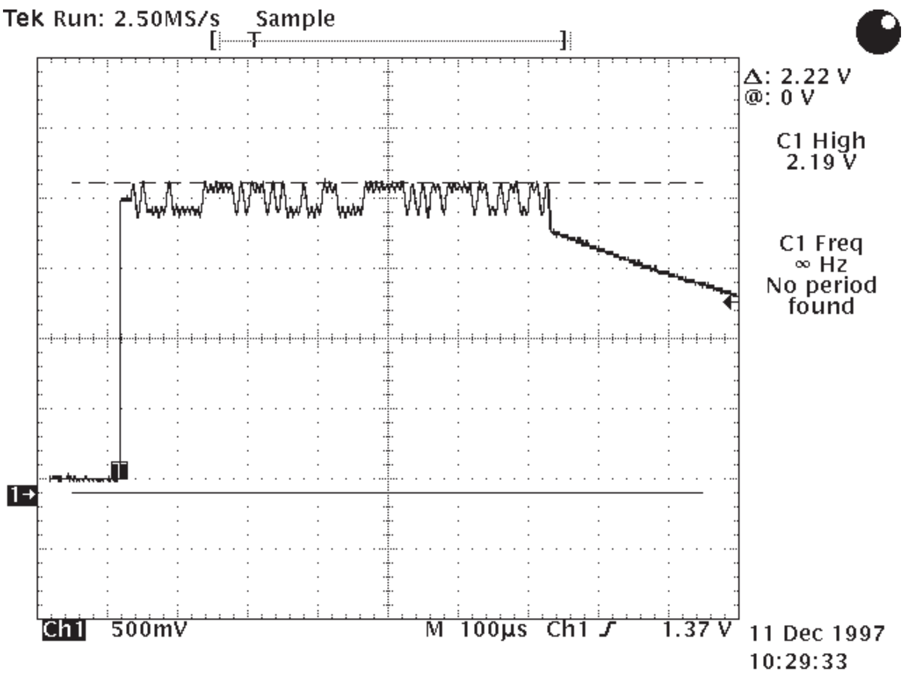

Figure 31. TX positive and negative I and Q signals signals should look like this (example is TXIN pin 21)

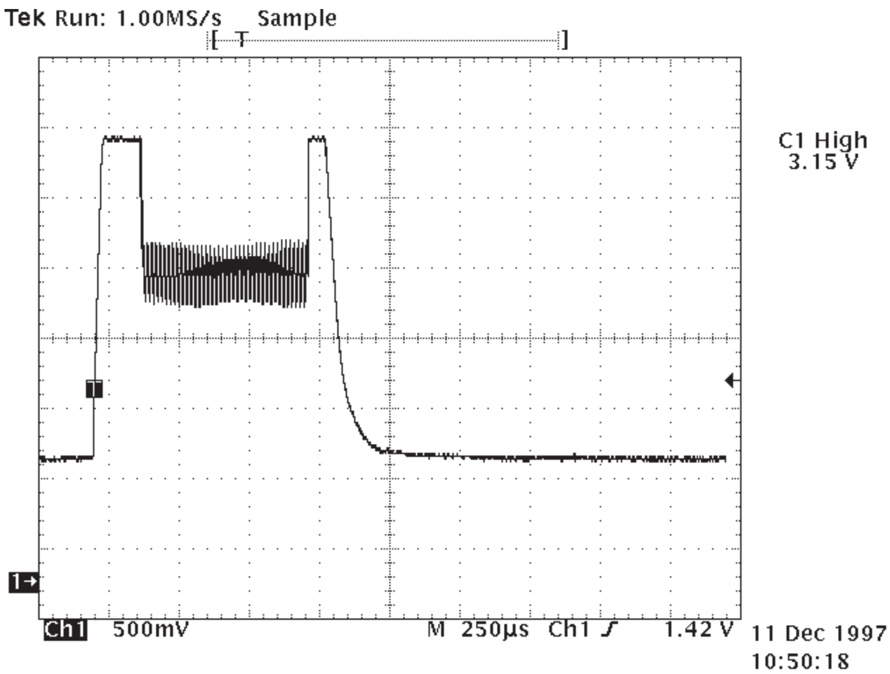

Figure 32. MOD0 signal measured using Tektronix TDS 744 (pin 28).

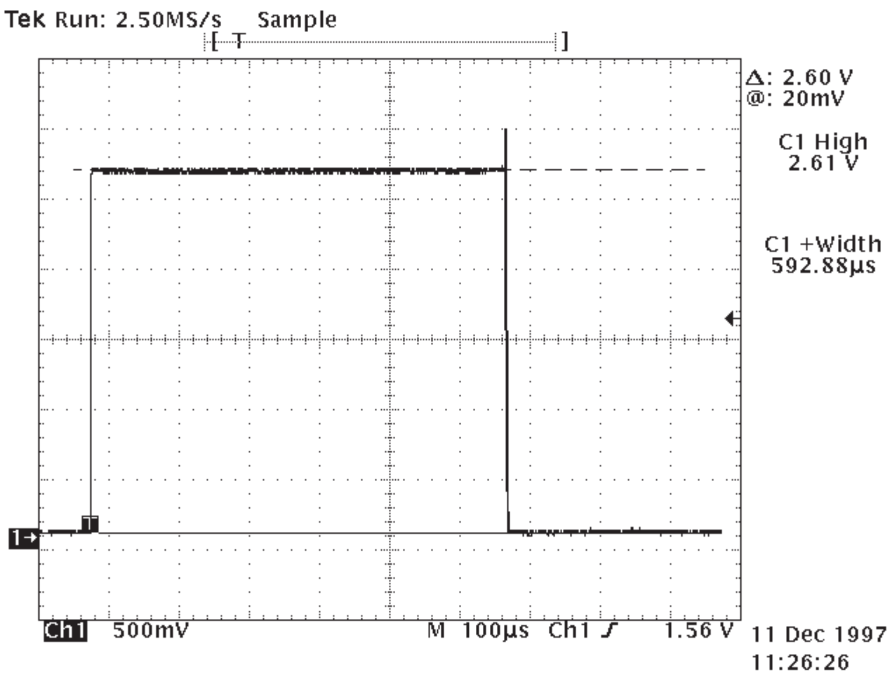

Figure 33. TX IF gain control (V103 pin 4).

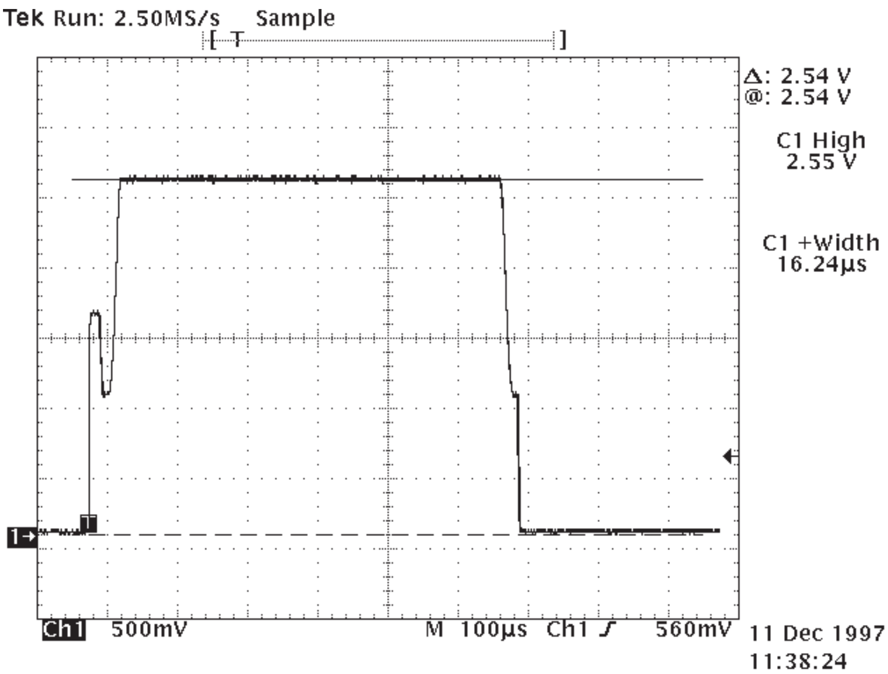

Figure 34. TXC (for Power tuning coefficient 0.848), (C141 down).

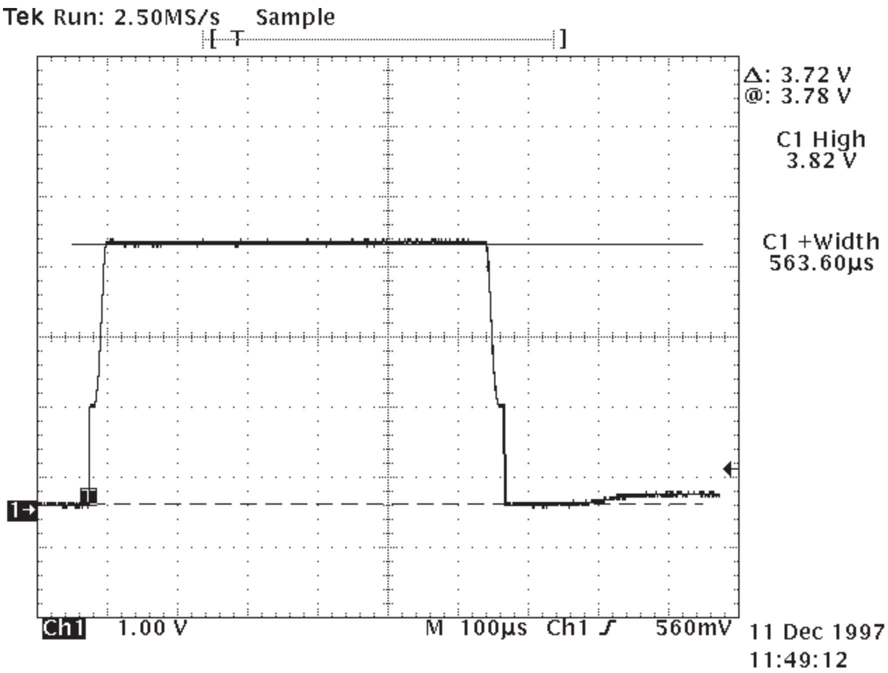

Figure 35. TXGX (for tuning coefficient 0.848), (R120 right).

Test RF mixer TX side

Table 10.

	test point	nominal	tolerance	notes
IF in	L210 up	–32 dBm	± 2 dB	Spectrum analyzer settings: FREQ 116 MHz, SPAN 10 MHz, TRACE > Max hold
LO in	V105 down	–13 dBm	± 3 dB	Spectrum analyzer settings: FREQ 1018 MHz, SPAN 10 MHz,
RF out	V104 pin 2 (lower right hand corner)	–42 dBm	± 4 dB	Spectrum analyzer settings: FREQ 902 MHz, SPAN 10 MHz, TRACE > Max hold

Test PA–driver

Table 11.

	test point	nominal	tolerance	notes
RF in	N204 pin 1 (upper left hand corner)	–44 dBm	± 4 dB	902 MHz
RF out	N204 pin 4 (lower right hand corner)	–22 dBm	± 5 dB	902 MHz
operating voltage 1	C249 up	2.8 V	± 0.2 V	pulsed DC
operating voltage 2	N204 pin 6	2.8 V	± 0.2 V	pulsed DC

Test TX RF SAW filter

Table 12.

	test point	nominal	tolerance	notes
RF in	Z208 pin 2	–22 dBm	± 5 dB	902 MHz
RF out	Z208 pin 5	–29 dBm	± 6 dB	902 MHz

Test power control circuit

Table 13.

	test point	nominal	tolerance	notes
pwr control out (APC)	R254 up	3.1 V see Figure 36	± 1 V	'smooth pulse', duration 576 us repetition 4.6 ms
reference in (TXGX)	V201 pin 5	3.8 V see Table 9 and Figure 35.	± 1V	”
detected voltage	C245 right	2.1 V see Figure 37.	± 0.7 V	”

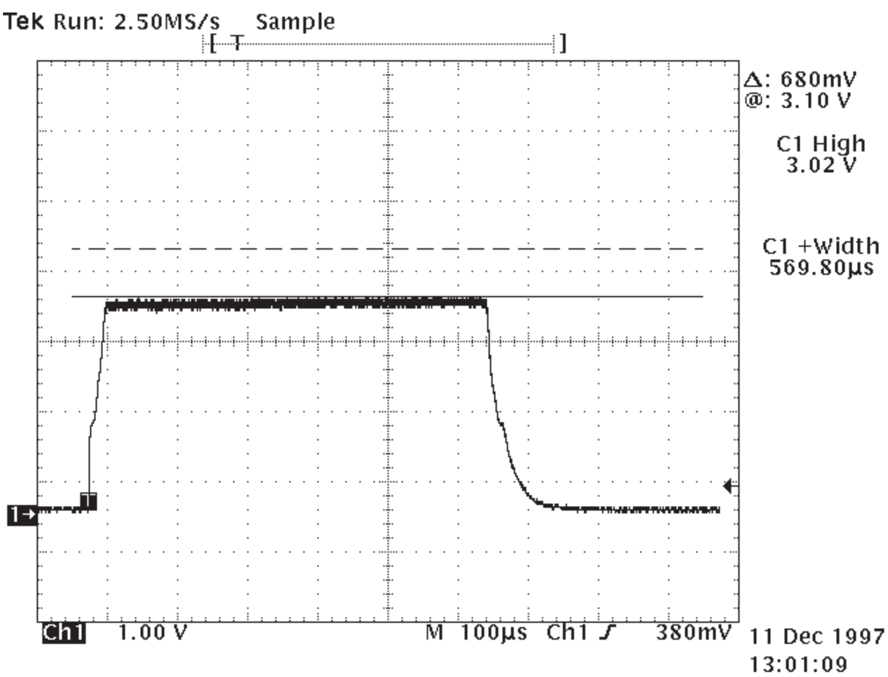

Figure 36. Typical APC voltage wave form to the PA at Power control level 7 (R254 up).

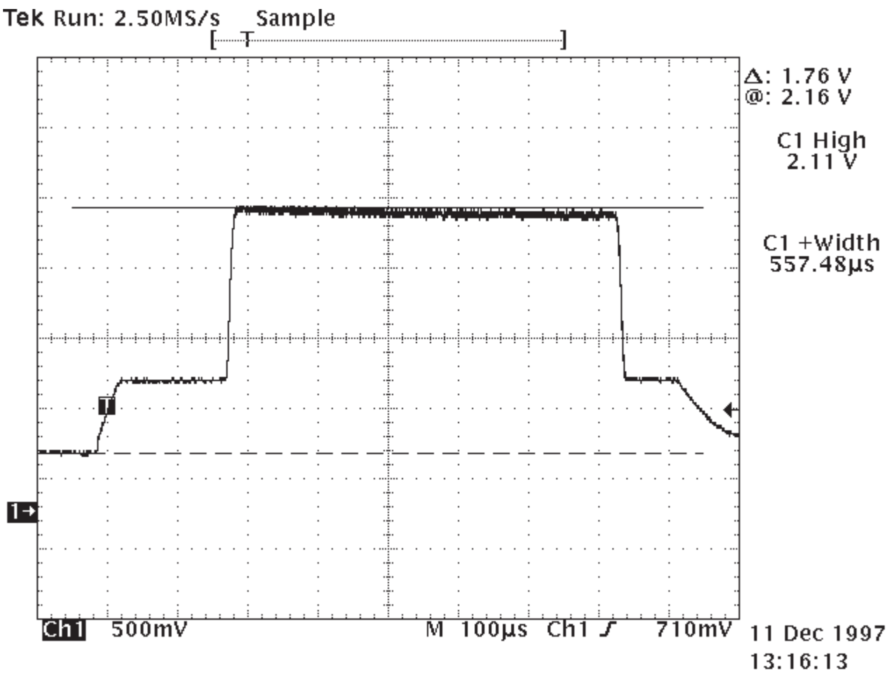

Figure 37. Detected voltage from the power detector (V201 pin 5).

Test power amplifier

Table 14.

	test point	nominal	tolerance	notes
RF in	C250 left	–26 dBm	± 5 dB	Spectrum analyzer settings: FREQ 902 MHz, SPAN 10 MHz, TRACE > Max hold
RF out	C255 left	+5 dBm	± 3 dB	Spectrum analyzer settings: FREQ 902 MHz, SPAN 10 MHz, TRACE > Max hold, AMPLITUDE 20 dBm
operating voltage 1	C282 up	3.3 V	± 0.1 V	DC (almost)
operating voltage 2	C208 up	3.3 V	± 0.1 V	DC (almost)

Test duplexer TX side

Table 15.

	test point	nominal	tolerance	notes
RF in	Z106 pin 2 (TX)	4.5 dBm	± 2 dB	Spectrum analyzer settings: FREQ 902 MHz, SPAN 10 MHz, TRACE > Max hold, AMPLITUDE 20 dBm
RF out	Z106 pin 1 (ANT)	4.0 dBm	± 2 dB	–"–

Check antenna switch

Make the connection and settings as on page 33.

Table 16.

	test point	nominal	tolerance	notes
RF in	X71 common port from duplexer	3.7 dBm	± 2 dB	Spectrum analyzer settings: FREQ 902 MHz, SPAN 10 MHz, TRACE > Max hold, AMPLITUDE 20 dBm
RF out	X71 internal antenna port (spring)	7 dBm	± 2 dB	Spectrum analyzer settings: as above. RF cable and attenuator removed.

Synthesizer trouble shooting

Test equipment

- Service adapter JPT–8
- Cable DAU–9P
- Charger ACH–6E
- PC with WinTesla SW
- Security key PKD–1A
- Spectrum analyzer
- HF–probe 85024A
- Digital multimeter (e.g. Fluke 77 series II)

Test each block separately while the phone is in local mode, (TX active). Measure the LO and clock outputs using the Hewlett Packard HF–probe HP 85024A. Use the 10:1 adaptor (HP 11881A, which actually is a –20 dBm attenuator). Measure the operating voltage using voltage meter and the control signals using either voltage meter or, in certain cases, oscilloscope.

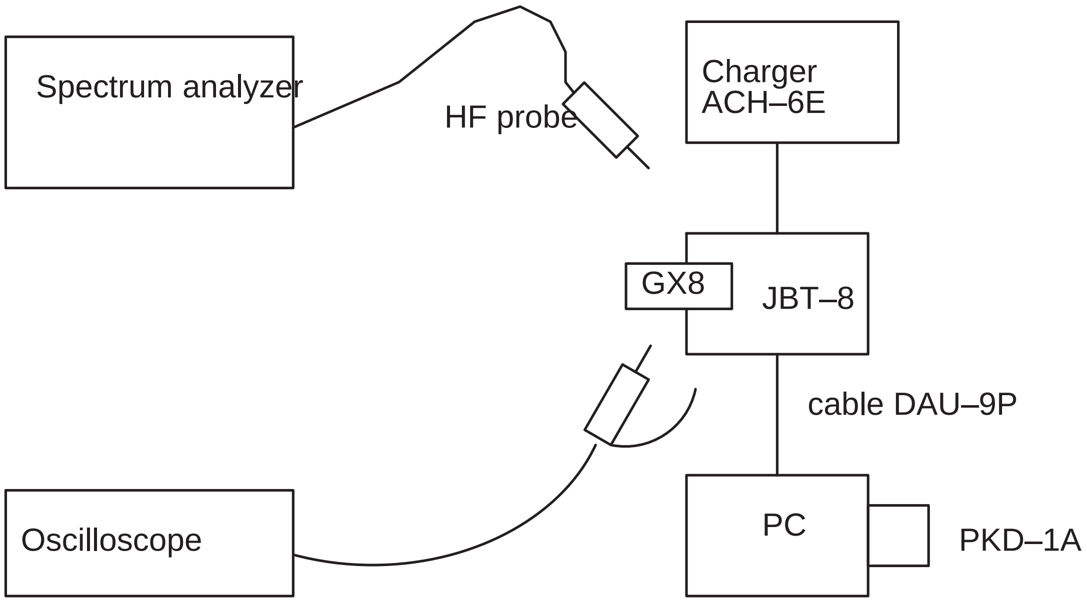

Figure 38. Synthesizer trouble shooting.

Settings

– WinTesla `Testing > RF Controls > Active unit; TX, Operation mode Burst, Channel: 60, TX data type: Rand, TX power level: 7.`
– Service adapter: ’vertical mode’

VCTCXO (G201)

Table 17.

	test point	nominal	tolerance	notes
control voltage	C230 right	2.0 V	± 0.2 V	DC
clock out	R227 right	1.13 Vpp	± 0.3 V	13.000 MHz
operating voltage	C218 left	4.5 V	± 0.3 V	DC
voltage drop due to operating current	V(R215 right) – V(R215 left)	0.22 V	± 0.05	DC (1.2 mA)

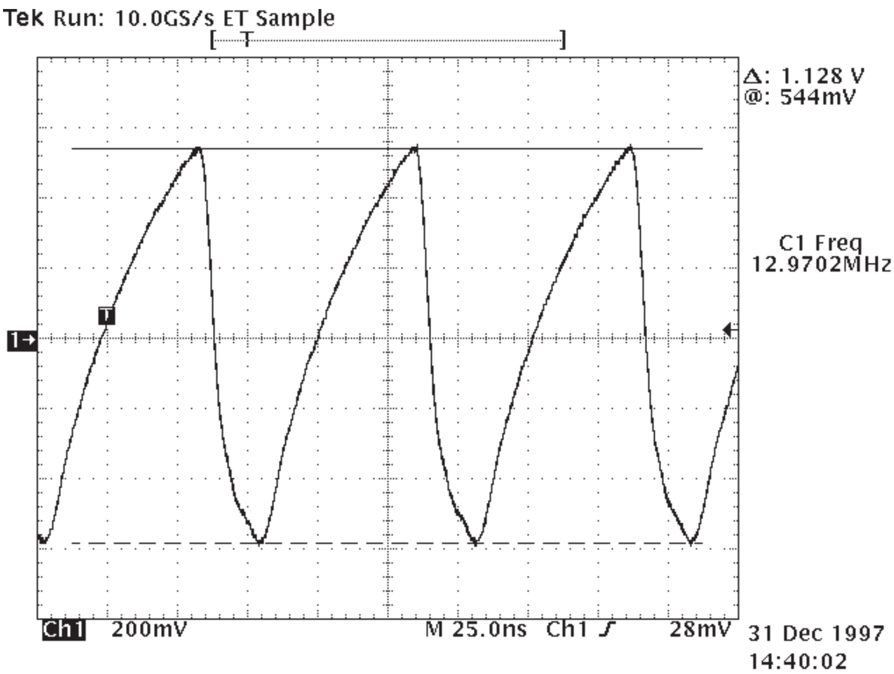

Figure 39. VCTCXO output at R227 right. (Toyocom)

UHF VCO (G200)

Table 18.

	test point	nominal	tolerance	notes
control voltage	G200 pin1 (lower right)	2.2 V	± 0.3 V	DC
LO1 out	G200 pin 4 (upper left)	–30 dBm (thru a 20 dB attenuator)	± 5 dB	1018 MHz (Easier to measure in **Contínious** Mode!)
operating voltage	G200 pin 3 (upper right)	4.5 V	± 0.2 V	DC
voltage drop due to operating current	V(R204 right) – V(R204 left)	0.15 V	± 0.05 V	DC (7 mA)

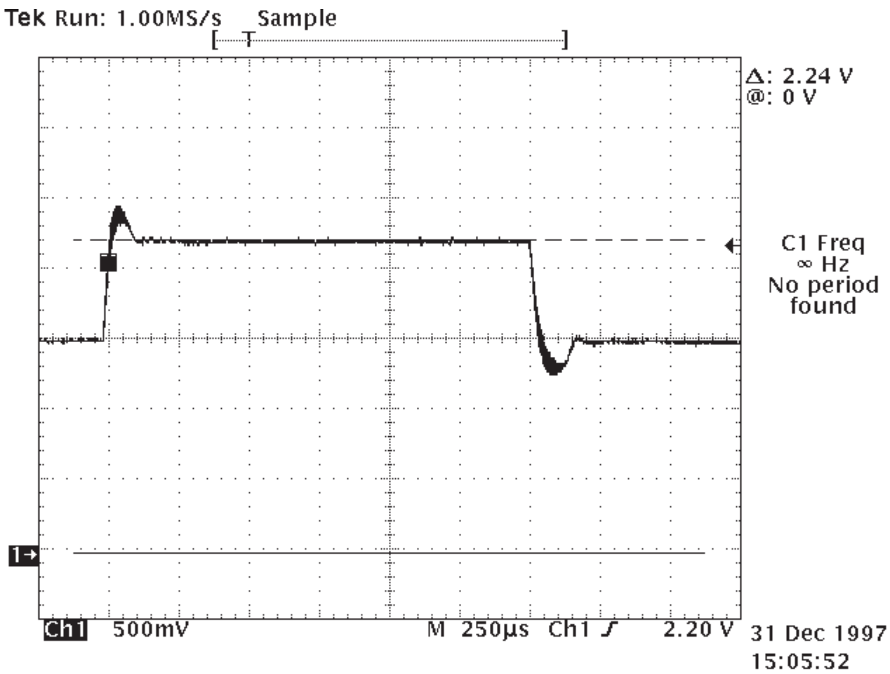

Figure 40. Control voltage of UHF VCO (pin 1 of G200)

UHF Buffer

Table 19.

	test point	nominal	tolerance	notes
operating voltage	V105 down (collector)	2.9 V	± 0.5 V	DC
voltage due to operating current	R129 (left) – R129(right)	1.5 V	± 0.3 V	DC
RF in	V105 upper right (base), or R133 left	–30.0 dBm	± 4 dB	1018 MHz
RF out	V105 down (collector)	–11.5 dBm	± 4 dB	1018 MHz

VHF VCO

Table 20.

	test point	nominal	tolerance	notes
control voltage	V205 left	3.0 V	± 1 V	DC
LO2 out	C213 right	–18 dBm	± 3 dB	232 MHz
operating voltage	L200 right	4.56 V	± 0.2 V	DC
voltage drop due to operating current	V(R201 up) – V(R201 down)	0.12 V	± 50 mV	DC (5.5 mA)

PLL IC (N202)

Table 21.

	test point	nominal	tolerance	notes
operating voltage1	C202 right	3.2 V	± 0.3	DC
operating voltage2	C205 right	3.3 V	± 0.3	DC
operating voltage of charge pumps	pin 19 of N202	4.7 V	± 0.3	DC
data enable	pin 13	see Figure 41	–	pulsed
data	pin 12	see Figure 41	–	pulsed
data clocking	pin 11	see Figure 41	–	pulsed

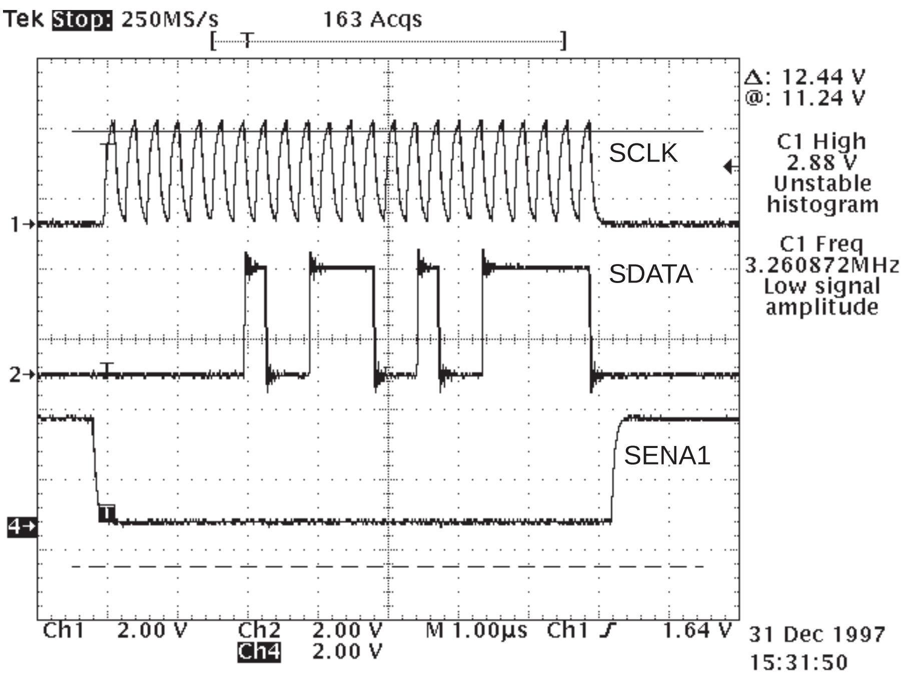

Figure 41.

Repair

Replace the broken component. Put on new covers. At least the extension box should be new, because it wears out when the bottom cover is removed.

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