

# **PAMS Technical Documentation**

## **RAE-3NU\* Series PDA**

# **8. Troubleshooting**

### AMENDMENT RECORD SHEET

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**CONTENTS -Troubleshooting**

	<b>Page No</b>
Introduction .....	8 - 6
RAE-3NU* System HW / UI Troubleshooting .....	8 - 6
Tools needed for troubleshooting: .....	8 - 6
General guidelines .....	8 - 6
System HW / UI Troubleshooting Cases .....	8 - 8
Nominal Current Consumption .....	8 - 9
1 System HW / UI Troubleshooting Cases .....	8 - 10
1.1 Dead Device .....	8 - 10
1.2 Keypad problems .....	8 - 11
1.3 PDA backlight problems .....	8 - 13
2 KL8/ System HW related .....	8 - 14
2.1 Flash programming troubleshooting .....	8 - 14
2.1.1 Flashing does not start .....	8 - 14
2.1.2 Flash memory fault indicated .....	8 - 15
2.1.3 Flash VPP Error .....	8 - 16
2.1.4 Flash Erasing /Programming Error .....	8 - 17
2.2 General Power Checking .....	8 - 18
2.3 Device does not stay ON .....	8 - 20
2.4 Charging checking .....	8 - 21
2.5 Backup Battery .....	8 - 23
2.5.1 Backup battery troubleshooting .....	8 - 23
2.6 Accessory Power Output Troubleshooting .....	8 - 25
2.6.1 No Accessory Voltage when needed .....	8 - 26
2.6.2 Accessory Voltage ON all the time .....	8 - 27
2.7 Clocks .....	8 - 28
2.7.1 Clocks Troubleshooting .....	8 - 28
2.8 KL8/KL9Memory Tests .....	8 - 30
2.8.1 Test in boot up .....	8 - 30
2.8.2 Test in PTS/WinTesla flashing .....	8 - 31
2.9 Memory Troubleshooting .....	8 - 32
2.9.1 Memory fails In Boot Up tests, CMT Backlight is blinking .....	8 - 32
2.9.2 CMT display backlight blinking 2 times in a loop .....	8 - 33
2.9.3 CMT display backlight blinking 3 times in a loop .....	8 - 34
2.9.4 CMT display backlight blinking 5 times in a loop .....	8 - 37
2.9.5 Memory fails in PTS/WinTesla flashing .....	8 - 38
2.9.6 DiskOnChip id read test fails .....	8 - 40
2.10 Serial Interface Troubleshooting .....	8 - 41
2.11 CONTACT SERVICE in CMT display .....	8 - 44
2.12 CCONT Serial interface Troubleshooting .....	8 - 46
2.13 SIM Card .....	8 - 48
2.13.1 SIM Card Error Troubleshooting .....	8 - 48
2.13.2 SIM Card Rejected .....	8 - 49

8. Troubleshooting	Technical Documentation
2.13.3 Insert SIM card .....	8 - 51
2.14 Memory Card .....	8 - 53
2.14.1 Memory Card Interface Troubleshooting .....	8 - 53
2.14.2 Memory card switch troubleshooting: .....	8 - 55
2.15 Lid Switch .....	8 - 56
2.15.1 Lid Switch Troubleshooting .....	8 - 56
2.16 Battery Removal Switch troubleshooting .....	8 - 58
2.17 COBBA Control Interface troubleshooting .....	8 - 60
2.18 COBBA PCM Interface Troubleshooting .....	8 - 62
2.19 Audio troubleshooting .....	8 - 65
2.19.1 Both Mic and Earpiece/PHF faulty .....	8 - 65
2.19.2 Mic faulty .....	8 - 67
2.19.3 Earpiece faulty .....	8 - 68
2.19.4 PHF Speaker faulty .....	8 - 69
2.19.5 Headset out of order .....	8 - 71
2.20 RF Interface .....	8 - 73
2.20.1 Phone doesn't register to the network .....	8 - 73
2.21 IR Interface Troubleshooting diagram .....	8 - 74
2.22 KL8 related Keyboard problems .....	8 - 75
2.23 KL8 related PDA UI problems .....	8 - 79
2.24 KL8 related CMT UI problems .....	8 - 84
3 DL2 UI Troubleshooting .....	8 - 86
3.1 CMT and keypad illumination problems .....	8 - 86
3.2 CMT LCD Troubleshooting .....	8 - 86
3.3 No picture on PDA LCD or picture is faulty .....	8 - 87
3.4 Backlight troubleshooting .....	8 - 100
3.5 DL2 related keyboard problems .....	8 - 105
4 UL 8 FLEX related .....	8 - 106
4.1 Audio troubleshooting .....	8 - 106
4.2 Display problem .....	8 - 107
4.3 Battery Removal Switch problem .....	8 - 108
4.4 UL8 related keyboard problems .....	8 - 108
5 RF related troubleshooting .....	8 - 109
Introduction to RF troubleshooting .....	8 - 109
RF Key Component Placement .....	8 - 110
5.1 EGSM Receiver .....	8 - 111
General Instructions for troubleshooting for EGSM RX .....	8 - 111
5.1.1 Troubleshooting diagram for EGSM Receiver .....	8 - 112
5.1.2 EGSM Signal Path .....	8 - 113
5.1.3 RX/TX Switch .....	8 - 113
5.1.4 Front end .....	8 - 113
5.1.5 Hagar .....	8 - 114
5.2 PCN Receiver .....	8 - 115
General Instructions for troubleshooting for PCN RX .....	8 - 115
5.2.1 PCN Signal Path .....	8 - 117
5.2.2 RX/TX Switch .....	8 - 117
5.2.3 Front end .....	8 - 117

## Technical Documentation

## 8. Troubleshooting

5.2.4 Hagar .....	8 – 117
5.3 EGSM Transmitter .....	8 – 119
General troubleshooting instructions for EGSM TX	8 – 119
5.3.1 Path of transmitted EGSM signal .....	8 – 119
5.3.2 Troubleshooting diagram for EGSM Transmitter .....	8 – 120
5.4 PCN Transmitter .....	8 – 122
General troubleshooting instructions for PCN TX	8 – 122
5.4.1 Path of the transmitted PCN signal .....	8 – 122
5.4.2 Troubleshooting diagram for PCN Transmitter .....	8 – 123
5.5 Synthesizer .....	8 – 125
General troubleshooting instructions for Synthesizer	8 – 125
5.5.1 26 MHz reference oscillator ( VCTCXO ) .....	8 – 125
5.5.2 VCO .....	8 – 125
5.5.3 Troubleshooting diagram for PLL Synthesizer .....	8 – 126
5.5.4 PLL Block Diagram .....	8 – 128
5.6 Frequency lists .....	8 – 129
6 Diagrams of Test Points .....	8 – 140

## Introduction

This document is intended to be a guide for localizing and repairing electrical faults in the RAE-3NUT/NUS device. First there is a brief guide for fault localizing. Then fault repairing is divided into troubleshooting paths.

Before any service operation you must be familiar with the RAE-3NU\* product and module level architecture. You must also be familiar with the RAE-3NU\* specified service tools such as the WinTesla service software, Flashing tools and software. Basic skills of using RF measurement devices are required when starting to follow the RF troubleshooting paths.

## RAE-3NU\* System HW / UI Troubleshooting

### Tools needed for troubleshooting:

- Service tools defined in RAE-3NU\* manual "Service Tools" section
- Laboratory power supply with current indicator
- Oscilloscope
- Digital multimeter . .

### General guidelines

General notes about the RAE-3NU\* product:

- RAE-3NU\* has only one common engine – KL8 system HW, . . . . . comprising CMT (phone) and PDA (computer)
- There are separate CMT and PDA displays and keyboards
- CMT display/keyboard and PDA display are on the UI module . . . . . DL1
- PDA QWERTY–keyboard UI is on UL8 flex module
- Audio connections for the handsfree speaker and earpiece are . . . . . on the UL8 flex module

When you have a faulty RAE-3NU\* device and you start to troubleshoot it, check first the following items:

- If the RAE-3NU\* cannot be turned on by any means, see "dead . . . . . device" troubleshooting
- Blinking CMT display means that a memory fault is preventing . . . . . normal boot up (-> Memory tests)
- Current consumption (missing consumption) gives an idea . . . . . whether the device is able to start up
- Dropping supply voltage indicates a short circuit
- Check whether the connection with WinTesla works and what can . . . . . be discovered with WinTesla

- Check self tests with Wintesla if "CONTACT SERVICE" is shown  
..... on the CMT display
- Check visual display faults
- Check that all connectors make good contacts
  - this might be the problem if the displays are dark or partially dark or if there are keyboard problems.

Care must be taken when assembling and disassembling the transceiver. Refer to the instructions in this manual. Failure to do this may result in unnecessary damage to the device.

**Locate failed module (KL8, UL8, DL1) with the MJS-14 test jig.  
This is the basis of further troubleshooting.**

- Check the failed module(s) visually:
  - mechanical damages?
  - solder joints OK?

Continue with the specific troubleshooting procedure for the module:

- If there is an obvious fault, repair it before reflashing the device
- Flash first if a fault is not obvious
  - Flashing troubleshooting leads to power checking and serial interface checking if flashing does not start.
  - At the beginning of flash programming, all memory interfaces are first tested
  - If flashing is aborted and error(s) return, refer to Memory testing section.
- Due to CSP packages short-circuits or broken solder joints are  
..... not easily seen. If the examined signal seems to be continuously  
..... in low or high level, then measure for possible short-circuit to  
..... ground (signal low) or to supply voltage (signal high). Note that  
..... if a problem is not found from any visible contact/component it  
..... can be under the CSPs where the signal is connected.

If there is no short circuit and the signal level is continuously at a low level, then the following faults are possible:

- contact problem in output soldering (output active)
- contact problem in soldering of pin having internal pull-up (tri-stated signals)

The PDA display must be calibrated after the following actions have been taken:

- RAE-3NU\* has been flashed
- PDA display or DL1 module has been replaced

**Note:** The last step in service before returning the RAE-3NU\* to the customer is to **set the RTC running time to 10 hours.**

- Service battery BBL-3B does that automatically.
- Always use only the BBL-3B service battery with Wintesla.

## System HW / UI Troubleshooting Cases

1. Troubleshooting of System HW/UI is divided to following cases:

- ..... 1.1      Dead Device
- ..... 1.2      Keypad problem

2. KL8 System HW related:

- ..... 2.1      Flash programming troubleshooting
- ..... 2.2      General Power Checking
- ..... 2.3      Device does not stay ON
- ..... 2.4      Charging checking
- ..... 2.5      Backup Battery
- ..... 2.6      Accessory Power Output Troubleshooting
- ..... 2.7      Clocks
- ..... 2.8      Memory Tests
- ..... 2.9      Memory Troubleshooting
- ..... 2.10     Serial Interface Troubleshooting
- ..... 2.11     CONTACT SERVICE in CMT display
- ..... 2.12     CCONT Serial interface Troubleshooting
- ..... 2.13     SIM Card
- ..... 2.14     Memory Card
- ..... 2.15     Lid Switch
- ..... 2.16     Battery Removal Switch troubleshooting
- ..... 2.17     COBBA Control Interface troubleshooting
- ..... 2.18     COBBA PCM Interface Troubleshooting
- ..... 2.19     Audio troubleshooting
- ..... 2.20     RF Interface
- ..... 2.21     IR Interface Troubleshooting diagram
- ..... 2.22     KL8 related Keyboard problems
- ..... 2.23     KL8 related PDA UI problems
- ..... 2.24     KL8 related CMT UI problems

3. DL1 UI Related:

- ..... 3.1      CMT and keypad illumination problems
- ..... 3.2      CMT LCD Troubleshooting
- ..... 3.3      No picture on PDA LCD or picture is faulty
- ..... 3.4      Backlight troubleshooting
- ..... 3.5      DL1 related keyboard problems



4. UL8 Flex Related:

- ..... 4.1 Audio troubleshooting
- ..... 4.2 Display problem
- ..... 4.3 Battery Removal Switch problem
- ..... 4.4 UL8 related keyboard problems

## Nominal Current Consumption

The following power consumption values (ref. Table 1 ) are measured from a complete RAE-3NU\*.

Vbattery = 3.7 V.

Measured nominal currents are drawn from the main battery.

Measurements have been made with a current probe connected to an oscilloscope.

**Table 1. Nominal current consumption in different operating modes**

State	CMT OFF	CMT ON	2W Call (TX5)	0.2W Call (TX19)
Lid closed	2.4 mA	5.6 mA	310 mA (Voice call)	120 mA (Voice call)
Lid Open (min. brightness on PDA display)	60 mA (running)	65 mA (running)	365 mA (HF call)	170 mA (HF call)
Lid Open (max. brightness on PDA display)	140 mA (running)	145 mA (running)	445 mA (HF call)	255 mA (HF call)

Identify the failed module (UL8, DL1, KL8) using the MJS-19 jig.

# 1 System HW / UI Troubleshooting Cases

## 1.1 Dead Device

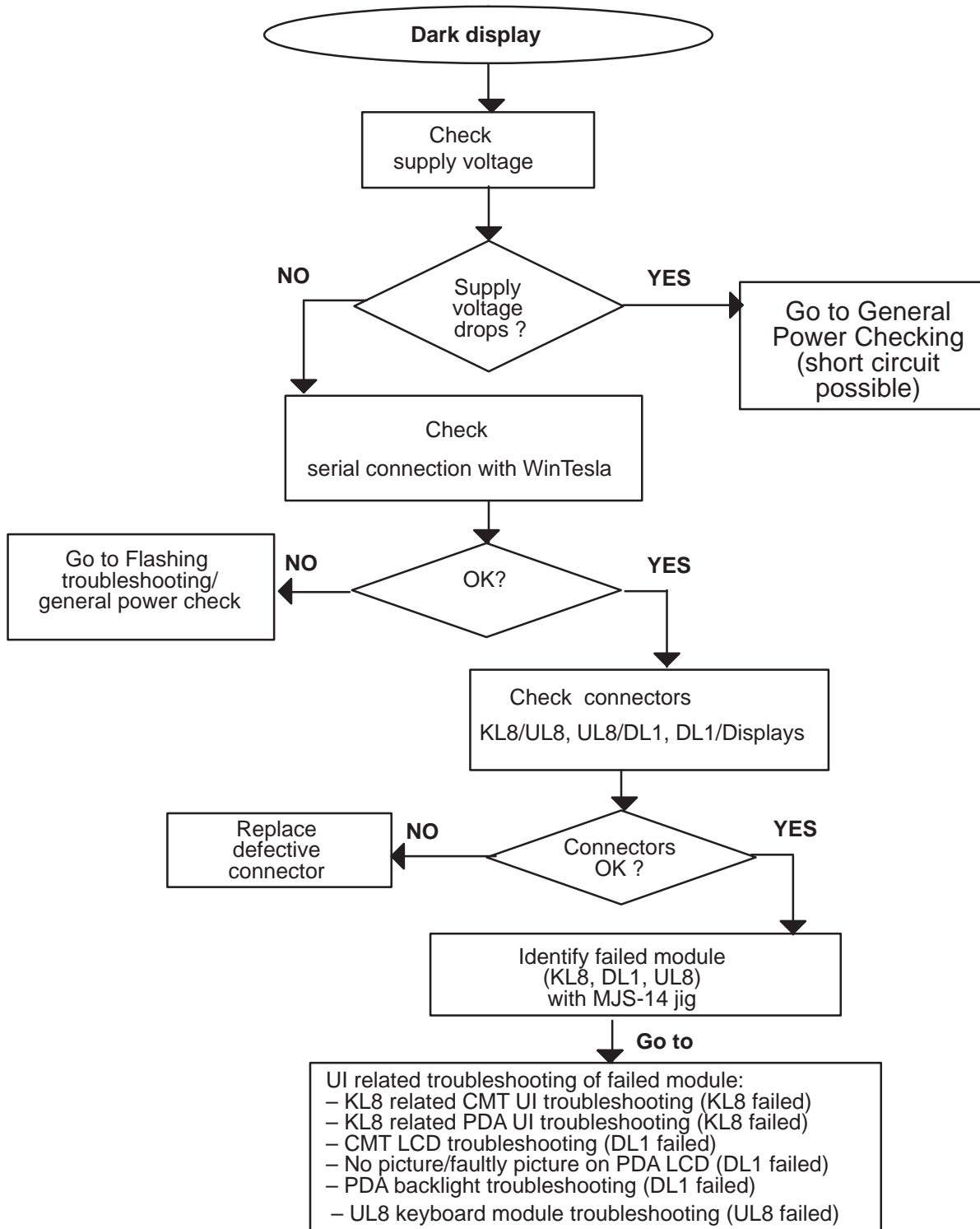


Figure 1.

## 1.2 Keypad problems

1. Connect the phone under test to Wintesa.
2. Select Testing → User interface testing
3. Select the CMT to be tested from the "Display" panel and click "Start key test" (figure 1). The test starts and the button text changes to "Stop key test".
4. Click the "Stop key test". Result window (Figure 2) appears.
  - ..... All letters under the key names should show "A".
  - ..... If there is "R", the key is stuck.
 Repeat the test. If the result is the same, use table 1 to find out the signals connected to the particular key(s).
5. Click "Start key test" again.
  - ..... This time, press and release all keys through, then stop the test.
  - ..... There should be "P" for every key.
  - ..... If "A" results are seen, repeat and press these keys again. If key presses are not registered, find out the signals connected to the key.
6. Change the keypad to be tested to PDA. Repeat test steps 4 and 5 for the PDA keyboard. The result window is shown in Figure 3.
7. Open the CMT side cover. Check the 50–way connector on UL2.
  - ..... Is it properly inserted, both parts of the connector properly soldered?
 Repair, retest
8. Check CMT key mat alignment and membrane switches on the mat. Replace key mat if broken.
9. Check 70–way connector on KL8.
  - ..... Is it properly inserted, both parts of the connector properly soldered?
 Repair, retest
10. Locate the faulty part by placing the parts into service jig and changing the parts one by one. Follow instructions in the proper section (2.23 for KL8 fault, 4.4 for UL8 flex fault, 3.5 for UL2 display module fault).

**Table 1. Keyboard matrix (keys on UL2 module highlighted) – English keymat**

	Col0	Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9
<b>Row0</b>	cmt Soft1	cmt Up	cmt Soft2	pda Soft 3	pda Soft 1			Space	Info <	/ >
<b>Row1</b>	cmt Send	cmt Down	cmt End	pda Soft 4	pda Soft 2		Z	Shift	C	B
<b>Row2</b>	cmt 1	cmt 2	cmt 3	cmt Profile	cmt Power		Chr	N	M	, @
<b>Row3</b>	cmt 4	cmt 5	cmt 6	cmt *	cmt #	Menu	Up	Right	Down	Left
<b>Row4</b>	cmt 7	cmt 8	cmt 9	cmt 0		::	+–	Back-space		Enter
<b>Row5</b>	ESC	App1	App2	App3	app4	App6	App7	App8		
<b>Row6</b>		Ctrl	V	X	6	App5				
<b>Row7</b>	1	2	3	4	5	7	8	9	0	P
<b>Row8</b>	Tab	Q	W	E	R	T	Y	U	I	O
<b>Row9</b>	Caps	A	S	D	F	G	H	J	K	L

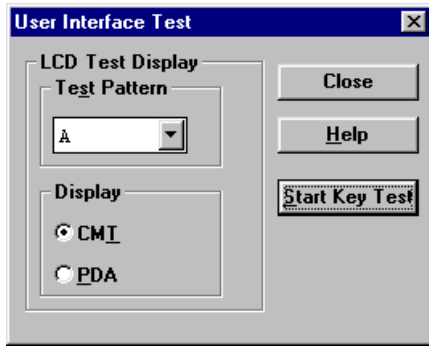


Figure 2. User interface test dialog

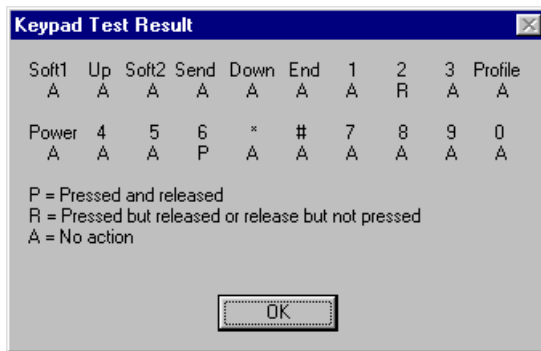


Figure 3. CMT keypad test results

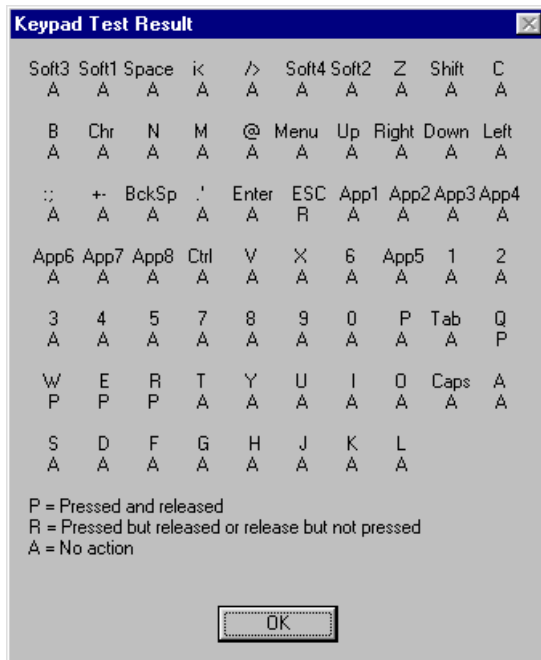
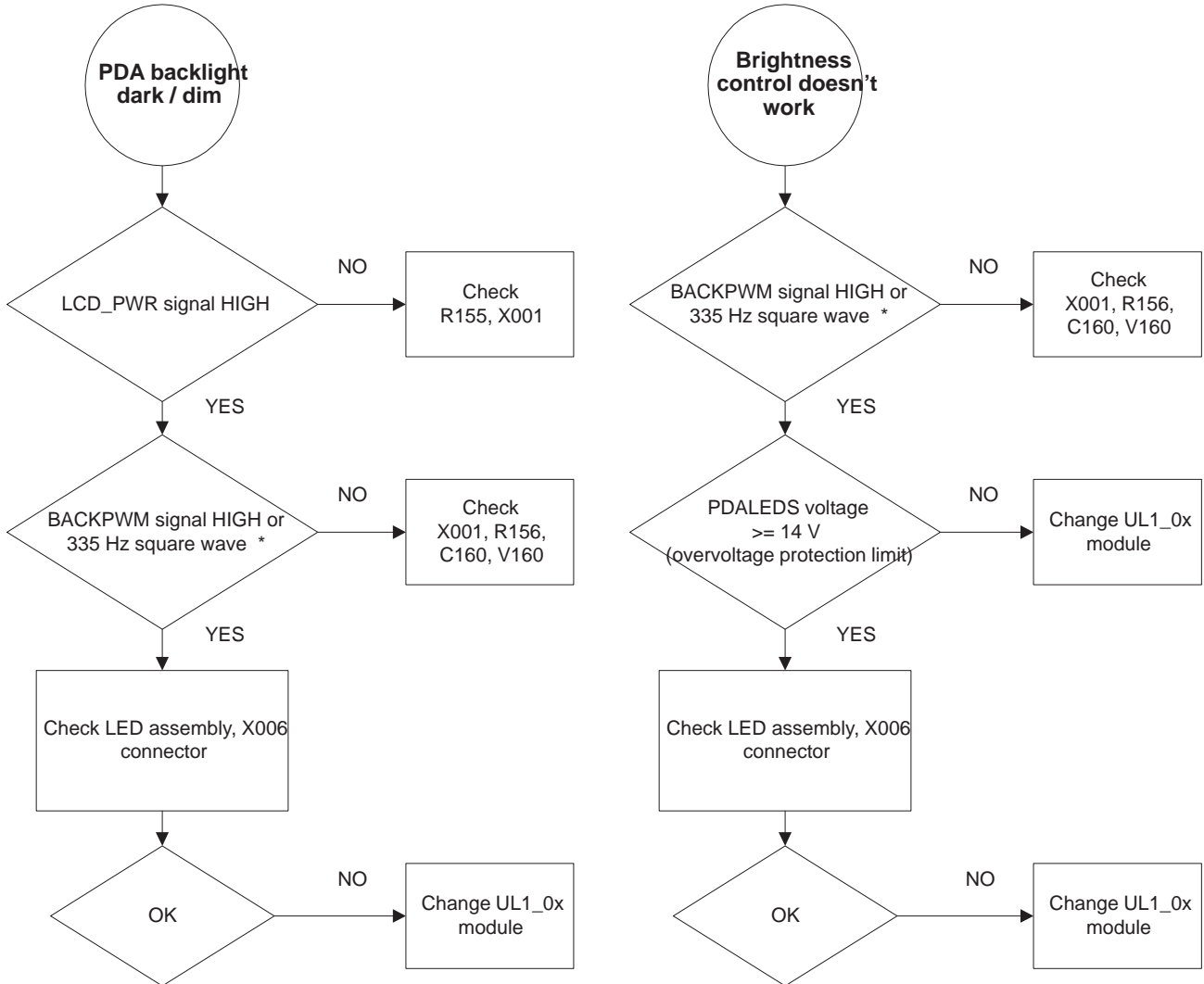


Figure 4. PDA keypad test results

### 1.3 PDA backlight problems

PDA LED backlight troubleshooting diagram for UL1\_0x module below.



\* Note! BACKPWM signal HIGH when maximum brightness level setting.

## 2 KL8 System HW related

### 2.1 Flash programming troubleshooting

#### 2.1.1 Flashing does not start

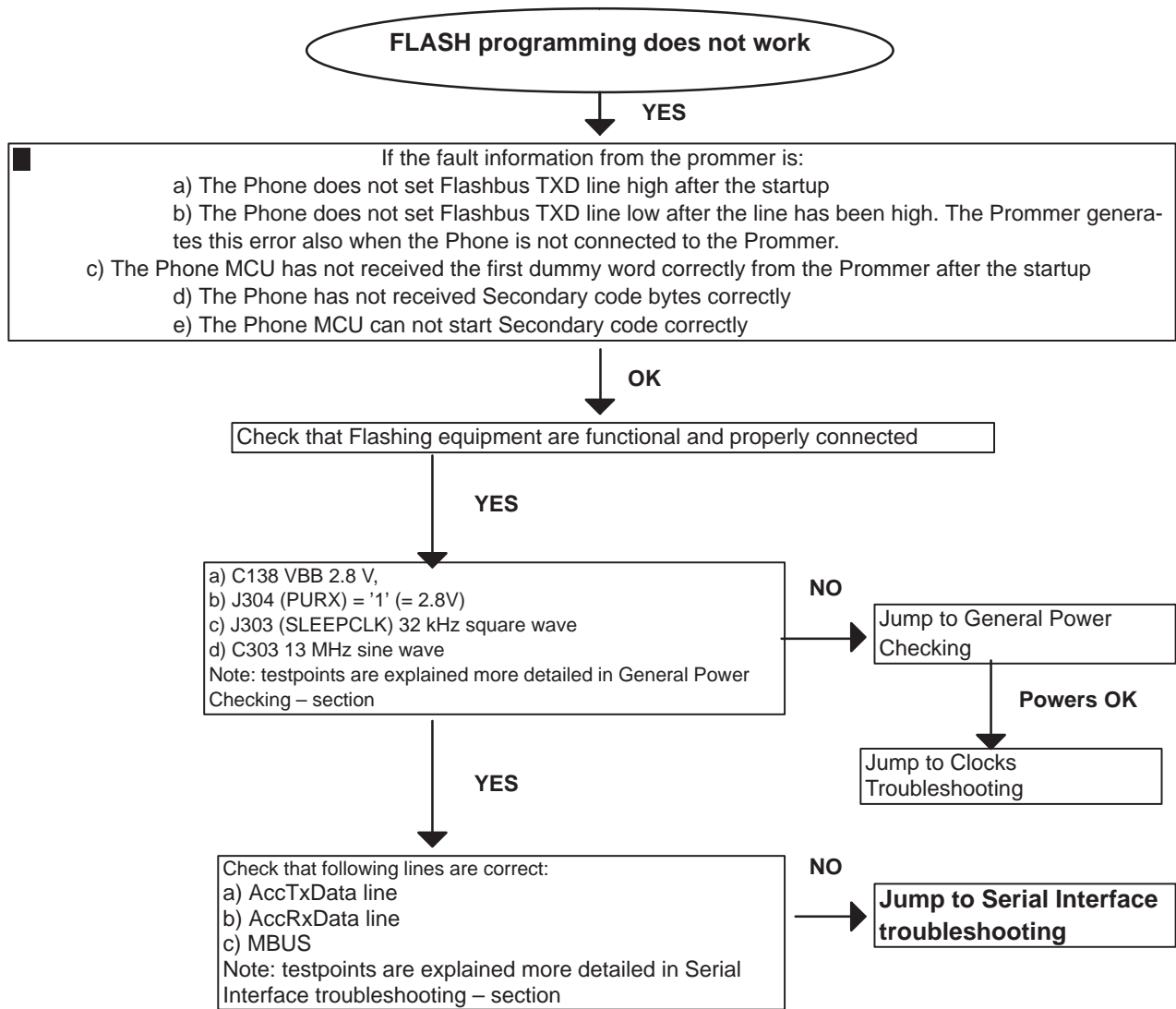


Figure 5.

2.1.2 Flash memory fault indicated

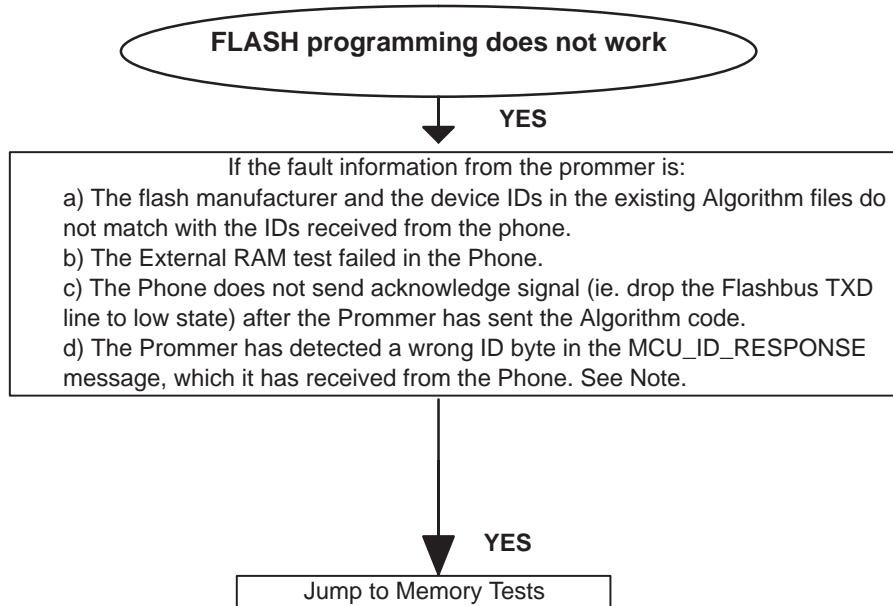


Figure 6.

Note: Wintesla shows the following Flash ID's for every flash device when programming is going on.

If Flash ID bytes are correct the following bytes are shown:

Flash ID 0089–8864,	0089–8864,	0000–0000	3030–0130
=Flash 0	=Flash 1	= No device	=Flash 2

Flash 2 ID bytes for MDOC 'MD2212–D16' are 3030–0130.

Flash 2 ID bytes for MDOC Plus 'MD3112–D16' are 4141–4141.  
(MDOC Plus replaces MDOC during 2002)

If one or more of Flash ID bytes is/wrong the Flash is faulty or there is short circuit in the flash interface.

2.1.3 Flash VPP Error

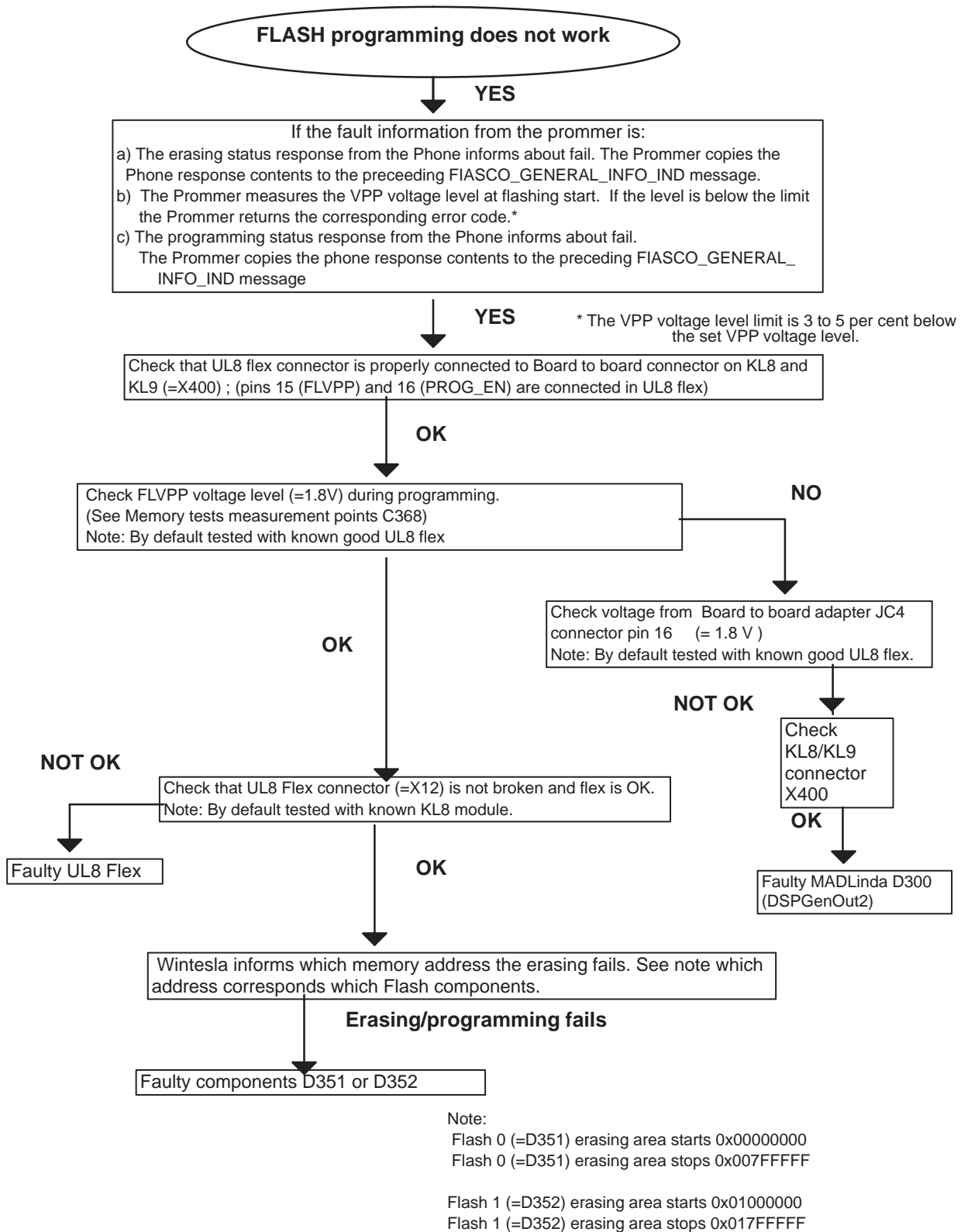
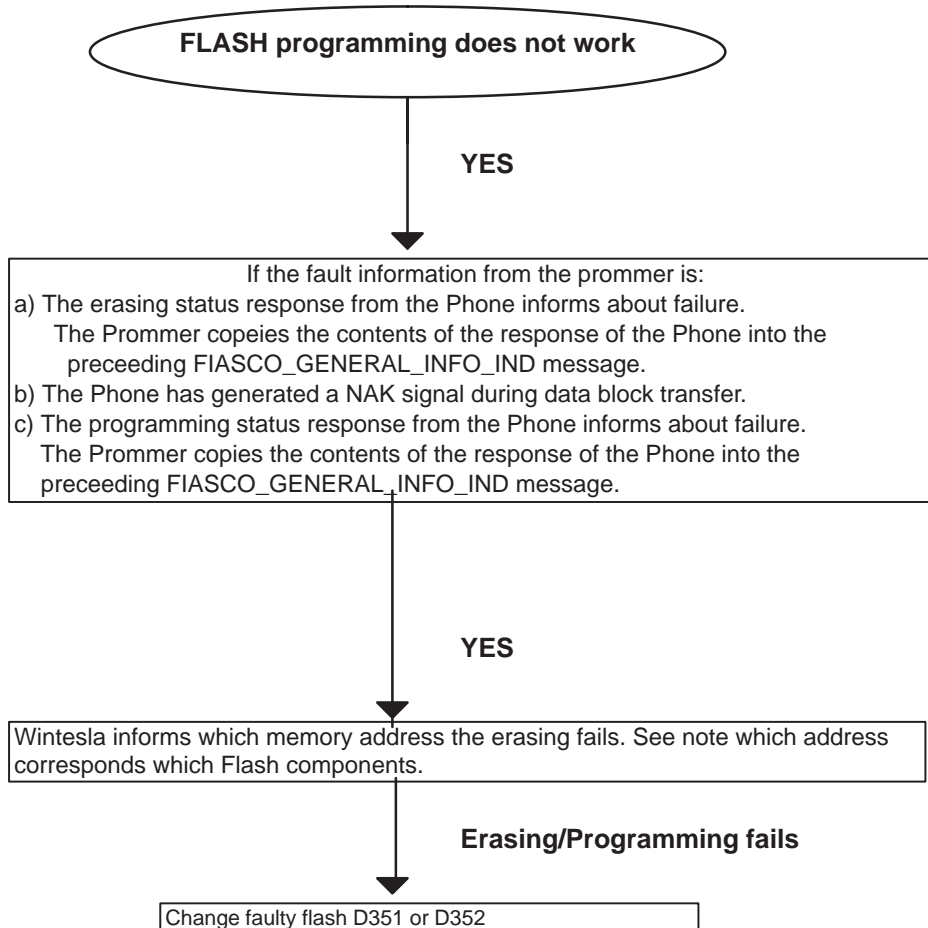


Figure 7.



2.1.4 Flash Erasing /Programming Error



Note:  
 Flash 0 (=D351) erasing area starts 0x00000000  
 Flash 0 (=D351) erasing area stops 0x007FFFFFFF  
  
 Flash 1 (=D352) erasing area starts 0x01000000  
 Flash 1 (=D352) erasing area stops 0x017FFFFFFF

Figure 8.

## 2.2 General Power Checking

Use BBL-3B service battery. Battery voltage must be 3.7 V.

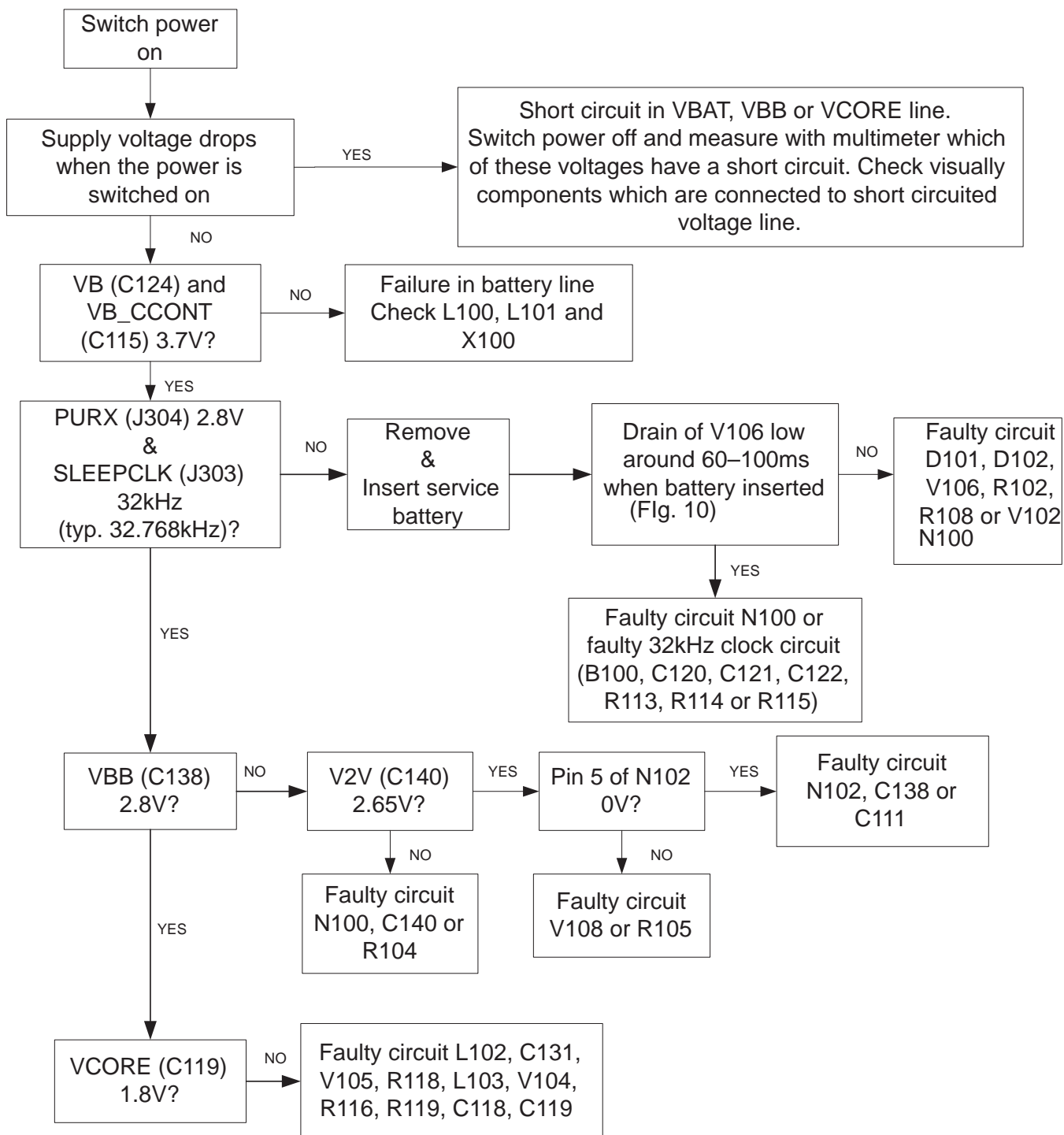


Figure 9.

Oscilloscope screen shot (Figure 10) .

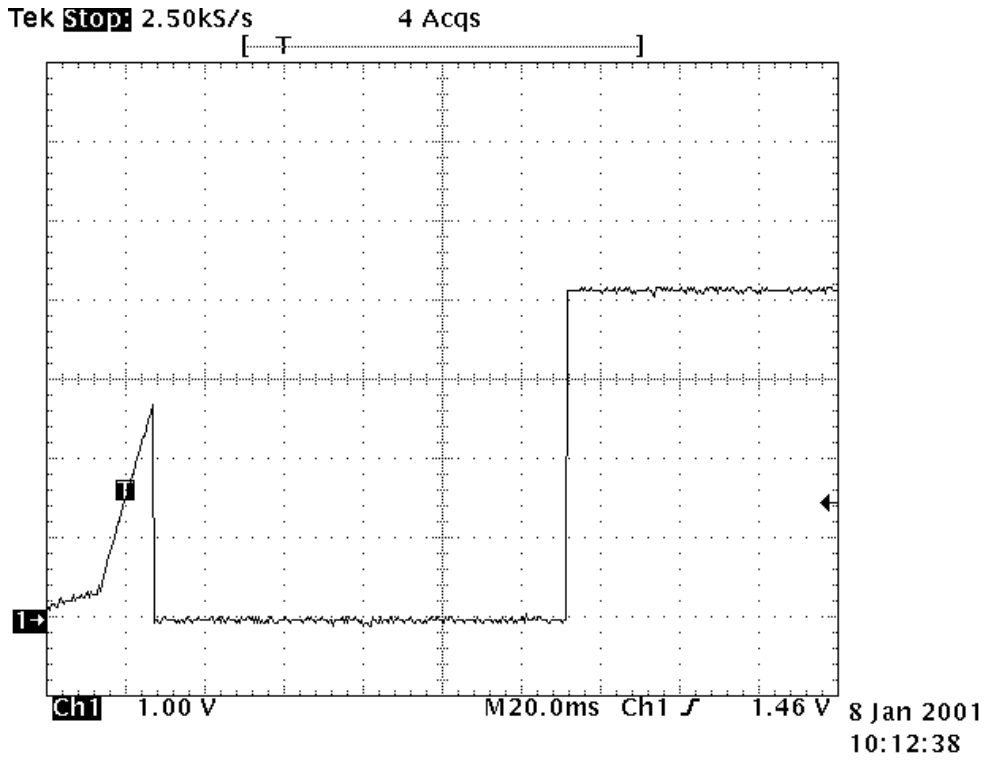


Figure 10. Drain of V106 when battery is inserted

## 2.3 Device does not stay ON

If the device is switched off without any visible reason, there may be problems in the following areas:

- CCONT watch dog problem
- BSI or BTEMP line problem
- Battery line problem
- Soldering problem

The most likely reason is CCONT WD (watchdog) problem, which turns the device off after about 32 s.

This may be caused by SW problem, MadLinda problem, CCONT problem or memory problems.

The following tests are recommended:

- General Power Checking
- Clocks
- Memory testing
- CCONT serial interface

If there is something wrong in BSI and BTEMP lines, the device seems to be dead after battery insertion. However, the regulators in the device are on 10s before the powerdown.

This mode can easily be detected from the current consumption of the device. After 10s the current consumption drops almost to 0mA.

In this case check components  
C126, C127  
R121, R122, R123,  
C103, C104,  
battery connector X100.

## 2.4 Charging checking

Use the BLL-3 battery and the JBE-2 calibration unit to test charging. When you are charging totally empty battery, remember that start-up charging might take 2 minutes with ACP-12 charger.

During this time display is blank. If charger is not NMP approved type and supported by phone then the software doesn't start charging and display 'NOT CHARGING'.

Remove and reconnect battery and charger few times before you start to measure module. This check ensures if module fault really exists.

See the diagram Figure 11 next page.

8. Troubleshooting

Technical Documentation

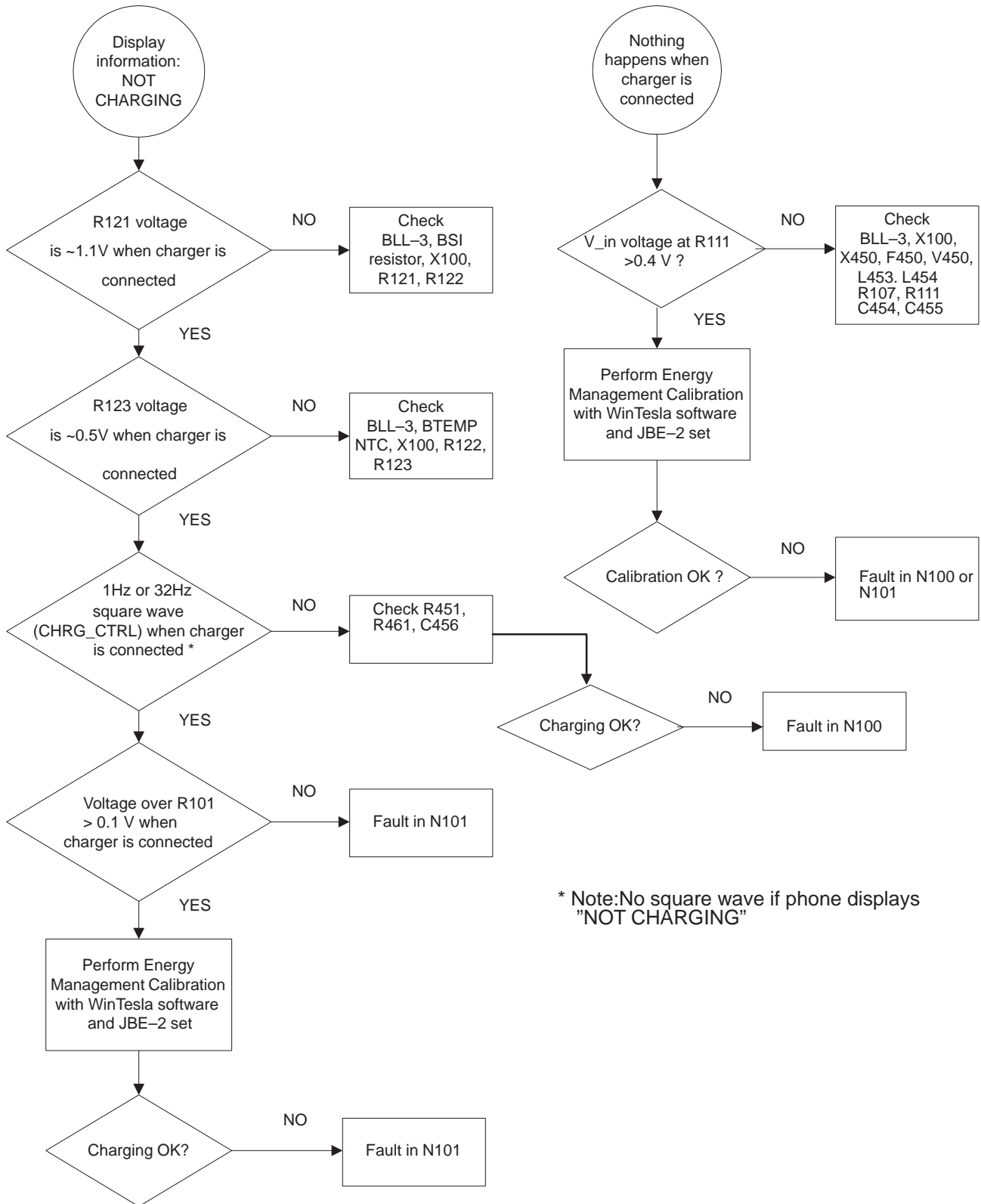


Figure 11.

## 2.5 Backup Battery

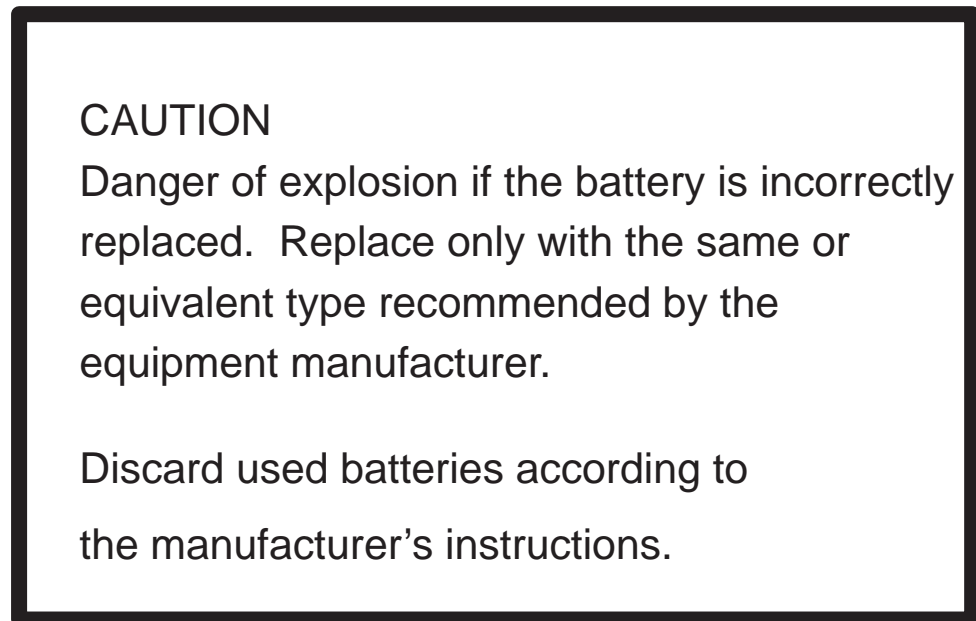


Figure 12.

### 2.5.1 Backup battery troubleshooting

Main power supply to the device must be 3.7 V when used.

Symptom of Backup battery fault is:

Real Time Clock loses the correct time when the main battery is not connected.

The same symptom can also be seen when the backup battery is empty. About one week is needed to fully charge the backup battery in the device.

Always check the backup battery visually for any leakage or any other visual defect.

Check that the backup battery is correctly mounted in the device before closing the cover.

KEEP IN MIND THAT THE BACKUP BATTERY DOES NOT TOLERATE EXCESS HEAT. WHENEVER HEAT BLOWER IS USED, FOR EXAMPLE TO REMOVE COMPONENTS, FIRST REMOVE THE BACKUP BATTERY AND PLACE IT TO ADEQUATE DISTANCE FROM THE WORKING LOCATION.

1. Remove the backup battery.
2. Measure the voltage of the backup battery:
  - Normal operation when the voltage is >1.8V.
  - Fully charged when voltage is about 3.1V.
3. Connect 3.7V power supply to the device.

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8. Troubleshooting

## Technical Documentation

4. Check the backup battery connector X102 visually.
5. Measure voltage at terminal 1 of X102.  
It must be 2.82 V to 3.3V.  
→ if NOT OK, then N101 is faulty.
6. Insert the backup battery in the connector, make sure that the contact is good.
7. Measure voltage at terminal 2 of X102.  
It must be 1.8 V to 3.3V. This voltage increases because of charging if the battery is not fully charged.
8. Read the backup battery with WinTesla.  
→ if not OK then N100 is faulty.
9. Ensure that the RTC running time is set to 10 hours setting.  
When the service battery BBL-3B is used, this is set automatically. (See General Guidelines)



## 2.6 Accessory Power Output Troubleshooting

Accessory power output is connected to the system connector’s DCE\_DTR pin inside the device. Accessory power output can be tested with MJS–14 test jig and Wintesla SW. There is a pushbutton called ACC VOLTAGE in MJS–14 test jig which is used to connecting load to DCE\_DTR pin of the system connector. Following Figure 13 shows the connection in MJS–14 test jig (load side).

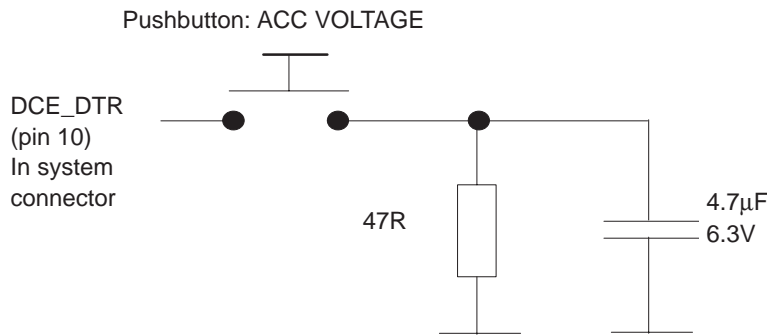


Figure 13. ACC VOLTAGE test configuration in MJS–14 test jig

Figure 13 describes the ACC VOLTAGE test configuration in the MJS–14 test jig. Status of the DTR signal in MADLinda is read by Wintesla SW. Test sequence in use is roughly shown in the following Figure 14:

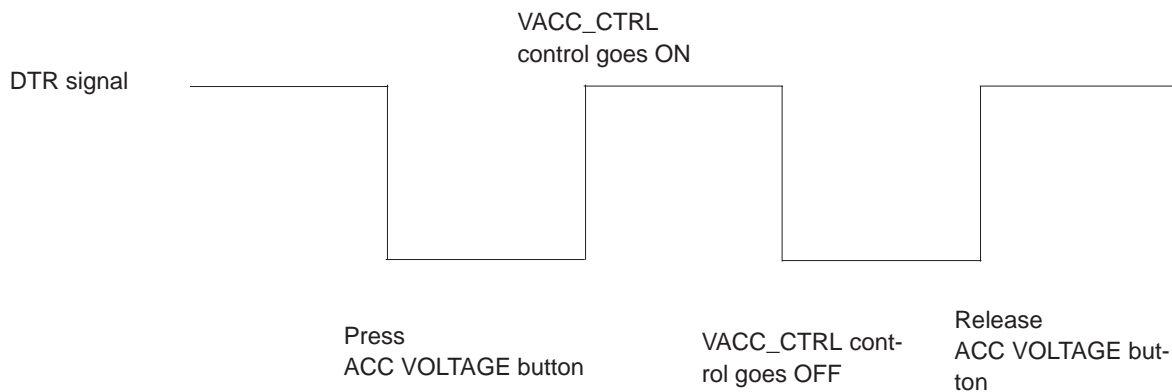


Figure 14. Test sequence

Figure 14 describes the test sequence and status of DTR line during Accessory Power Output Testing . Accessory output voltage test in Wintesla asks the test person to press ACC VOLTAGE button and keep it pressed. After that SW automatically turns ON and OFF the accessory output voltage and gives the passed/fail information. Wintesla SW gives guidance during this test.

**2.6.1 No Accessory Voltage when needed**

- Power supply must be 3.7V.
- MJS-14 Test Jig must be used.
- Signals must be measured during Wintesla Accessory Power Output Test .

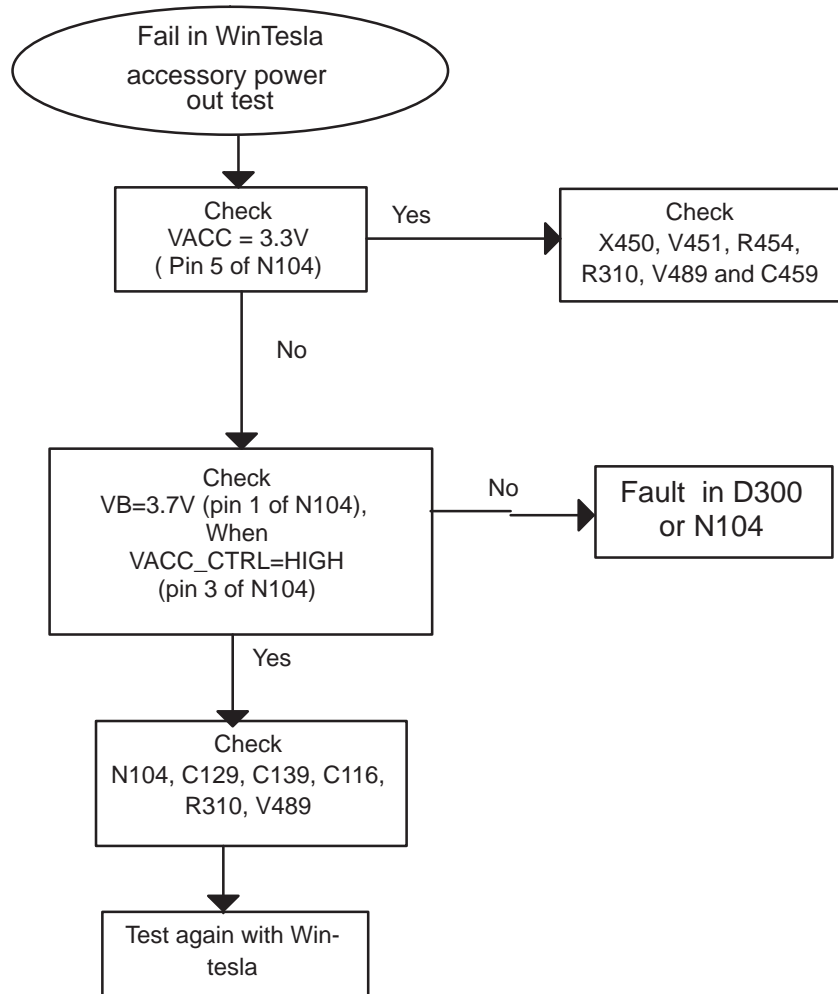


Figure 15.

### 2.6.2 Accessory Voltage ON all the time

- Power supply must be 3.7V.
- MJS-14 Test Jig must be used.
- This fault can be seen also as serial interface problem.
- Signals must be measured during Wintessa Accessory Power Output Test.

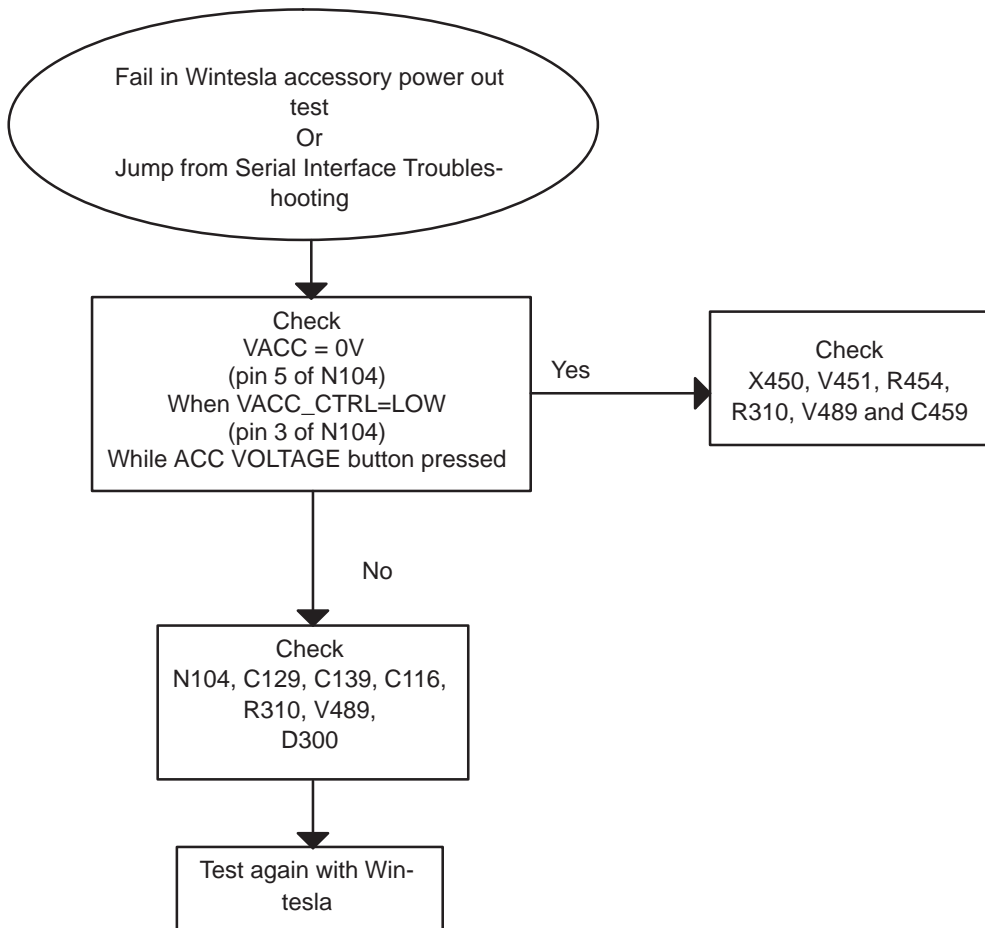


Figure 16.

## 2.7 Clocks

### 2.7.1 Clocks Troubleshooting

When the flashing of the device does not succeed, but the powering is OK, follow these instructions.

Note: The absence of clocks may indicate that the device is in sleep mode. Move the magnet away from the sensor to simulate cover open situation.

**IMPORTANT:** Clock signals must be measured with 1M $\Omega$  (or greater) probe! New Tektronix P6249 probes (20k $\Omega$  impedance) and similar cannot be used!

1 Measure RFC signal at C303. It should show 13.000 MHz sine wave, approximately 1.2Vp-p with about 950mV DC-offset (see Figure 17). Check the C303 capacitor.

- If this is OK, the processor gets the clock signal. The processor may be faulty, or the fault is in the memories. Continue to "Memories" section.
- If there is the clock signal, but there is no DC-offset (signal low level around 0V), check the probe used so that it is not loading the signal. If the probe is not responsible for missing DC-offset, try cycling the power a couple of times. If this does not help, the clock slicer circuitry in the MADLinda (D300) is faulty.
- If there is no clock signal at all, continue at 2.

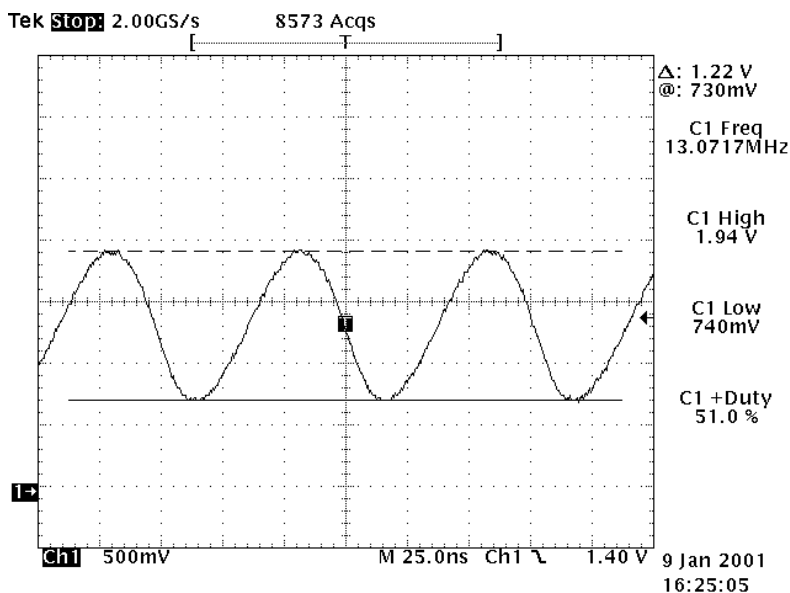


Figure 17. Clock signal

2. Check VXO power line at C553. It should be around 2.8V. If it is, move to 4.
3. Check VCXOPwr (J302). It should be around 2.8V.
  - If it is 2.8V, CCONT (N100) is faulty.
  - If VCXOPwr is 0V, MADLinda (D300) has shut down the regulators (sleep) or it is faulty. Cycle the power and re-check.

1. Open the smaller RF shield metal can. Check Hagar RFC-out signal at V800. It should show sine wave of 1.2V amplitude, 13MHz frequency (see Figure 18 ).
  - If this is OK, the problem is in V800 transistor or in R834, R830, C834, L800.

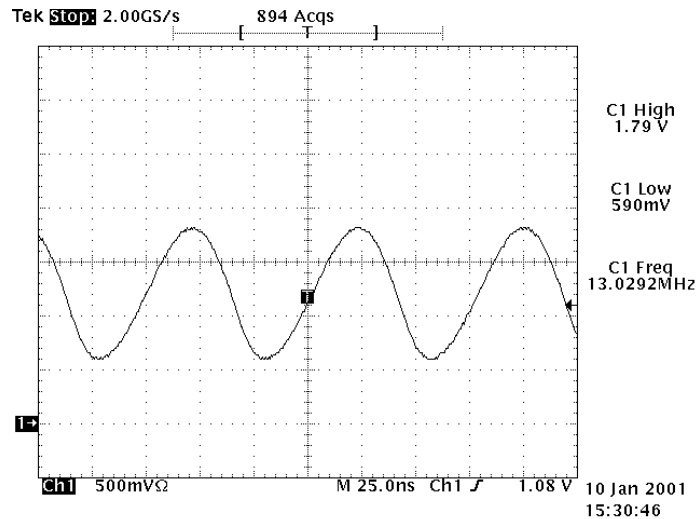


Figure 18. 13 MHz sine wave

2. Check VTCXO output at R833. This should be 26MHz sine wave (see Figure 19 ).
  - If this is OK, Check R835, C830 for shorts and bad connections. If they are OK, Hagar (N505) or C800 or R829 is faulty.
  - If this is not OK, R835, C830, R833 may be faulty. If they are OK, check VTCXO (G830).

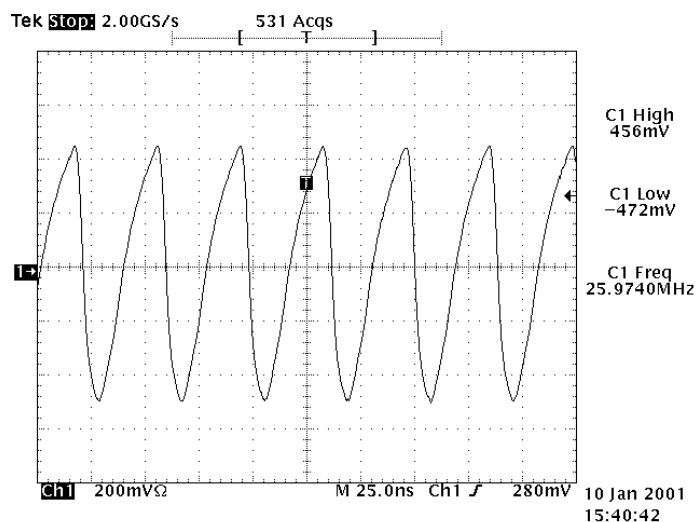


Figure 19. 26 MHz sine wave

## 2.8 KL8/KL9 Memory Tests

### 2.8.1 Test in boot up

#### FLASH 0 (D351) and 1 (D352):

- manufacturer and device id are read from each of the flashes then compared to value stored in FLASH 0.
- id read program code is executed from API RAM
- If FLASH 0 is broken the phone will not boot up properly (user test code resides in FLASH 0) i.e. probably not even blink CMT backlights.
- If one or more flash manufacturer and device id read fail CMT display backlights will blink 2 times in a loop.

#### SDRAM (D350):

- Data bus test:
  - Test will detect if lines are stuck at high or low state
  - Test will detect any bridging faults
- Address bus test:
  - data is written to certain addresses and read back and verified
- tested lines: address bus, data bus, SDRRASX, SDRCASX, SDRWEX and SDRCLK
  
- SDRDQMU, SDRDQML and SDRCKE functionality is tested only partly
- If either of these tests fail CMT display backlights will blink 3 times in a loop

#### Mobile DiskOnChip (MD2212–D16) or Mobile DiskOnChip Plus (MD3112–D16) (D353):

- Id is read and id bits are compared to values 0x30h (for MDOC) and 0x41h (for MDOC Plus)
- If the test fails CMT display backlights will blink 5 times in a loop
- tested lines: FLAd[13:1], FLDa[7:0] and FLCSX2
- Data is written to certain addresses, read back and verified

### 2.8.2 Test in PTS/WinTesla flashing

These tests are in the beginning of device flashing. If any of these tests fail the flashing will be stopped and a notification will be shown on the monitor screen.

#### **SDRAM (D350):**

- data is written to certain addresses, read back and compared

#### **FLASH 0 (D351) and 1 (D352):**

- device and manufacturer ids are read from each of the flashes and then the values are compared (same test as in boot up)

#### **DiskOnChip (D353):**

- device id is read and the value is compared

## 2.9 Memory Troubleshooting

### 2.9.1 Memory fails In Boot Up tests, CMT Backlight is blinking

If the device won't boot up and CMT display backlight is blinking

⇒ FLASH 0 (D351) probably ok !

To measure signals from D352, D353 and D350 the device needs to be booted up constantly since the lines are active only a short time in the beginning of the boot. Also CCONT WATCHDOG will shut the device off after 32 seconds !

The interval between each memory device blinks is 1 second and the interval between different memory device blinks is 2 seconds.

For example if FLASH1 and DiskOnChip are broken the blinking sequence goes:

..... 2 blinks with 1 sec interval (FLASH fault)

..... 2 sec without blinks

..... 5 blinks with 1 sec intervals (DiskOnChip fault)

..... 2 sec without blinks

then to the beginning again.



### 2.9.2 CMT display backlight blinking 2 times in a loop

CMT display backlight blinking 2 times in a loop ("Flash fault"):

Manufacturer and device id read from FLASH 1 (D352) fails.

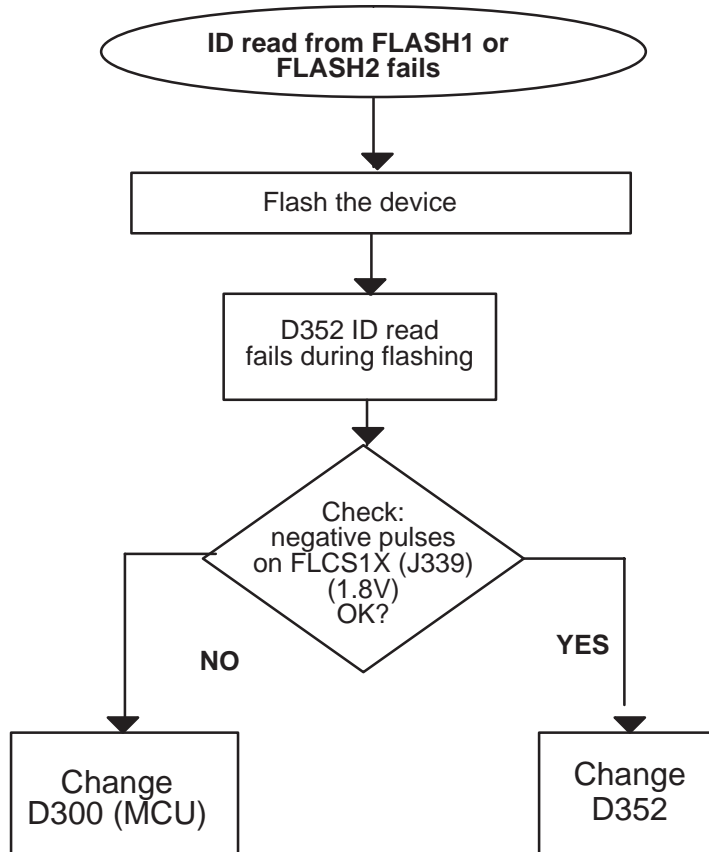


Figure 20.

Refer to FLASH signal diagrams in .

**2.9.3 CMT display backlight blinking 3 times in a loop**

CMT display backlight blinking 3 times in a loop ("SDRAM fault"):

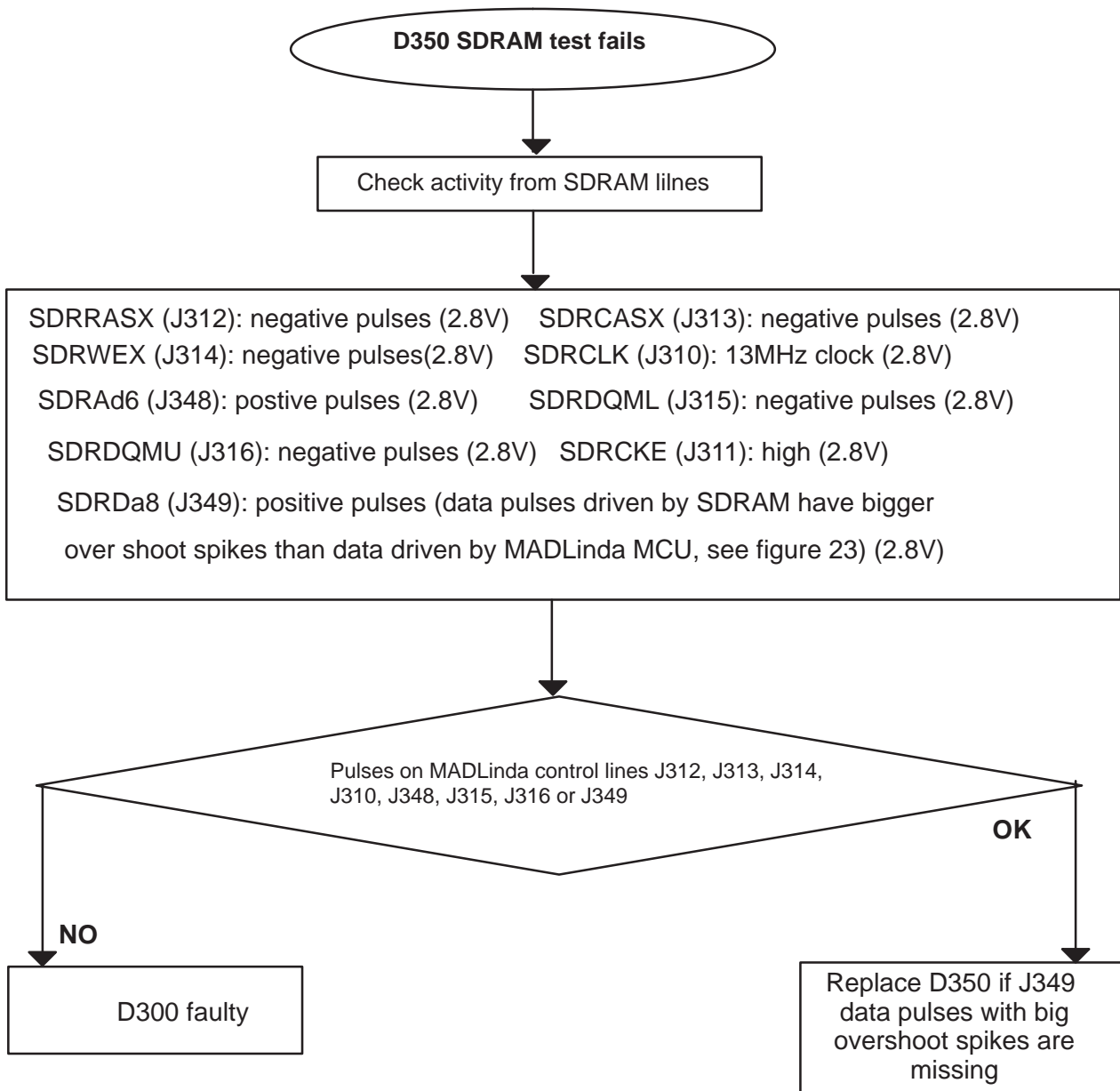


Figure 21.

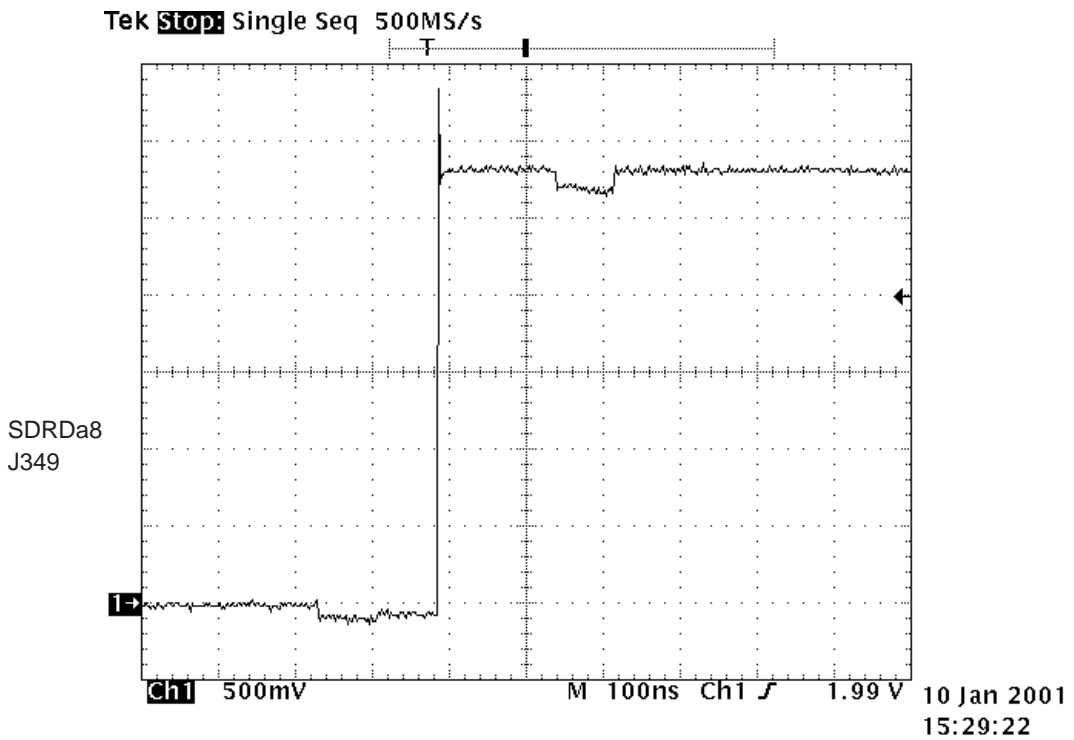


Figure 22. SDRAM (D350) driven data line SDRDa8 (J349)

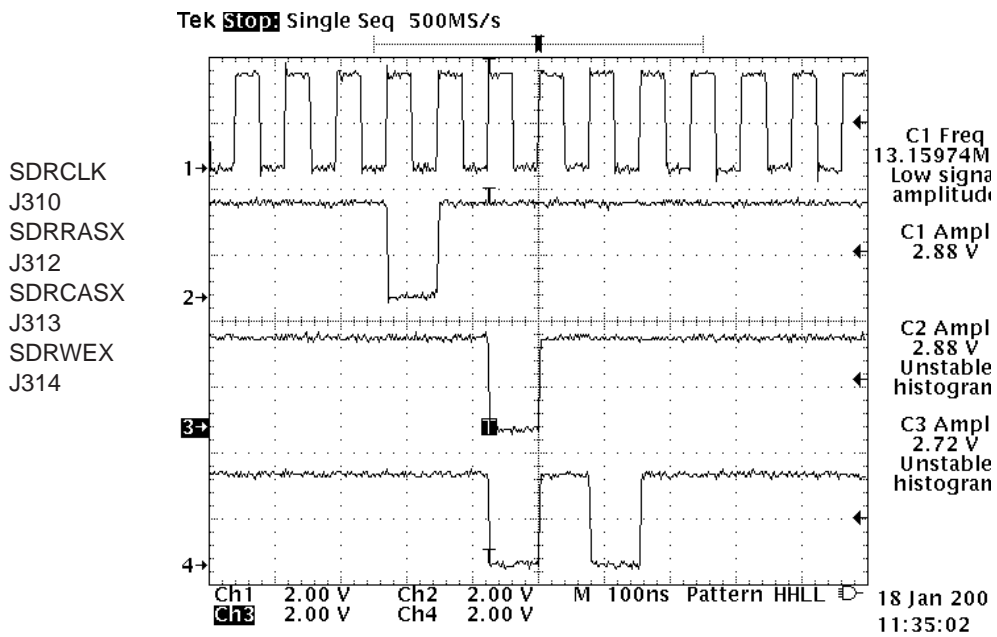


Figure 23. SDRAM signals and levels 1

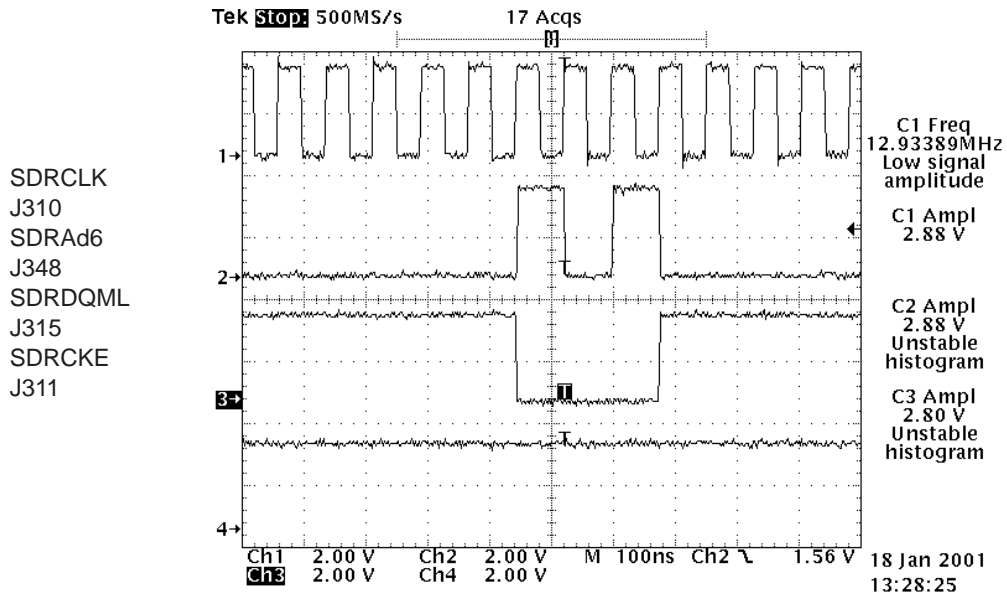


Figure 24. SDRAM signals and levels 2

**2.9.4 CMT display backlight blinking 5 times in a loop**

CMT display backlight blinking 5 times in a loop ("DiskOnChip fault"):

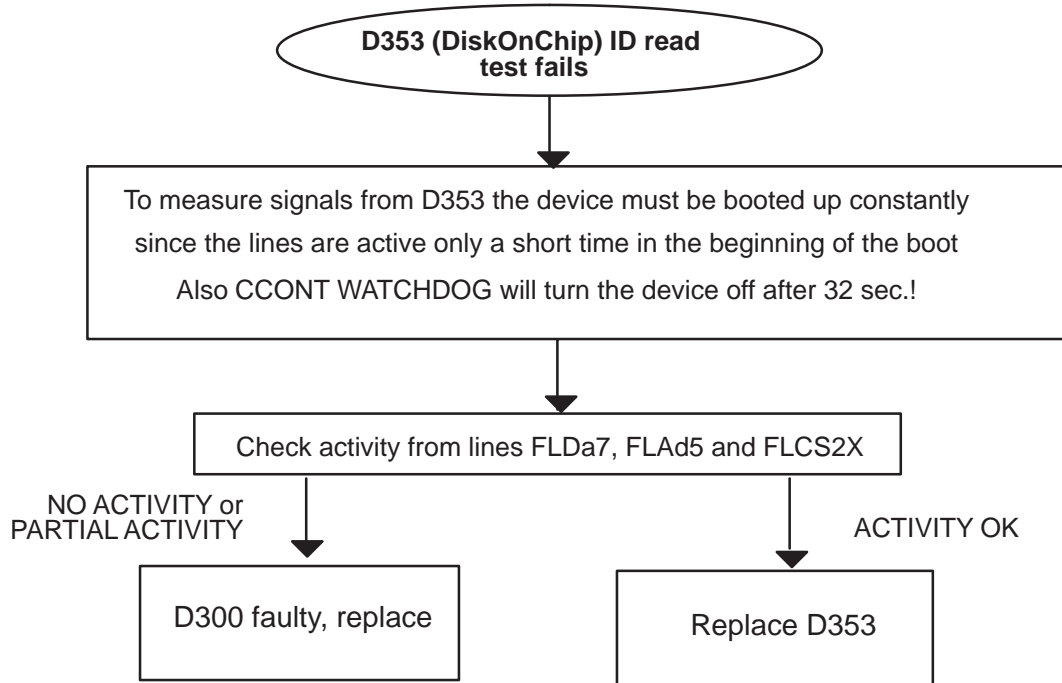


Figure 25.

## 2.9.5 Memory fails in PTS/WinTesla flashing

### 1. SDRAM id read test fails

Refer to the previous "SDRAM fault" chapter.

### 2. Flash manufacturer and device id read fails

a) If id read from all of the flashes (D351.and D352) fails most likely the problem is in D300.

Check D300 and control lines:

- ..... FLDa7 (J351): positive pulses (1.8V)
- ..... FLCS0X (J338): negative pulses (1.8V)
- ..... FLOEX (J341): negative pulses (1.8V)
- ..... FLCS1X (J339): negative pulses (1.8V)
- ..... FLWEX (J342): negative pulses (1.8V)
- ..... FLCS2X (J340): negative pulses (1.8V)
- ..... FLAd5 (J350): positive pulses (1.8V)
- ..... FLRPX (J343): high (1.8V)
- ..... FLWPX (J347): low (1.8V)

If any of the signals is missing replace the D300.

b) If id read from one or two flashes fails

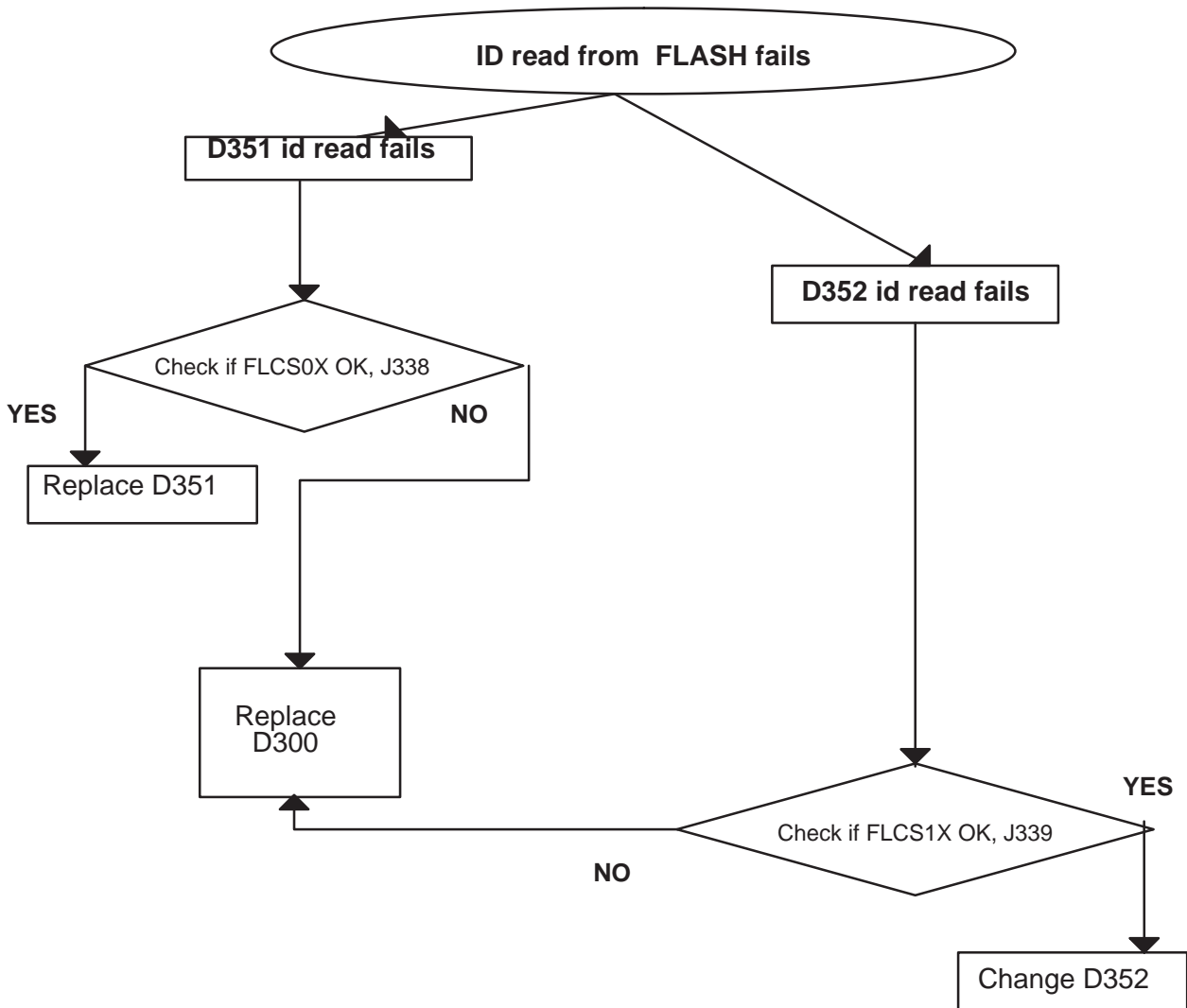


Figure 26.

Refer to the oscilloscope screen shots next page for what the signals should look like.

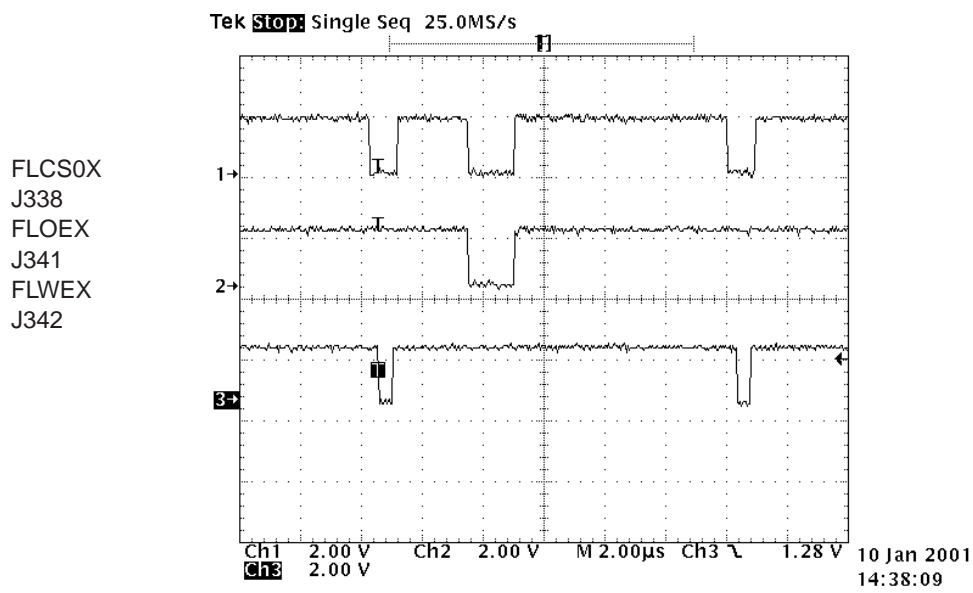


Figure 27. Flash 0 (D351) manufacturer and device id read

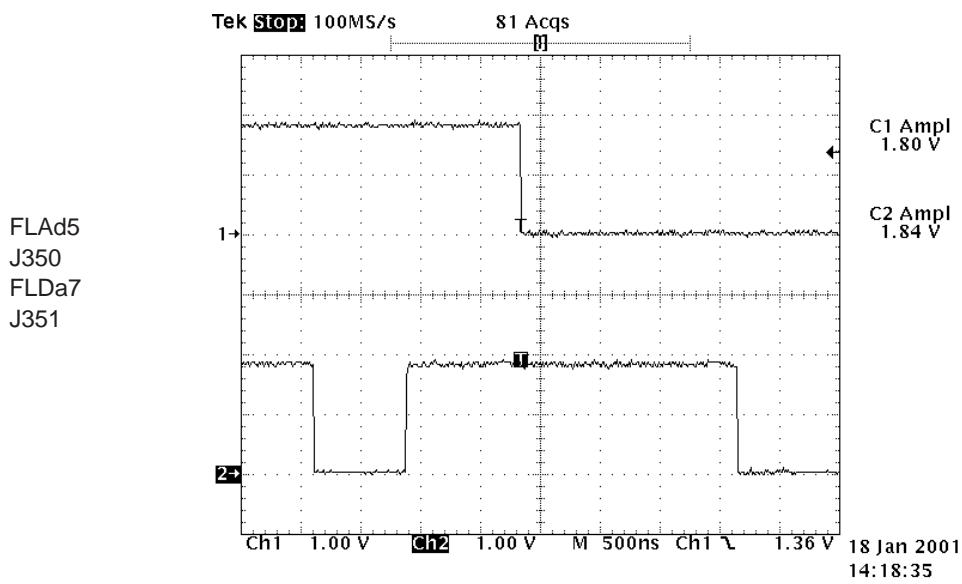


Figure 28. the Flash address and databus signals

### 2.9.6 DiskOnChip id read test fails

Refer to previous chapter "DiskOnChip fault" 2.9.4.



## 2.10 Serial Interface Troubleshooting

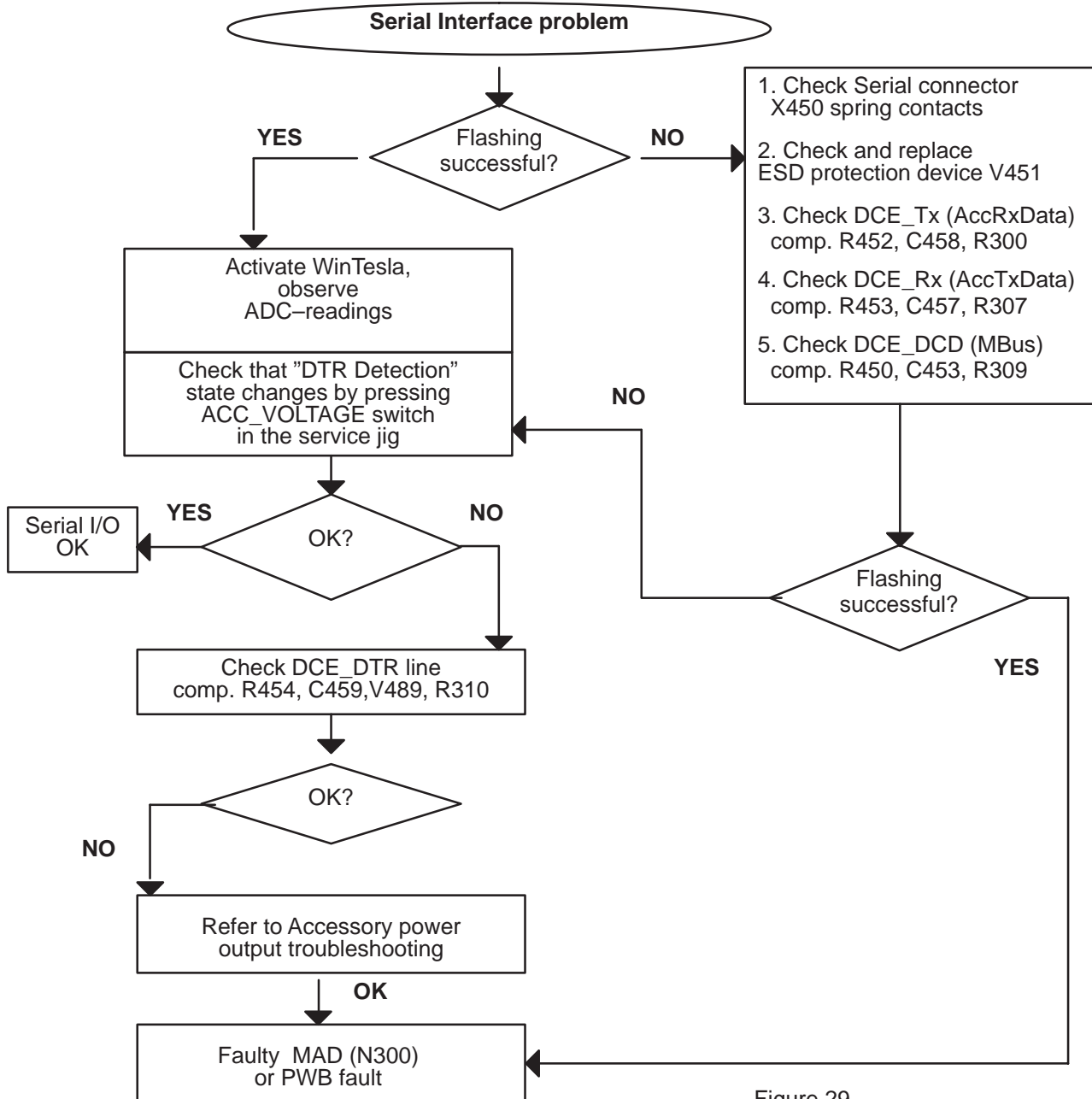


Figure 29.

NOTE1: Ensure that the customer's DLR-2L is OK.

NOTE2: Wintesla ADC-readings for 'DTR Detection': state "0" = DCE\_DTR – line at 2.8 – 3.0V

Wintesla ADC-readings for 'DTR Detection': state "1" = DCE\_DTR – line at 0 – 0.3V

NOTE3: Signal levels in practice: High  $\geq$  2.7V, Low  $\leq$  0.3V

Exception: Diode in DTR line causes voltage drop, see Figure 30 below:

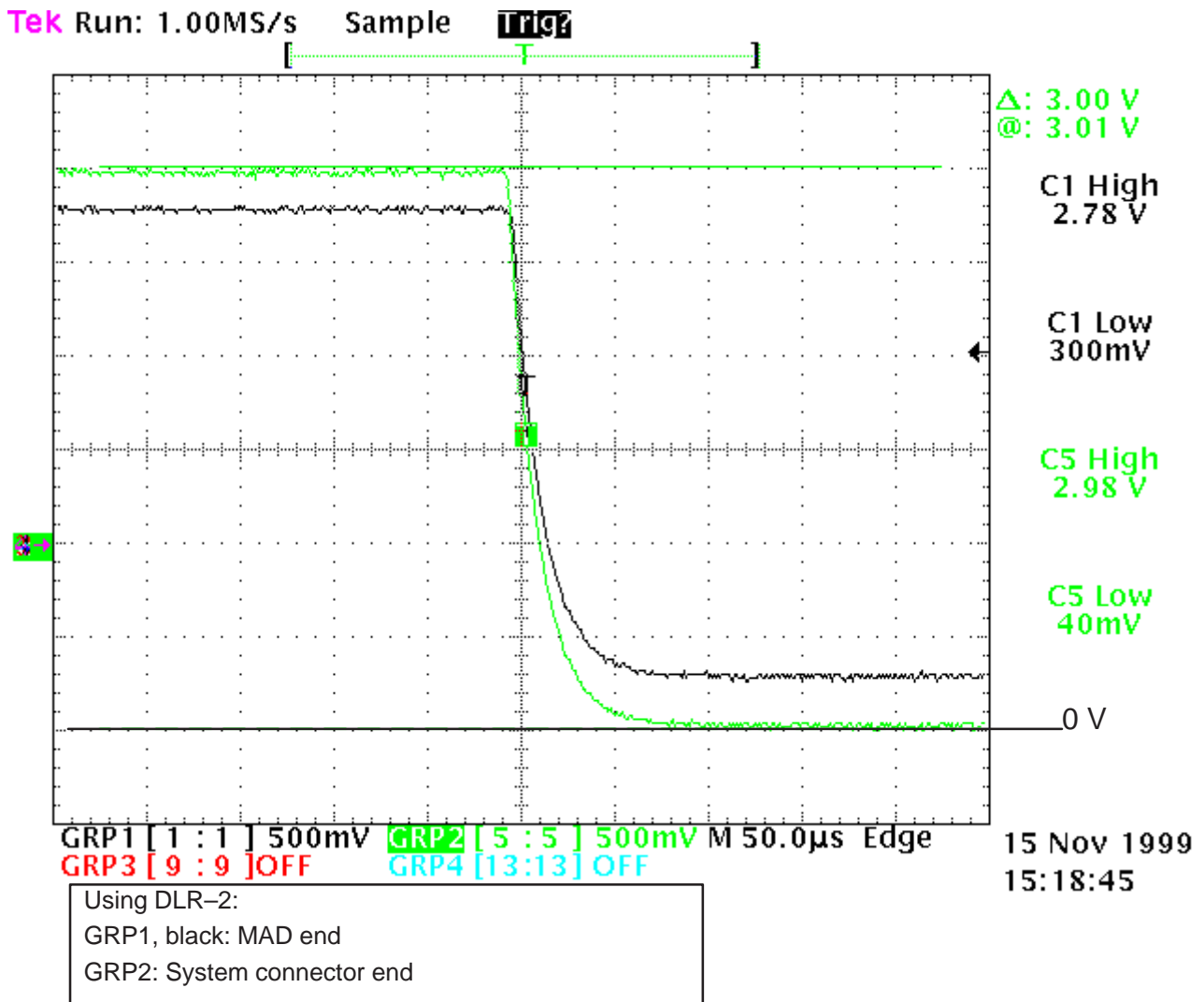
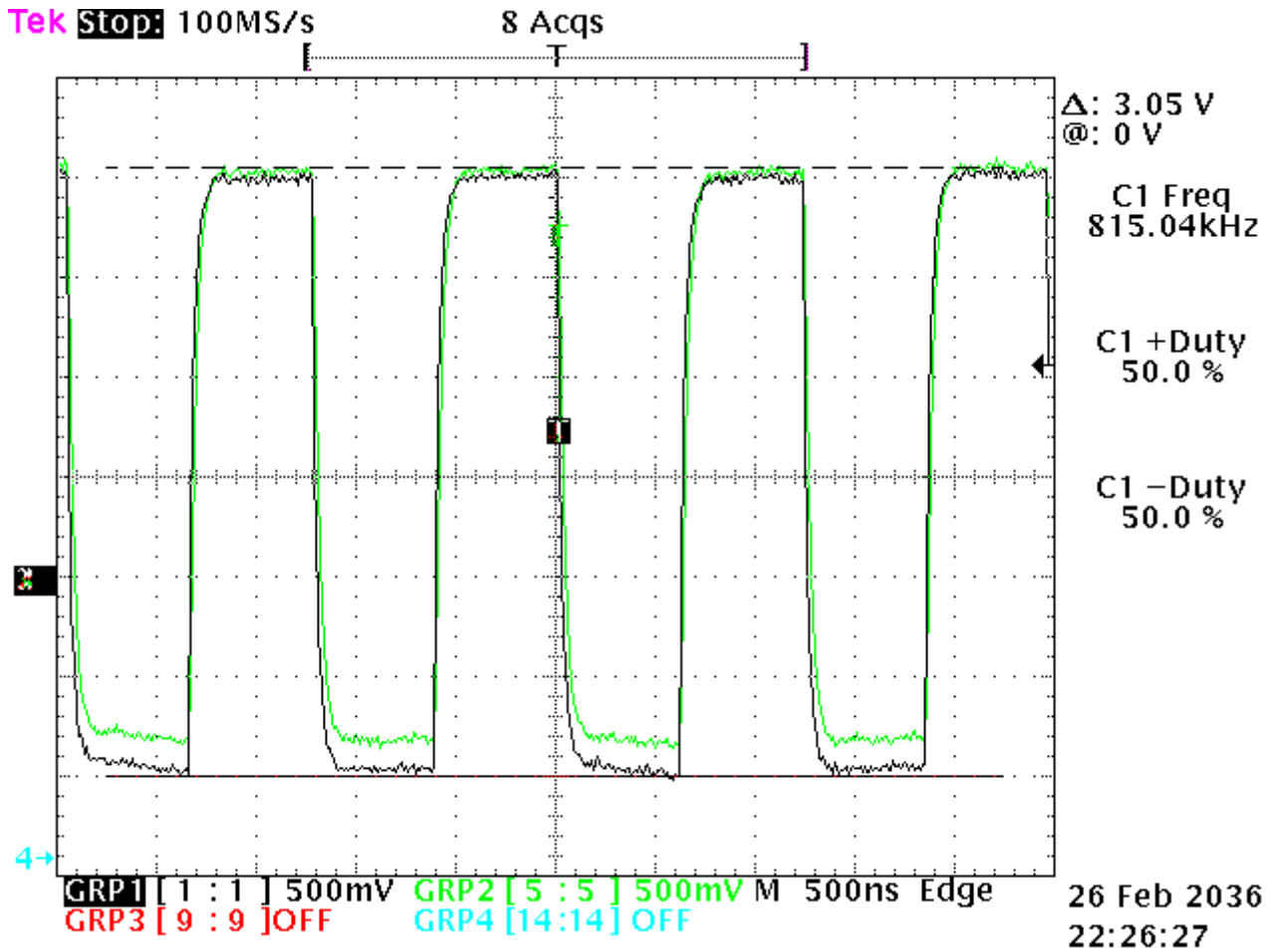


Figure 30. DTH line voltage

MBUS (clock) Signal during flashing (Figure 31):



GRP1, black: MAD-end  
GRP2: system connector end  
Approx. 0.2V difference results from MBUS pull-up resistor (R309, 4k7) & serial resistor (R450, 270R) voltage slicing.

Figure 31. MBUS (clock) Signal during flashing

## 2.11 CONTACT SERVICE in CMT display

CONTACT SERVICE in CMT display (Self-tests with WinTesla)

Display Information: **"Contact Service"**

This fault means that software is able to run and thus the watchdog of CCONT (N100) can be served. Self-test functions are executed when power is switched on and software is started to execute from flash.

If any one of the self-tests fails (except no. 3, 7, 8, and F), the text "Contact Service" is shown in the phone display.

MCU Self-tests are divided into those executed while power up (tests: 1–5 and 9–I ) and the ones can be executed with the connected PC. The tests and included items are as follows (Figure 32, screndump from the WinTesla)

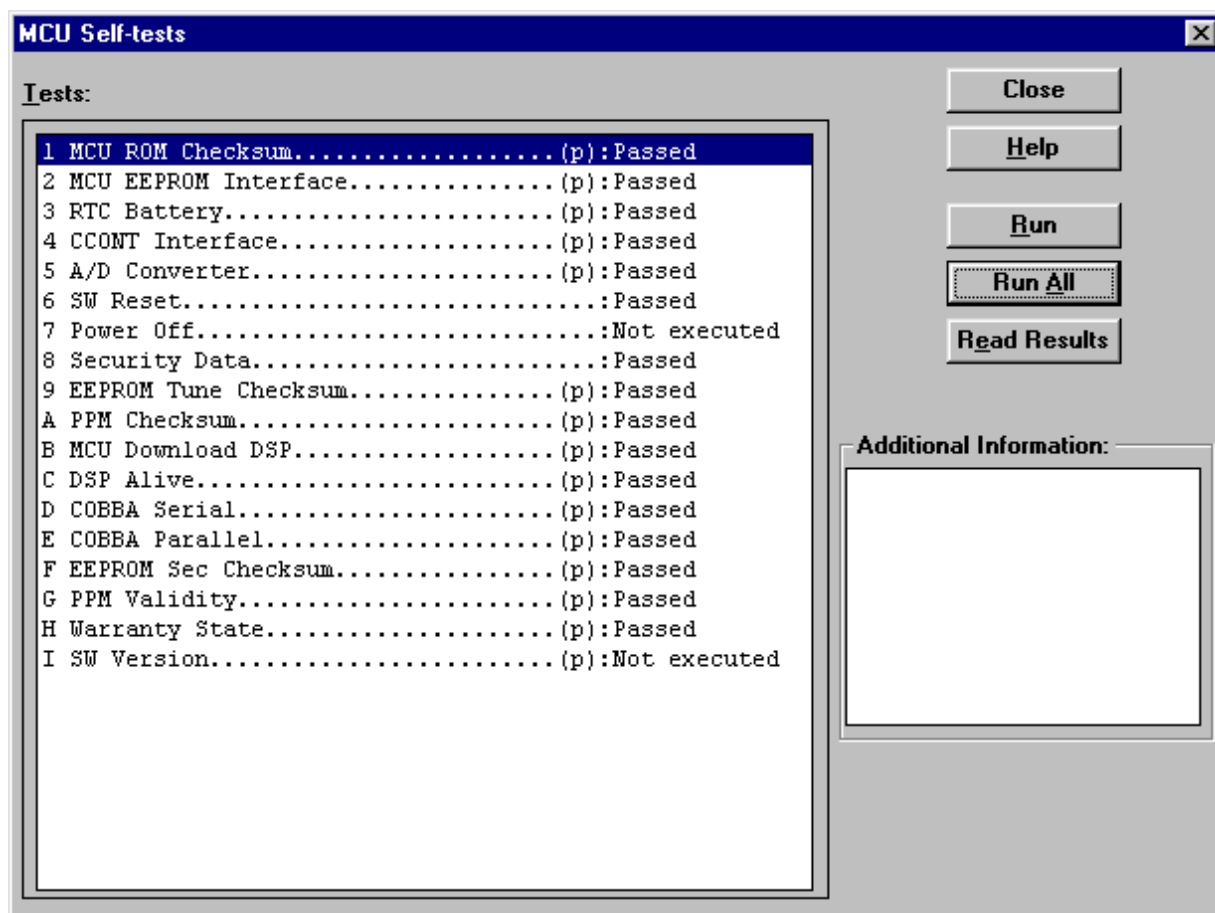


Figure 32. MCU self tests

The information can be used for diagnosis.

Memory tests differ from normal DCT3 self-tests. They can not be executed in the ENOS because memory protection.

There is no EEPROM. The EEPROM is emulated in the FLASH (part of CS1). All contents where EEPROM is mentioned refer to emulated EEPROM.

## Item no. 1; MCU ROM Checksum:

Calculates 16 bit checksum out of Flash code and compares it to the one found in Flash. Items being checked are MADLinda <-> Flash data- and address lines FLDa0-15 and FLAd1-21, FLCS0X (CE0), FLCS1X (CE1), FLCS2X (CE2), FLWEX (WE), Vbb (Vcc), VCORE (Vccq), GND, and Flash internal functionality.

## Item no. 2 MCU EEPROM Interface:

Checks current PMM error status. If this test FAILs, the PMM data is not valid anymore and should be formatted.

## Item no. D COBBA Serial

This test tests Audio interface (PCM) of the COBBA\_GJP.

## Item no. E COBBA Parallel

This test tests the serial control/RF interface of the COBBA\_GJP.

## 2.12 CCONT Serial interface Troubleshooting

If there are problems in CCONT's serial control interface, self tests fail and there is "Contact service" shown on the display. Wintesla shows this fail as "CCONT Interface".

NOTE: Low level means 0V, high level means approximately 2.8V.

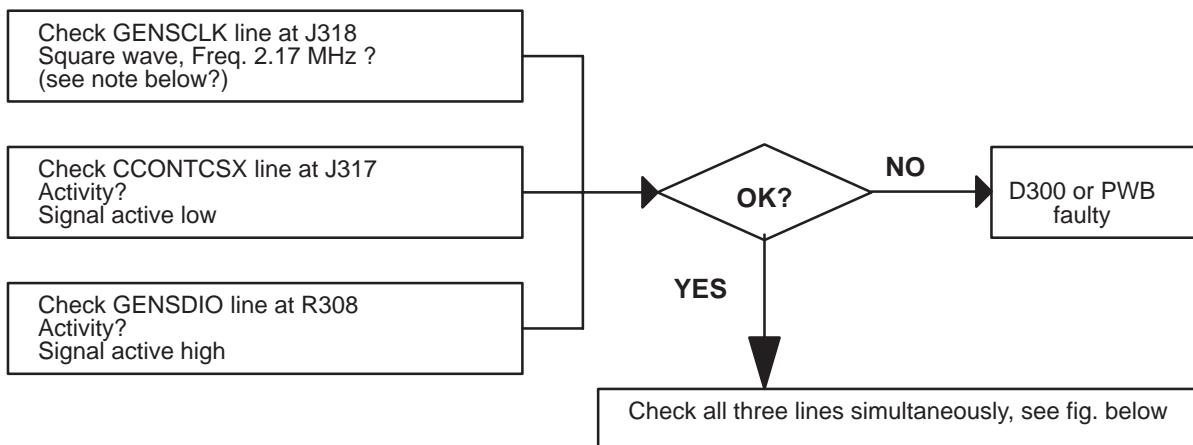


Figure 33.

(Note: Measurement should show 2.17MHz square wave. This interface is connected to CMT display also, so there is other activity too. The 3.1MHz clock is targeted for CMT display, do not worry about that. The clock signal is low when inactive.)

1. Measure all the three lines simultaneously (Figure 34).

Set the trigger to CCONTCSX line falling edge.

You should see the two cases, Figure 34 and Figure 35 .

(Channel 1–GENSCLK,  
Channel 2–CCONTCSX,  
Channel 3–GENSDIO). High level is about 2.8V

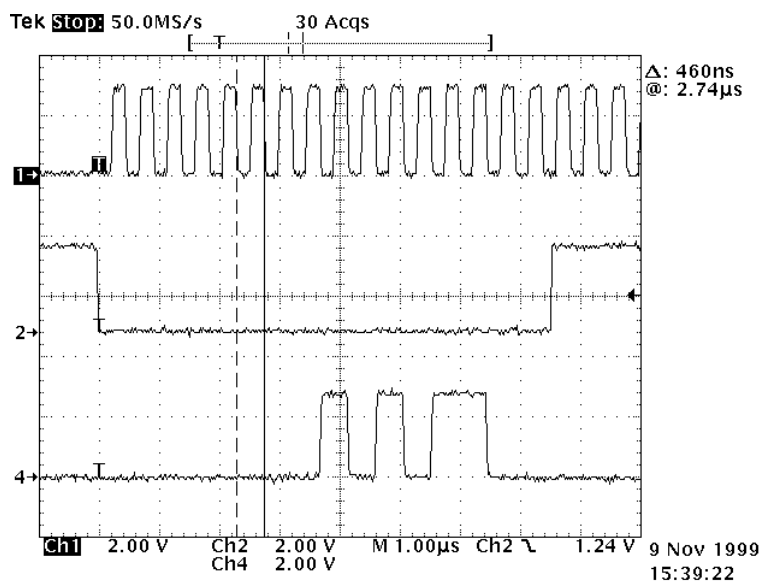


Figure 34.

MADLinda writes to CCONT. The data at sixth bit is '0' as marked with the cursors. The data after the read/write bit varies, just like the address before the bit. If you can see this kind of traffic, MADLinda side of the interface is functioning correctly.

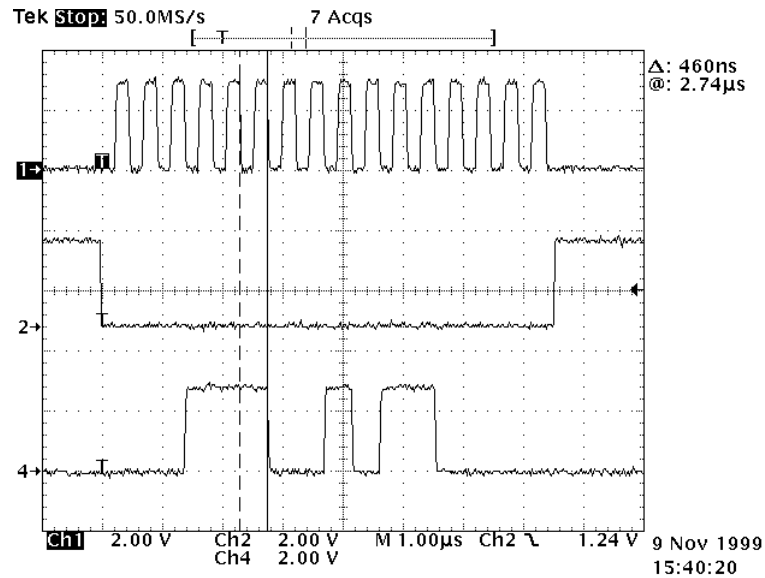


Figure 35.

MADLinda reads from CCONT. The data at sixth bit is '1', marked with the cursors. There should be data seen after the 'read' bit. All zero values may be read, but there should be other data seen, too. CCONT read cycles are fairly rare compared to write cycles. If there is not any non-zero reads from CCONT, the CCONT (N100) may be faulty.

## 2.13 SIM Card

### 2.13.1 SIM Card Error Troubleshooting

The fault information "SIM Card error" means most likely that the SIM locked phone has been inserted with a SIM which does not correspond to the lock code.

Check the SIM lock status of the phone with WinTesla:

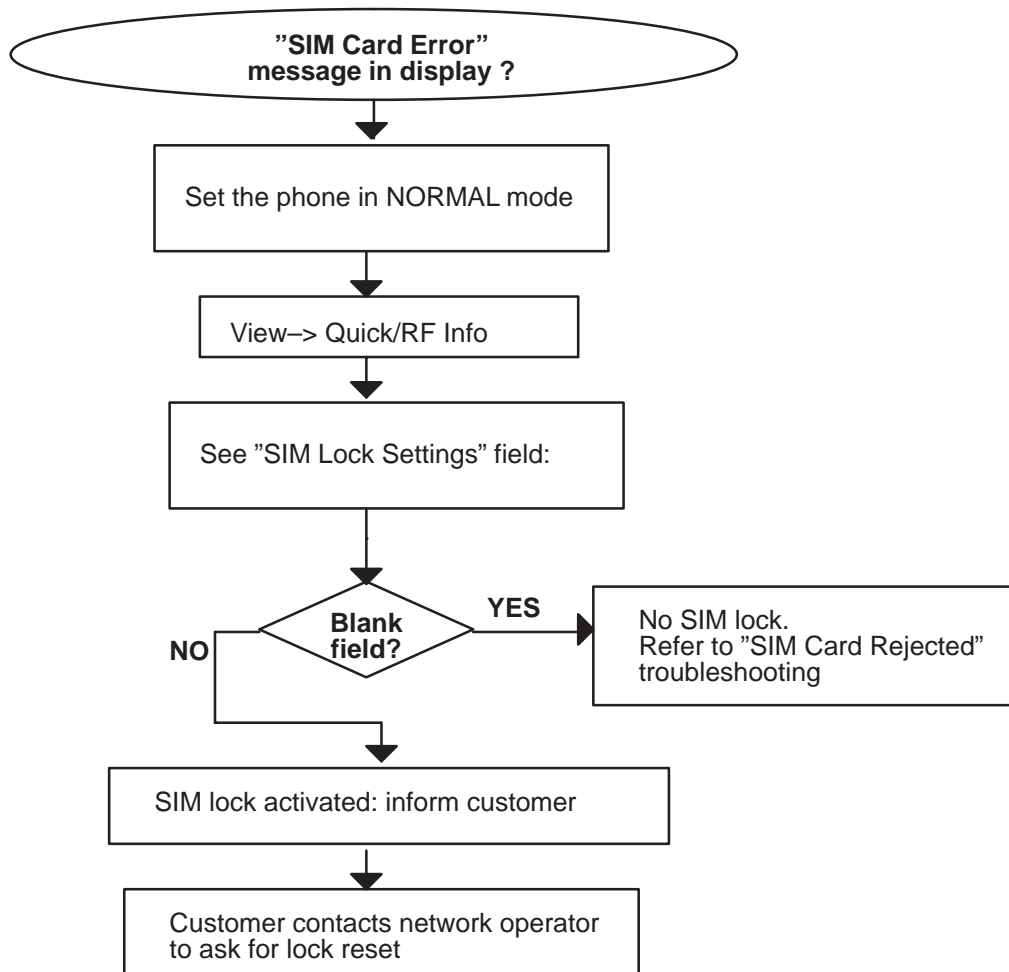


Figure 36.



### 2.13.2 SIM Card Rejected

The fault information "SIM Card rejected" means that the ATR message (Answer To Reset; the first message from SIM card to phone after SIM card power up) is sent, but it is corrupted somehow, eg. the dataline signal levels are wrong or factory set values (stored in the EEPROM) are not correct.

NOTE1: CHECK THE MEASUREMENT POINT PICTURE BEFORE SERVICE ACTIONS

SIM\_xxx\_Cardside – refers to signal which exists in SIM card contacts

SIM\_xxx\_o – refers to signal which exists in CCONT(N100) side

NOTE2: SIM Signals between CCONT (N100) and LindaMAD (D300) are not possible to measure in KL8-module because traces are running in inner layers of PWB.

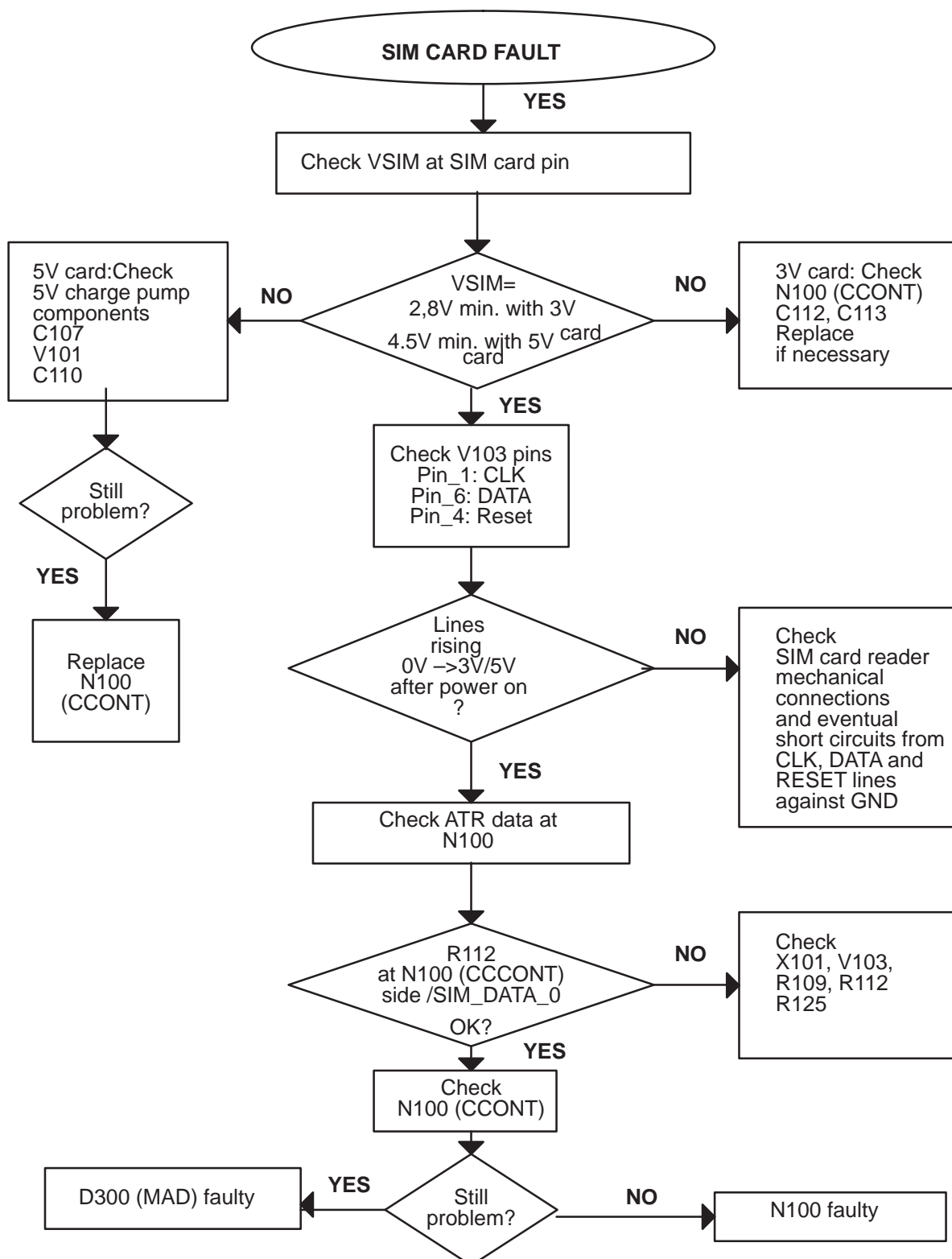


Figure 37.

### 2.13.3 Insert SIM card

The hardware of the SIM interface from the MADLinda (D300) to the SIM connector (X101) can be tested without SIM card. This leaves SIM connector (X101) contacts to be used as an measurement points.

When the power is switched on and if the BSI line (X100:2) is grounded by resistor (which happens automatically in service jig), all the used lines (VSIM, RST, CLK & DATA) rise up to 3V and/or 5V four times (SW tries to ask SIM card four times).

**NOTE1: CHECK THE MEASUREMENT POINT PICTURE BEFORE SERVICE ACTIONS**

SIM\_xxx\_Cardside – refers to signal which exists in SIM card contacts

SIM\_xxx\_o – refers to signal which exists in CCONT(N100) side

**NOTE2: SIM Signals between CCONT (N100) and LindaMAD (D300) are not possible to measure in KL8-module because traces are running in inner layers of PWB.**

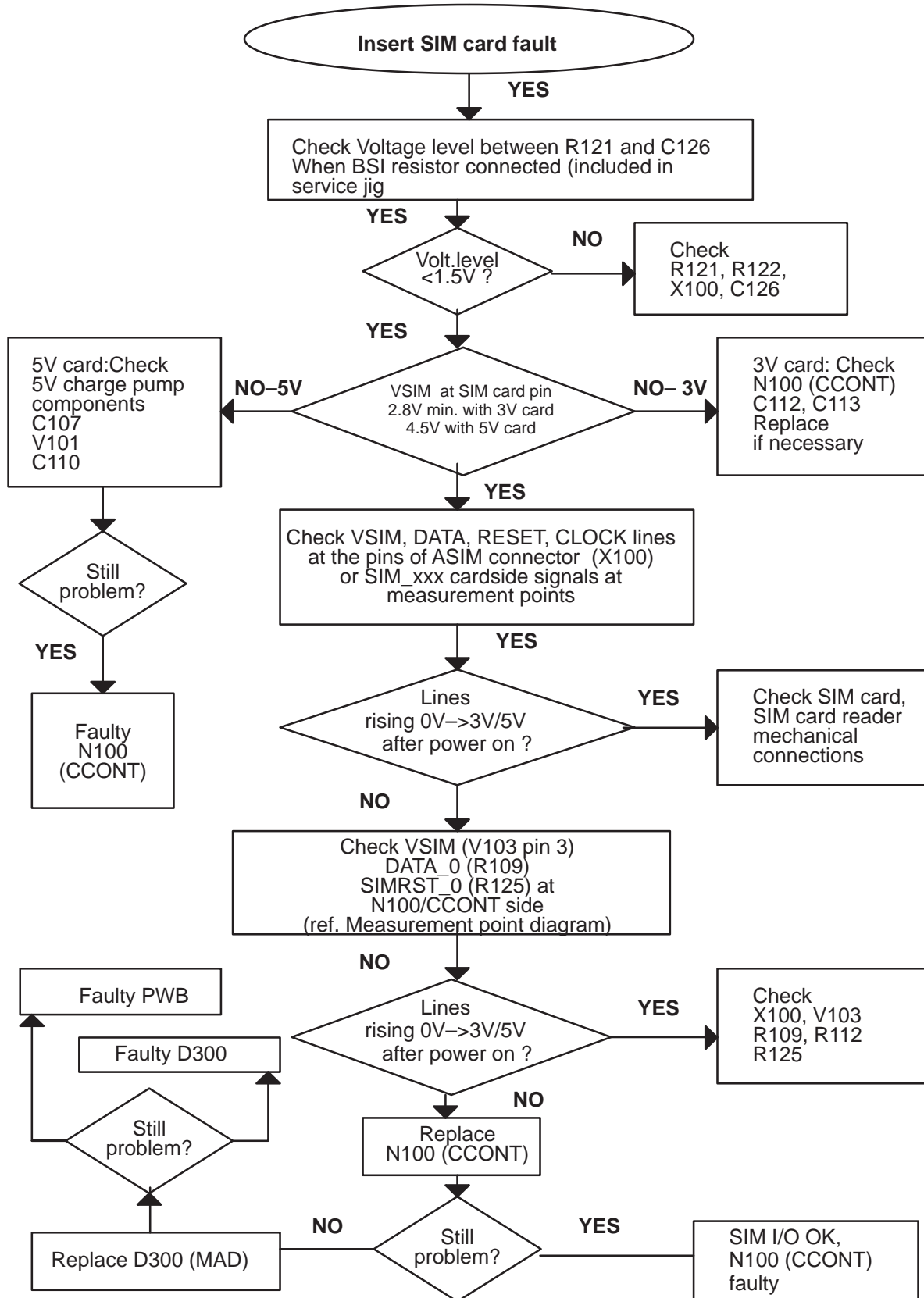


Figure 38.

## 2.14 Memory Card

### 2.14.1 Memory Card Interface Troubleshooting

Start with assembled device with a faultless memory card inserted.

If necessary, proceed with tests in the jig with the faultless memory card inserted.

Clk, Cmd and Data OK means that frequency, rise and fall timing are OK during various operating modes.

Note:

During initialization phase (MMCClk = lower frequency) the response via MMCCmd line from card to MAD is sent in open drain mode i.e. rise time is about 1us.

Voltage of MMCCmd and MMCDa signals depends on direction of transfer (MAD I/O voltage is 2.8V and Card I/O is 3.0V).

Test pads J10x are located on the JL4 board of the Module Jig.

Troubleshooting diagram next page, Figure 39.

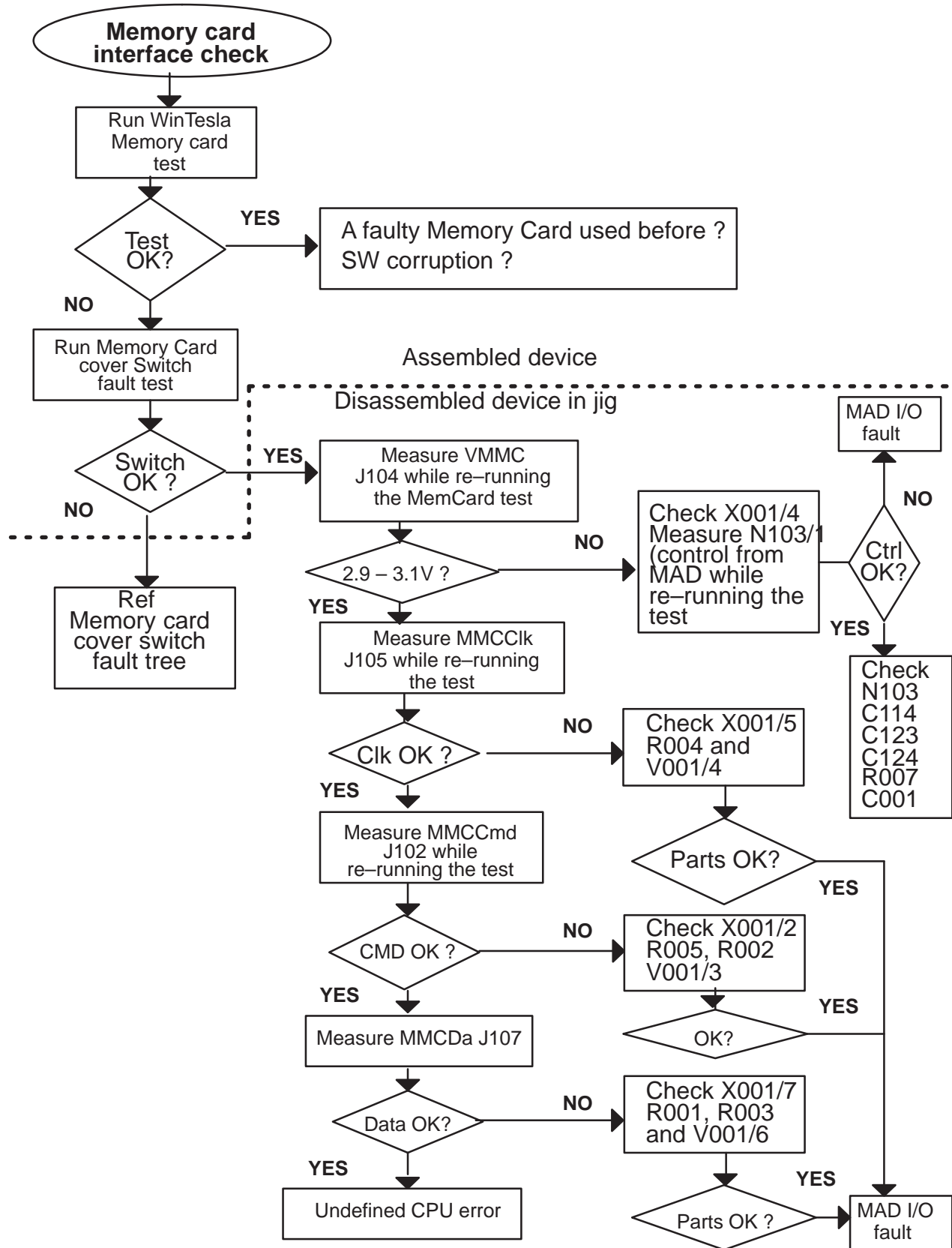


Figure 39.

**2.14.2 Memory card switch troubleshooting:**

NOTE1: Memory card switch pressed (lid closed) => ADC reading 'Memory Card Cover Detection' is in state "0" => MMC\_Switch – line = 0V

Memory card switch released (lid opened) => ADC reading 'Memory Card Cover Detection' is in state "1" => MMC\_Switch – line = 2.8V

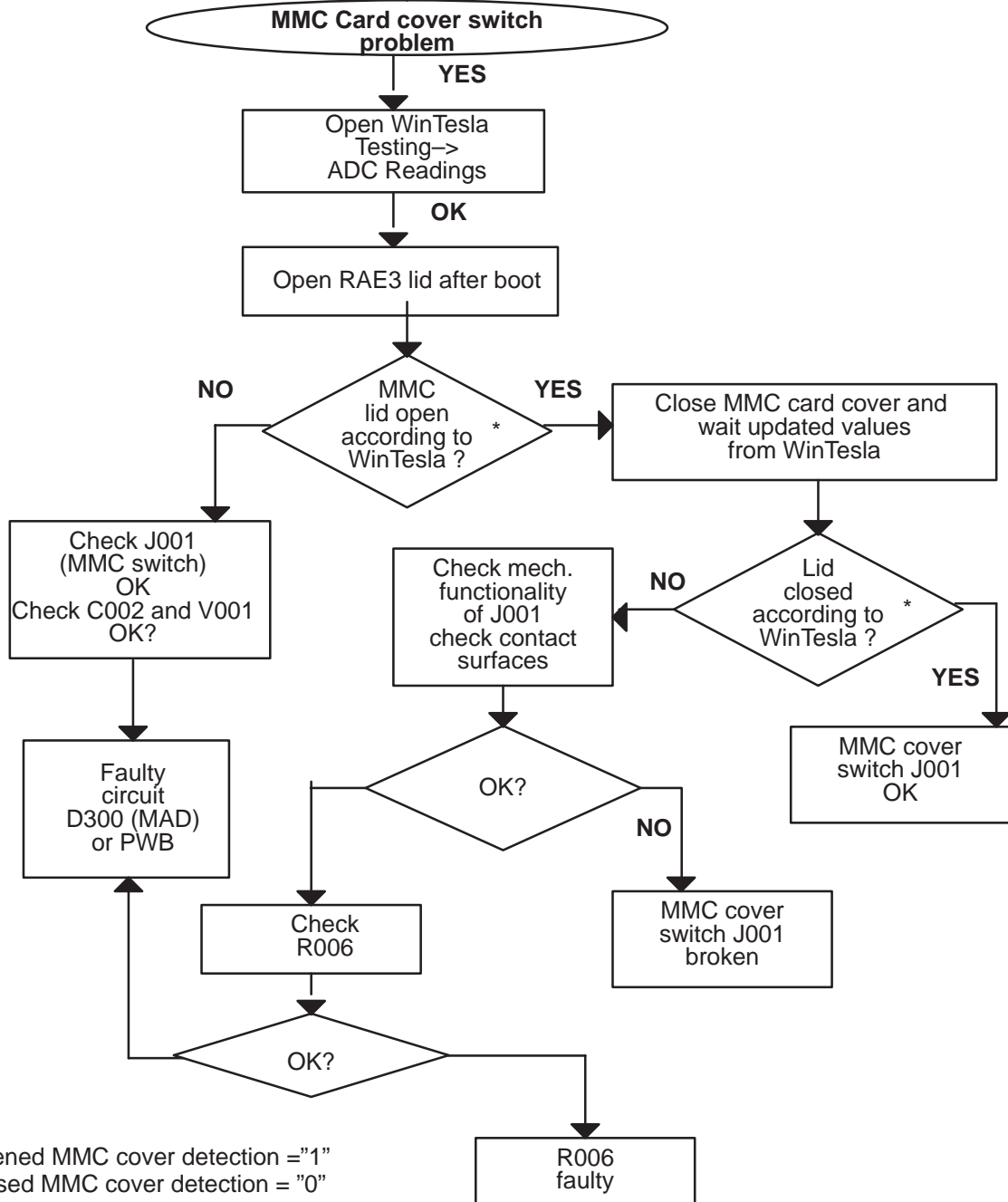


Figure 40.

## 2.15 Lid Switch

### 2.15.1 Lid Switch Troubleshooting

NOTE1:

Lid signal (MAD pin P2 gendet) :

**Lid closed = 'Cover Detection' from Wintesla ADC readings is state "0"**

=> V301 (HALL) output = **2.8V**

**Lid opened = 'Cover Detection' from Wintesla ADC readings is state "1"**

=> V301 (HALL) output = **0V**

Troubleshooting diagram Figure 41 next page.



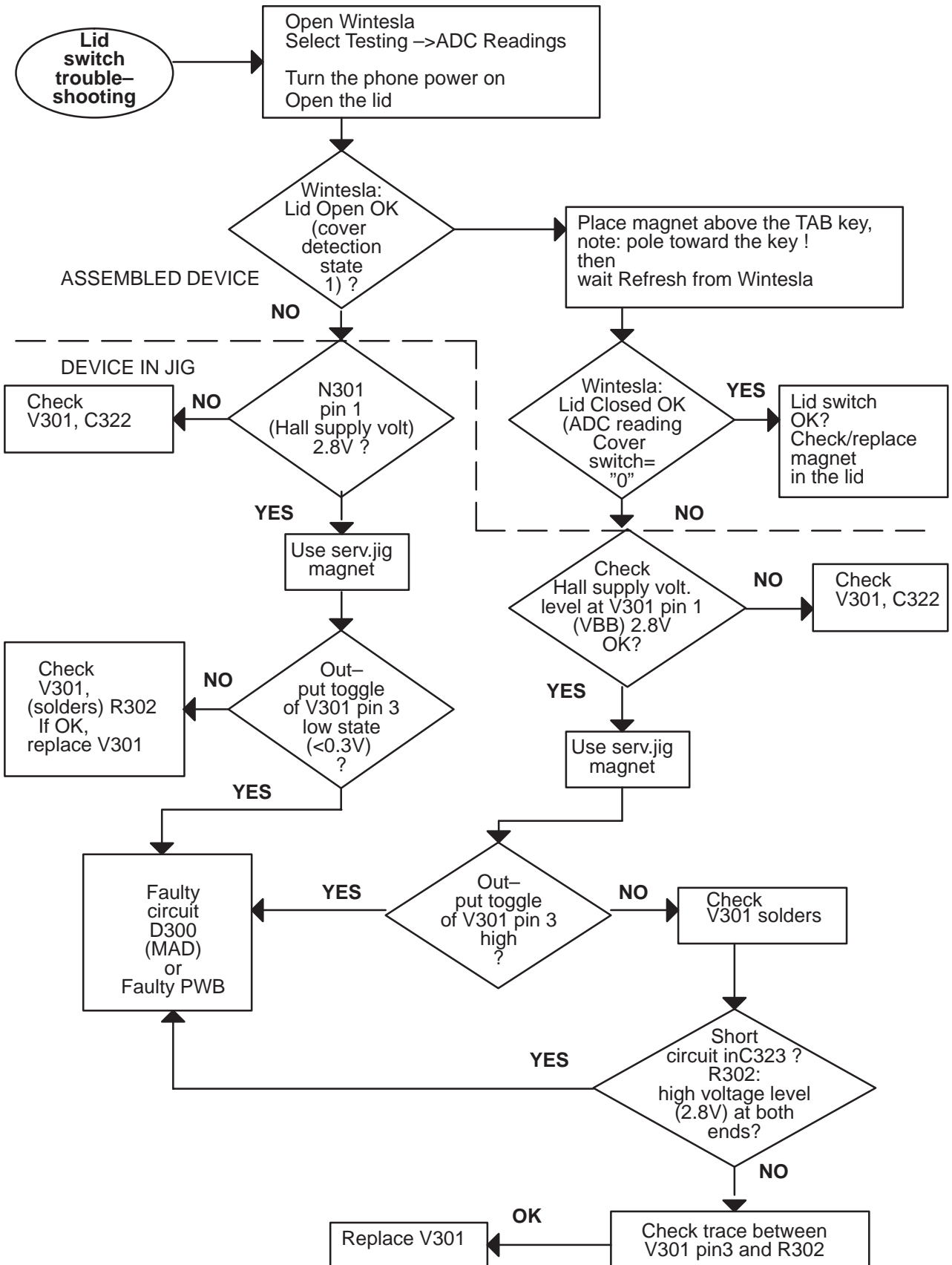


Figure 41.

## 2.16 Battery Removal Switch troubleshooting

NOTE1: Switch itself is not possible to test in service jig.

NOTE2: Switch FREE position = Wintesla ADC-readings '**Battery Removal Switch**' is in state "0" => BATT\_REM – line = 2.8V

Switch CONNECTED position = Wintesla ADC-readings '**Battery Removal Switch**' is in state "1" => BATT\_REM – line = 0V

NOTE3: Battery removal **switch** (latch spring) gets connected when battery **latch** is pressed during battery release.

Refer to the diagram Figure 42 next page.

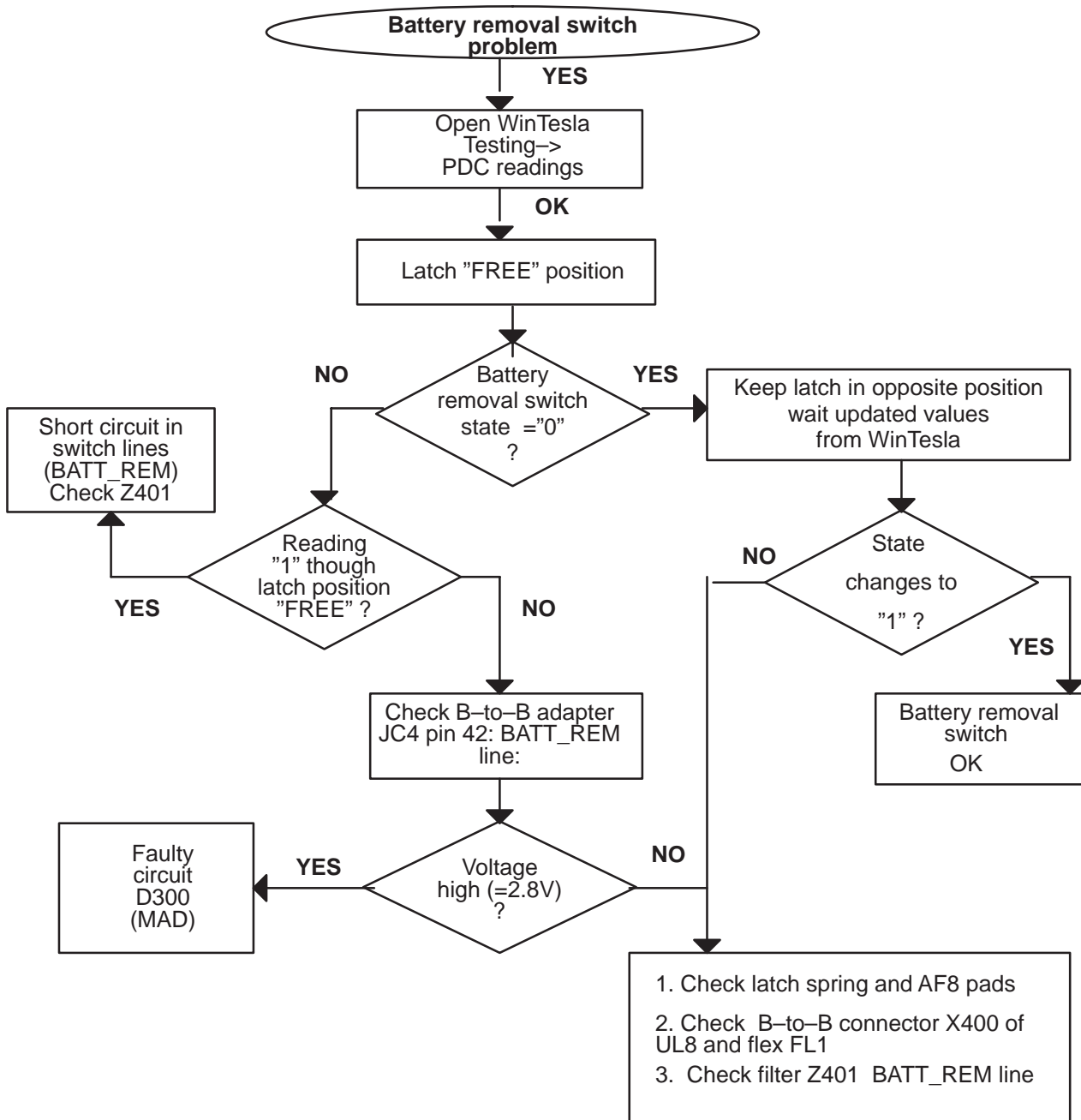


Figure 42.

### 2.17 COBBA Control Interface troubleshooting

NOTE: If there are problems in COBBA serial interface, self tests fail and there is "Contact service" shown on the display. Wintesta shows fails at "Cobba parallel".

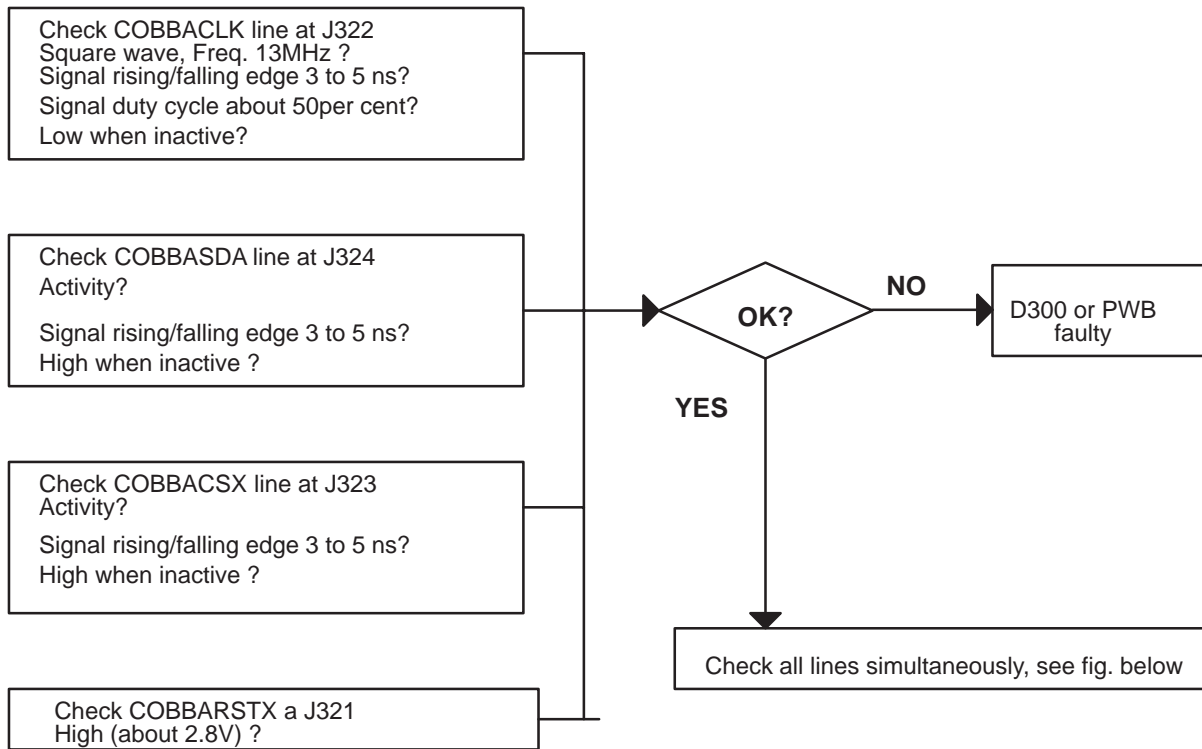


Figure 43.

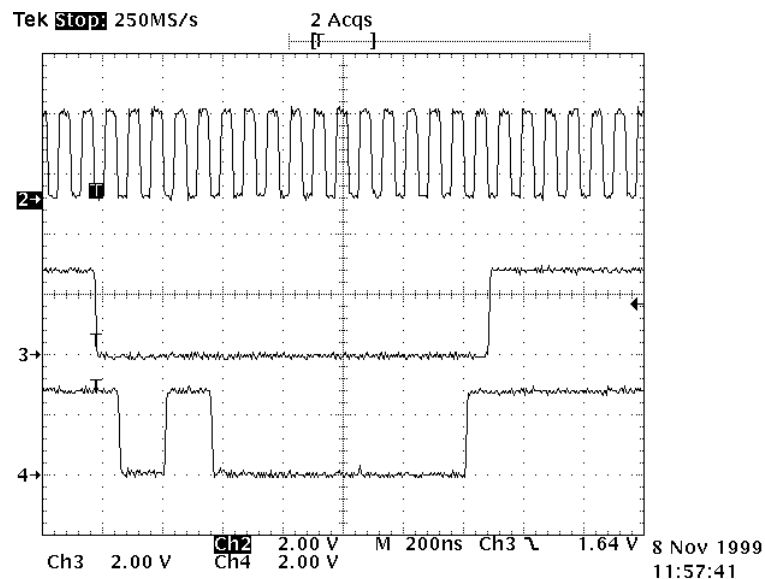


Figure 44. Write sequence to COBBA.

Figure 44 is a write sequence to COBBA. There should be non-all-zero writes to COBBA.

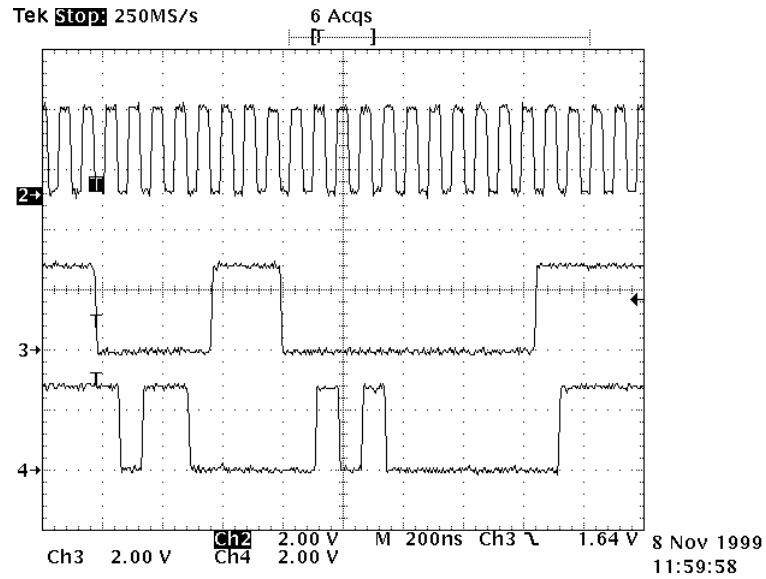


Figure 45. COBBA read

Figure 45 is a COBBA read.

The MADLinda writes first the address to be read, deactivates the COBBAC SX line and then activates the COBBAC SX line again. Then the COBBA\_GJP sends the requested data. There should be non-zero reads.

If no non-zero reads from COBBA can be seen, COBBA (N200) may be faulty.

If both reads and writes of non-zero values can be seen and the signal characteristics were good, the COBBA serial control interface is working correctly.

## 2.18 COBBA PCM Interface Troubleshooting

PCM interface transfers digital audio data. Problems in this interface result in missing or flawed audio in either or both in uplink and downlink directions. If Wintesla shows errors in "COBBA serial interface", PCM interface is faulty.

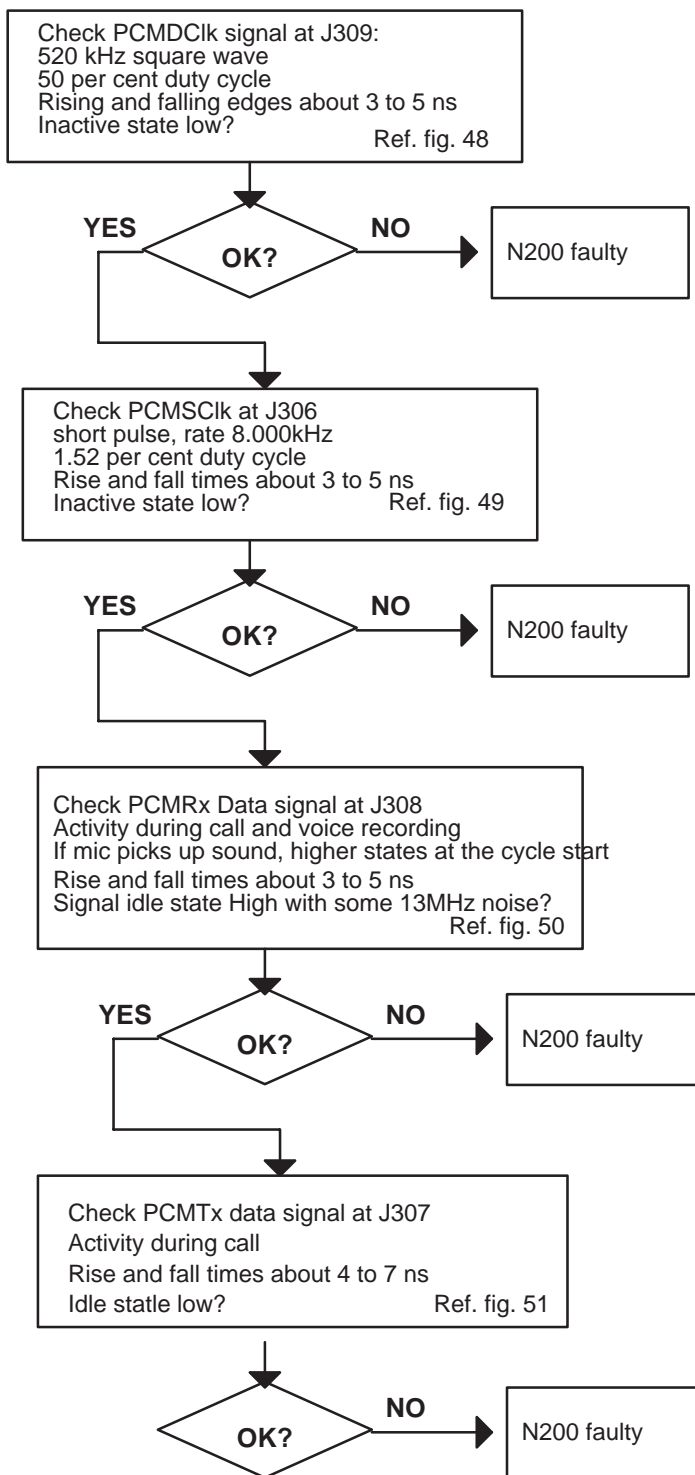


Figure 46.

There is no traffic in PCM interface without a call or audio play (voice recorder, video player, etc). These signals can be measured with a call, which generates

traffic in both directions. Audio play generates traffic in one direction only. Recording audio (voice recorder) generates traffic in the other direction.

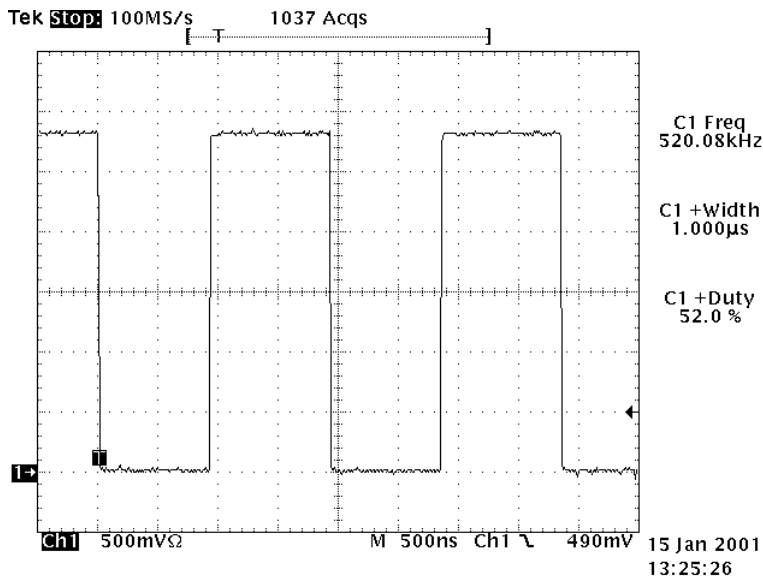


Figure 47. PCMDClk signal at J309

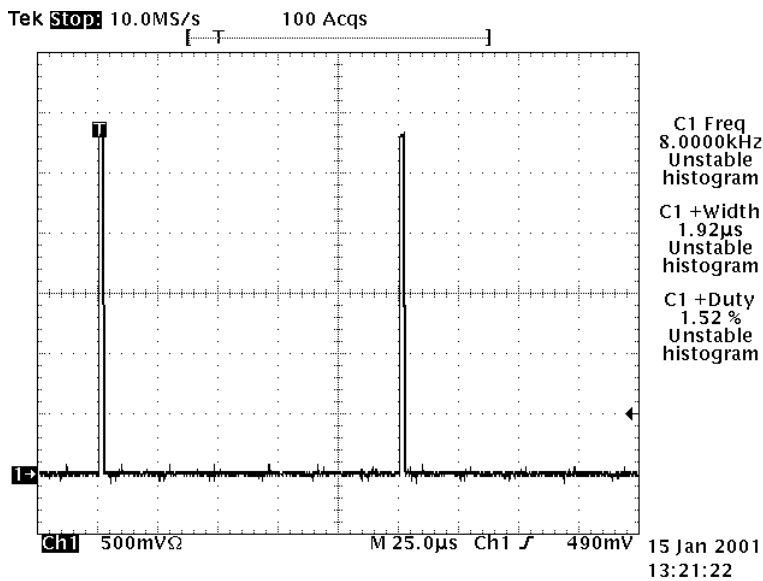


Figure 48. PCMSClk signal at J306.

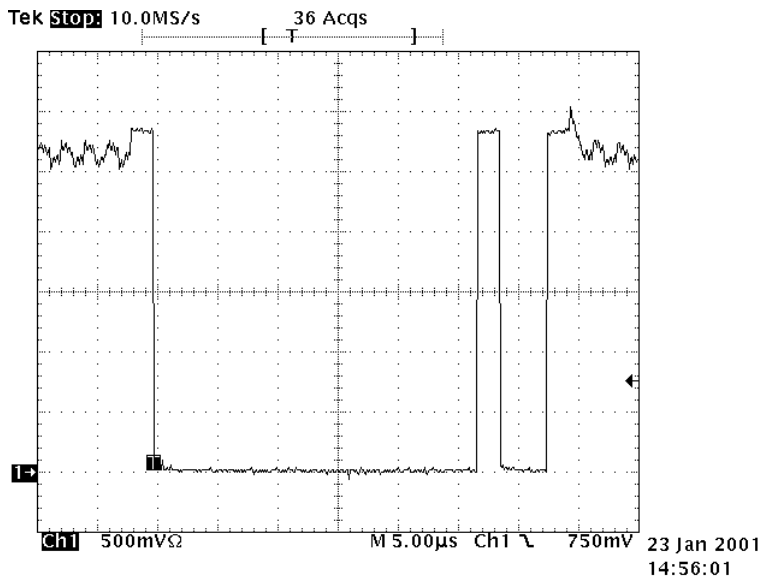


Figure 49. PCMRxData signal at J308.

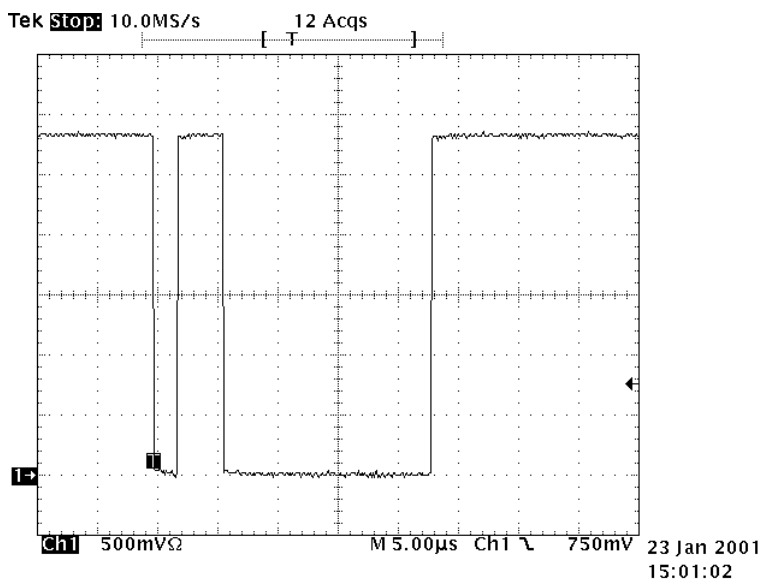


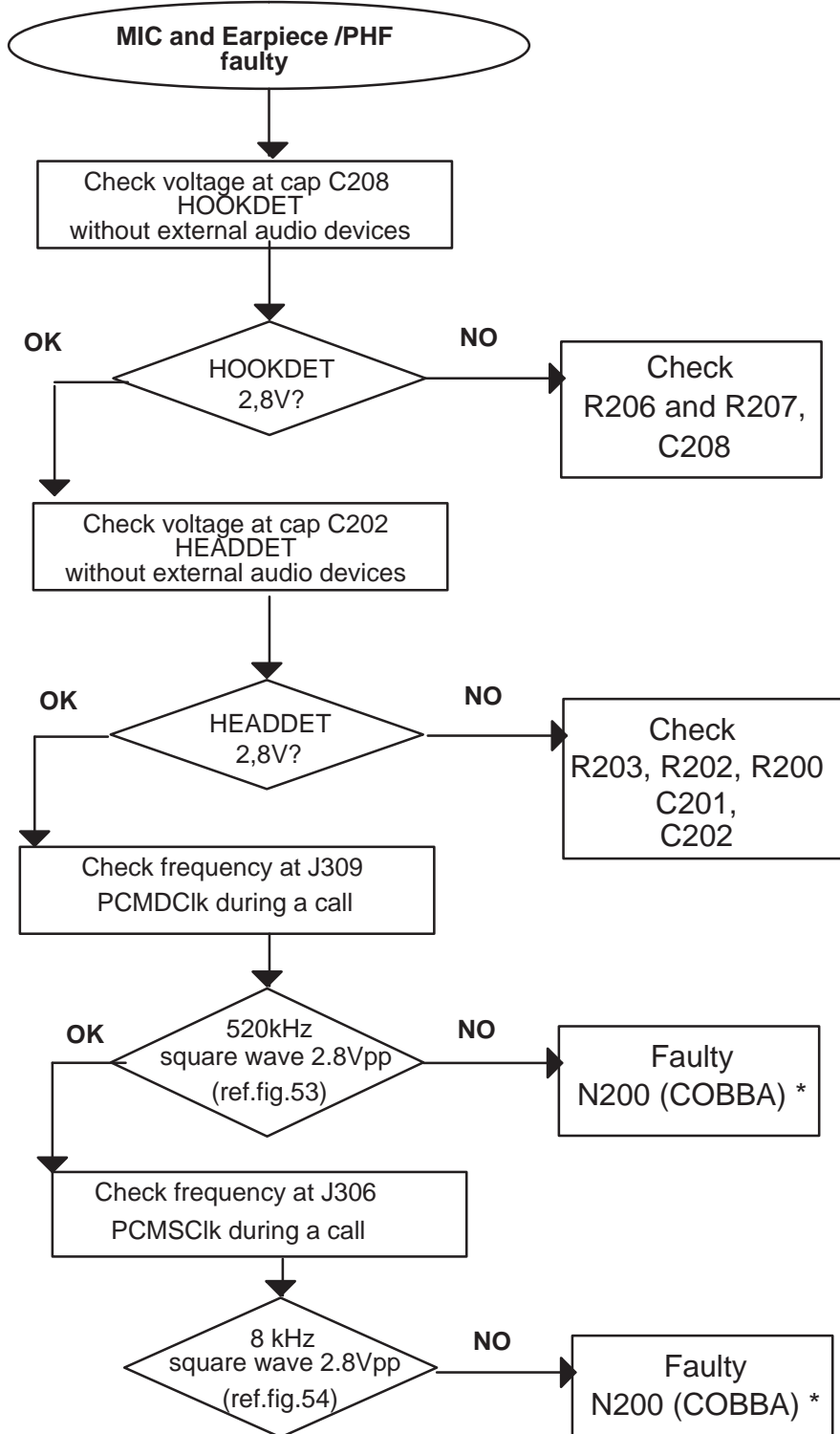
Figure 50. PCMTxData signal at J307

PCMTxData signal at J307 (Figure 50). This signal comes from the other end's microphone or audio playing software (voice recorder, video player etc) and is targeted for the earpiece or hands free speaker. There should be activity during a call. Signal rise and fall times are around 4–7ns. Idle state is low.



## 2.19 Audio troubleshooting

### 2.19.1 Both Mic and Earpiece/PHF faulty



\* refer to section 2.17 in this document

Figure 51. PCMDClk

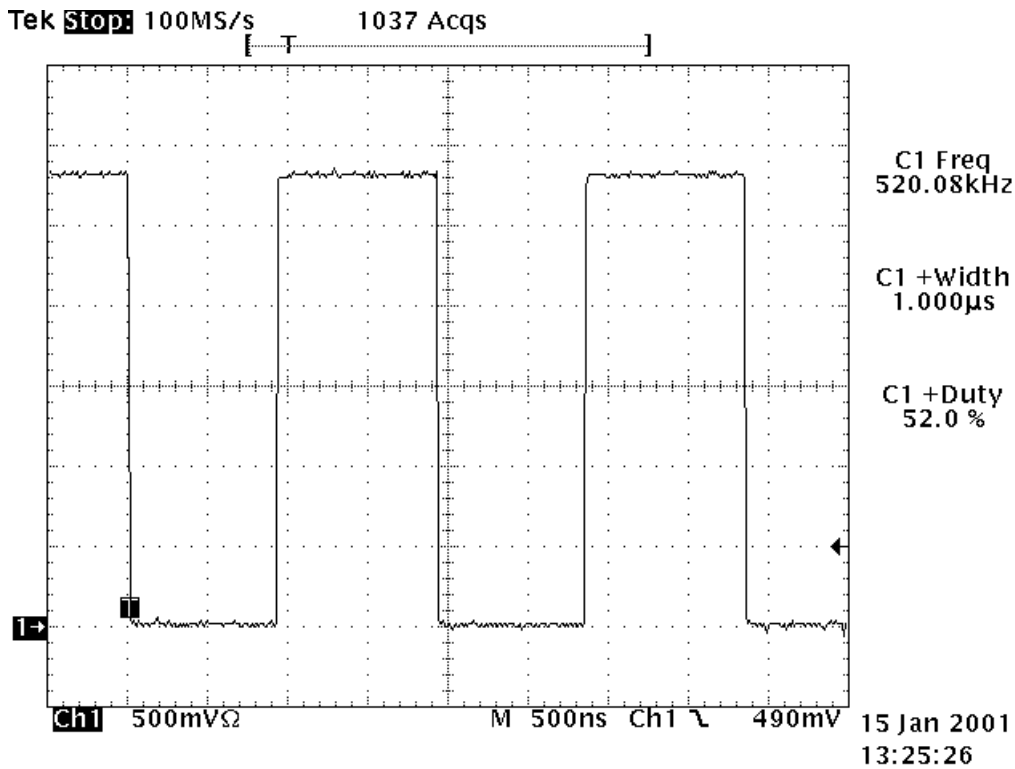


Figure 52. PCDCIk

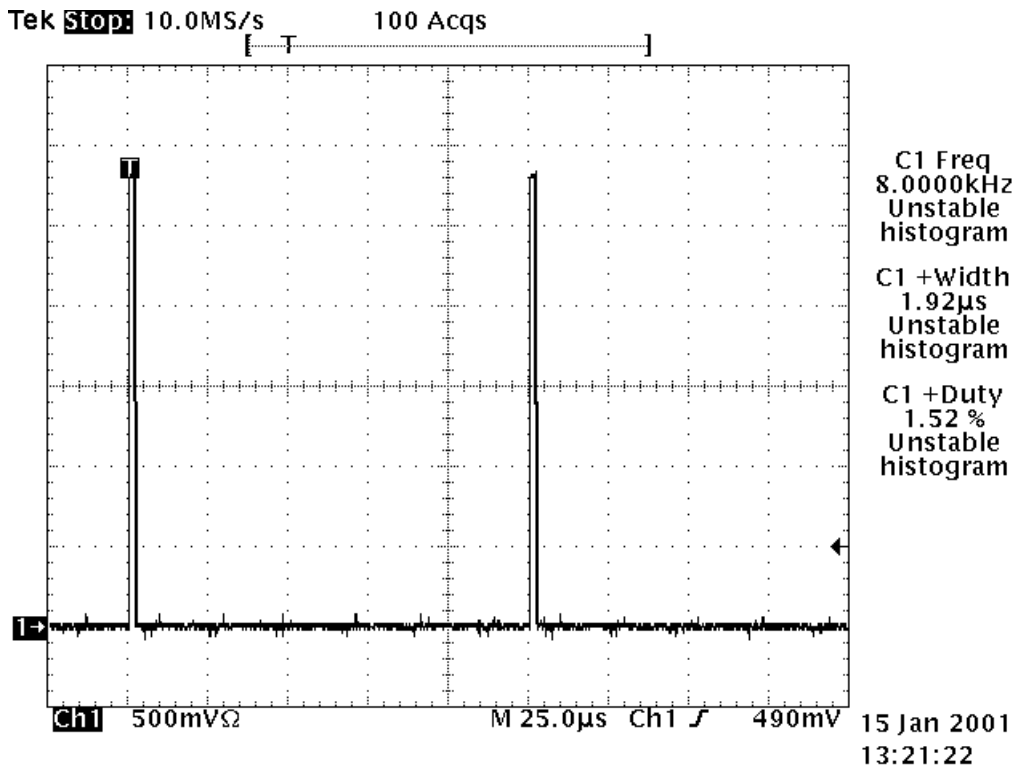


Figure 53. PCMSCIk

2.19.2 Mic faulty

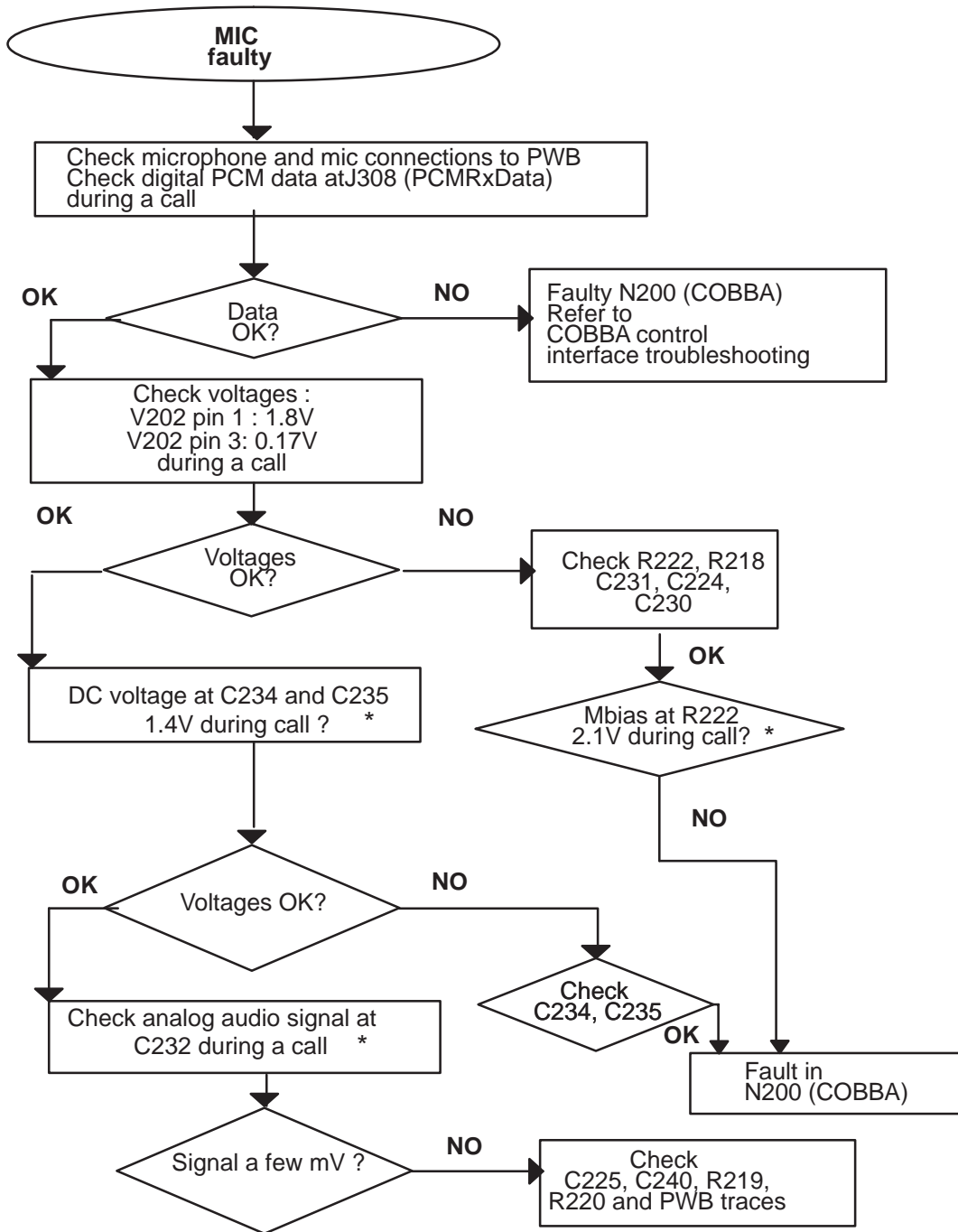


Figure 54.

Note:\* can not be measured in the service jig, because components are under the SIM connector.

Use wire to measure them. After removing measurement wire, check that components are not defected. It is recommended to replace the components.

2.19.3 Earpiece faulty

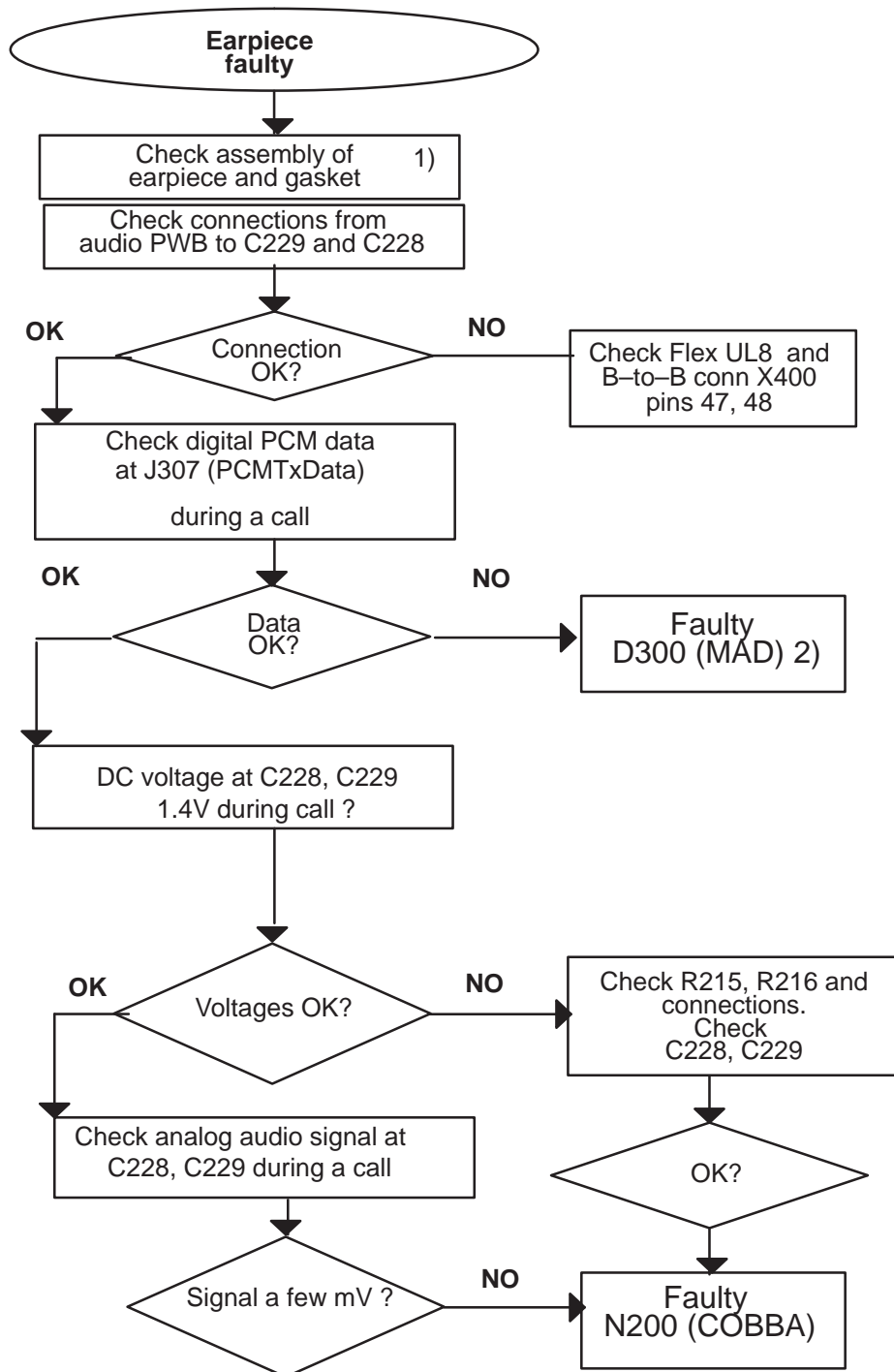


Figure 55.

Note:

1) If sound is distorted or too quiet fault is most probably in the gasket or in the earpiece diaphragm.

2) Refer to section 2.16 in this document.

2.19.4 PHF Speaker faulty

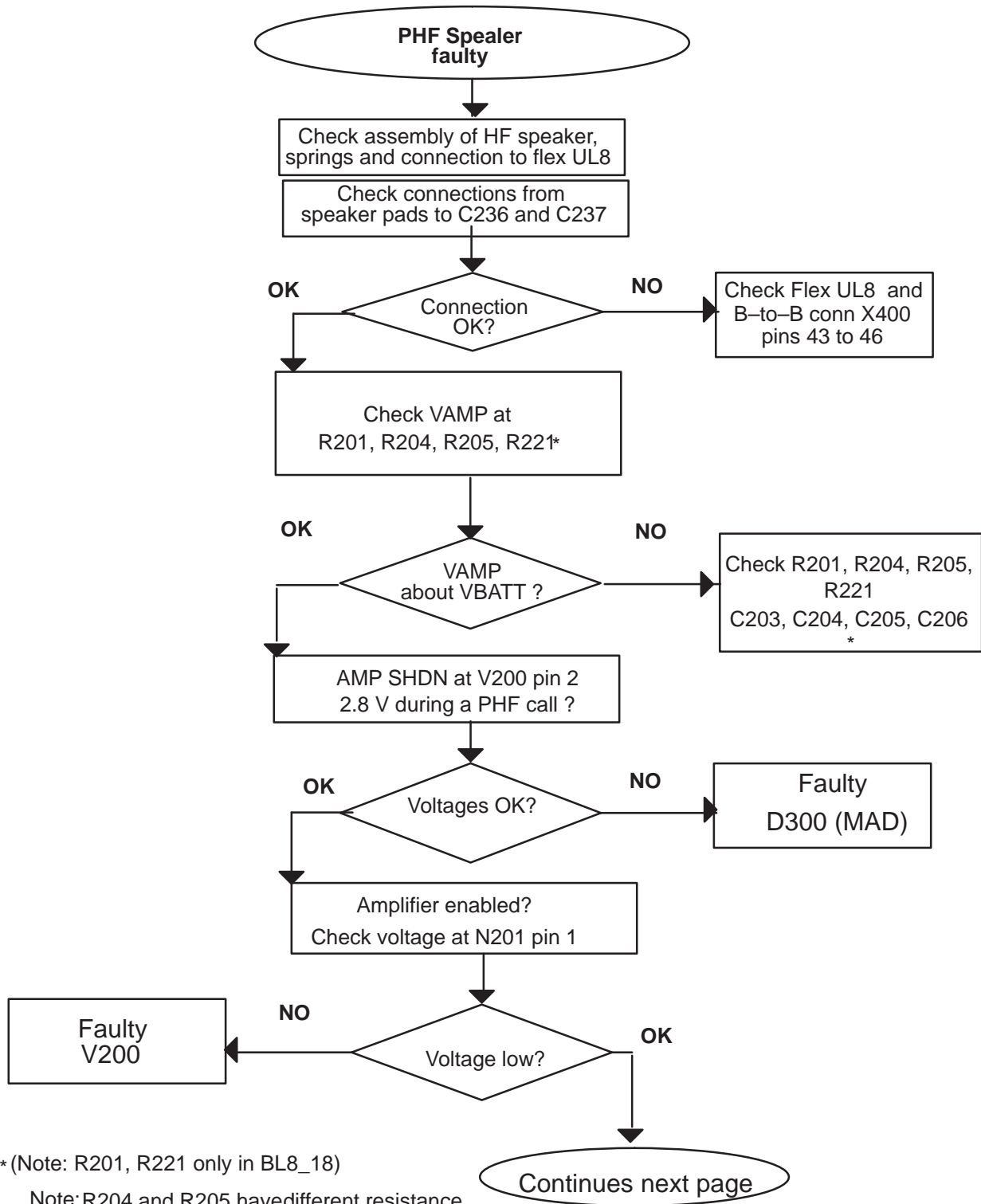


Figure 56.

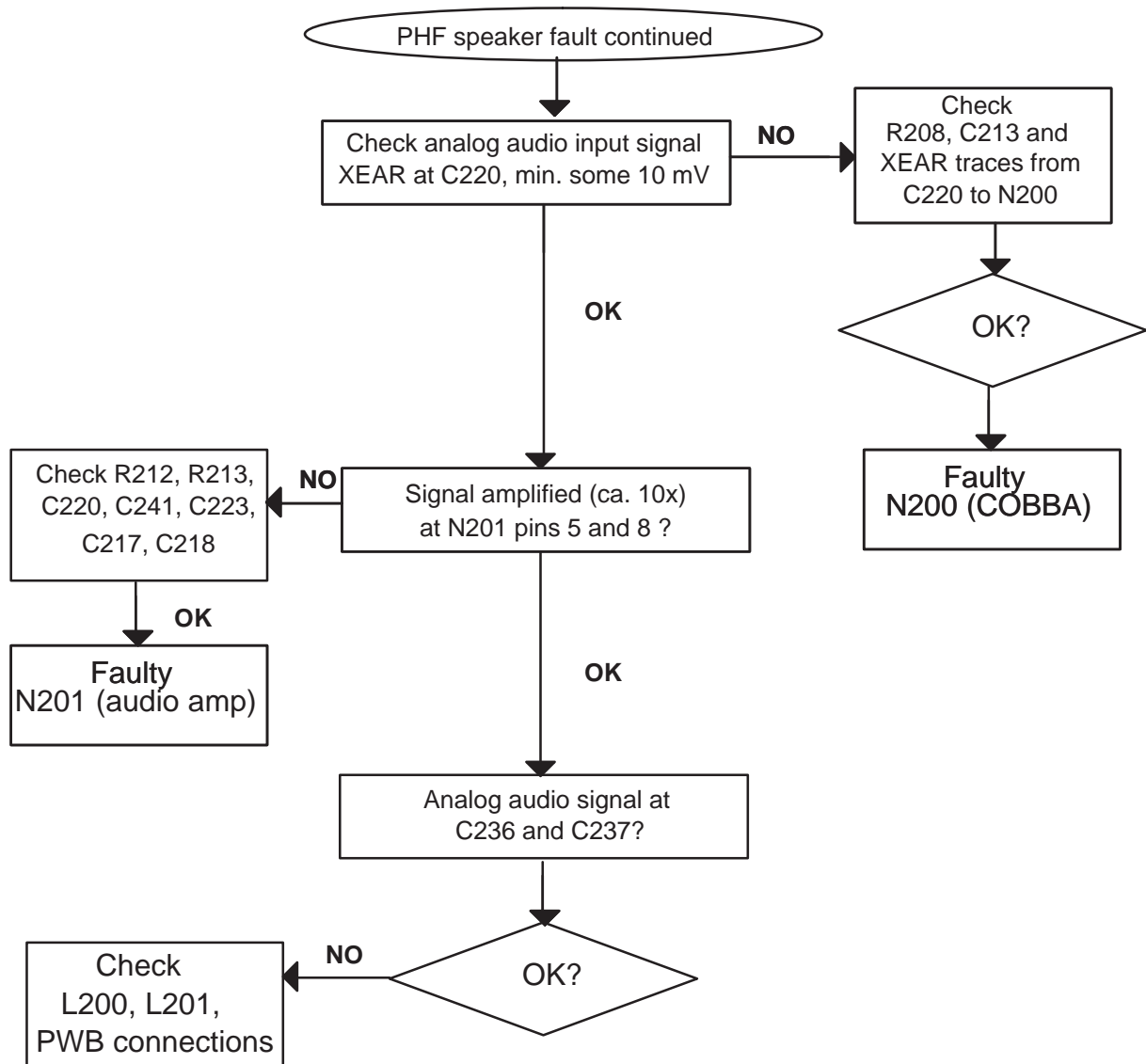


Figure 57.

2.19.5 Headset out of order

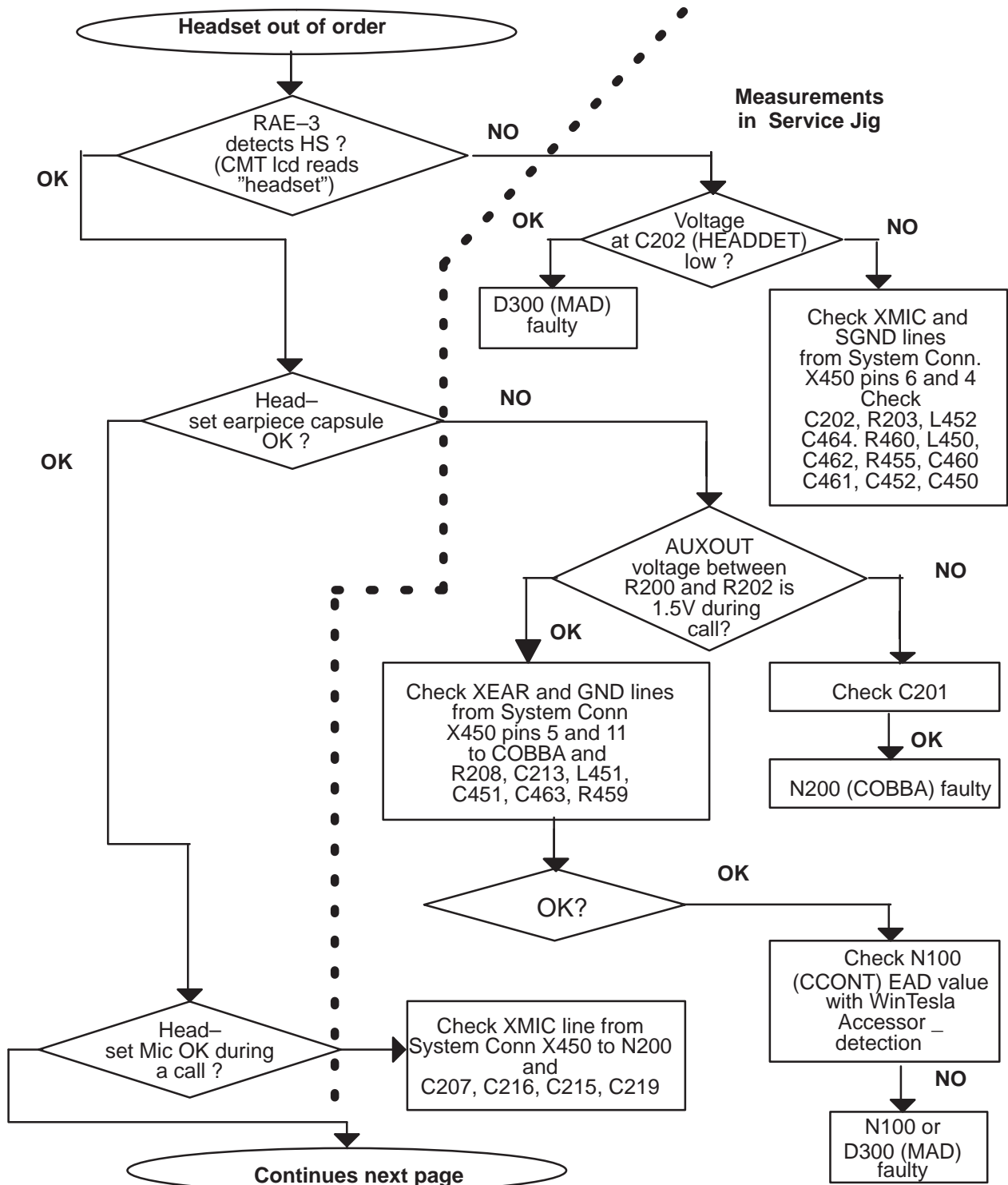


Figure 58.

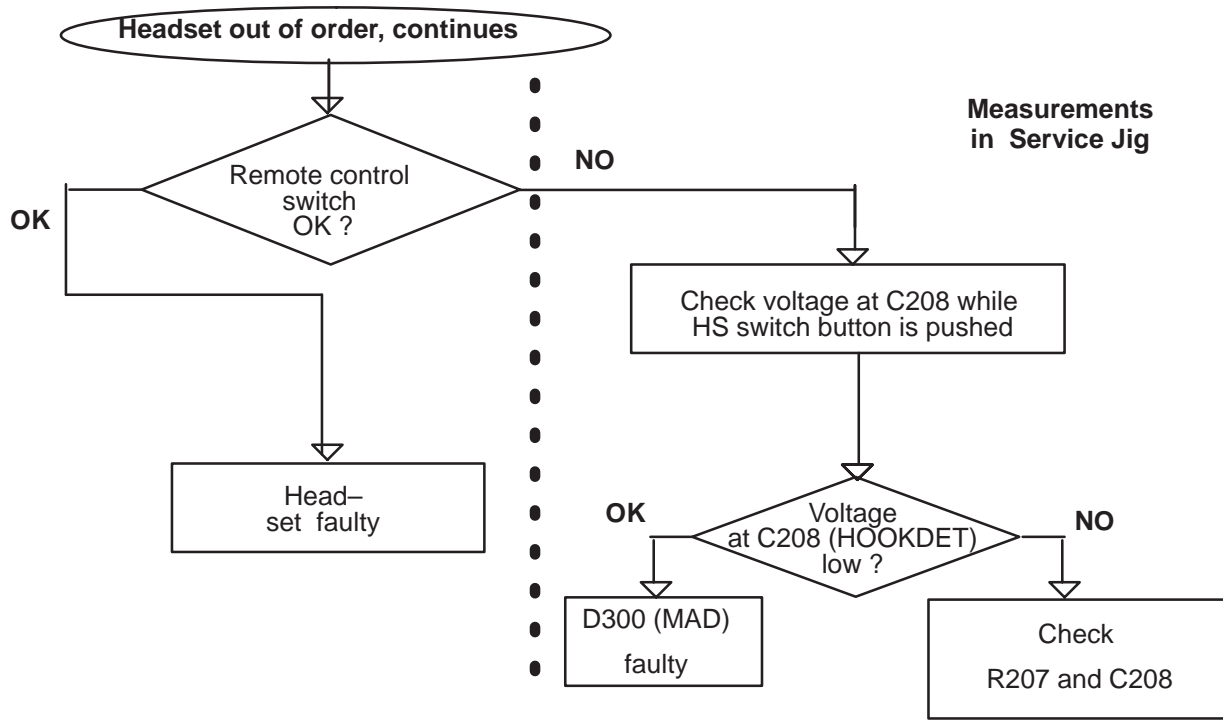


Figure 59.



## 2.20 RF Interface

### 2.20.1 Phone doesn't register to the network or doesn't make a call

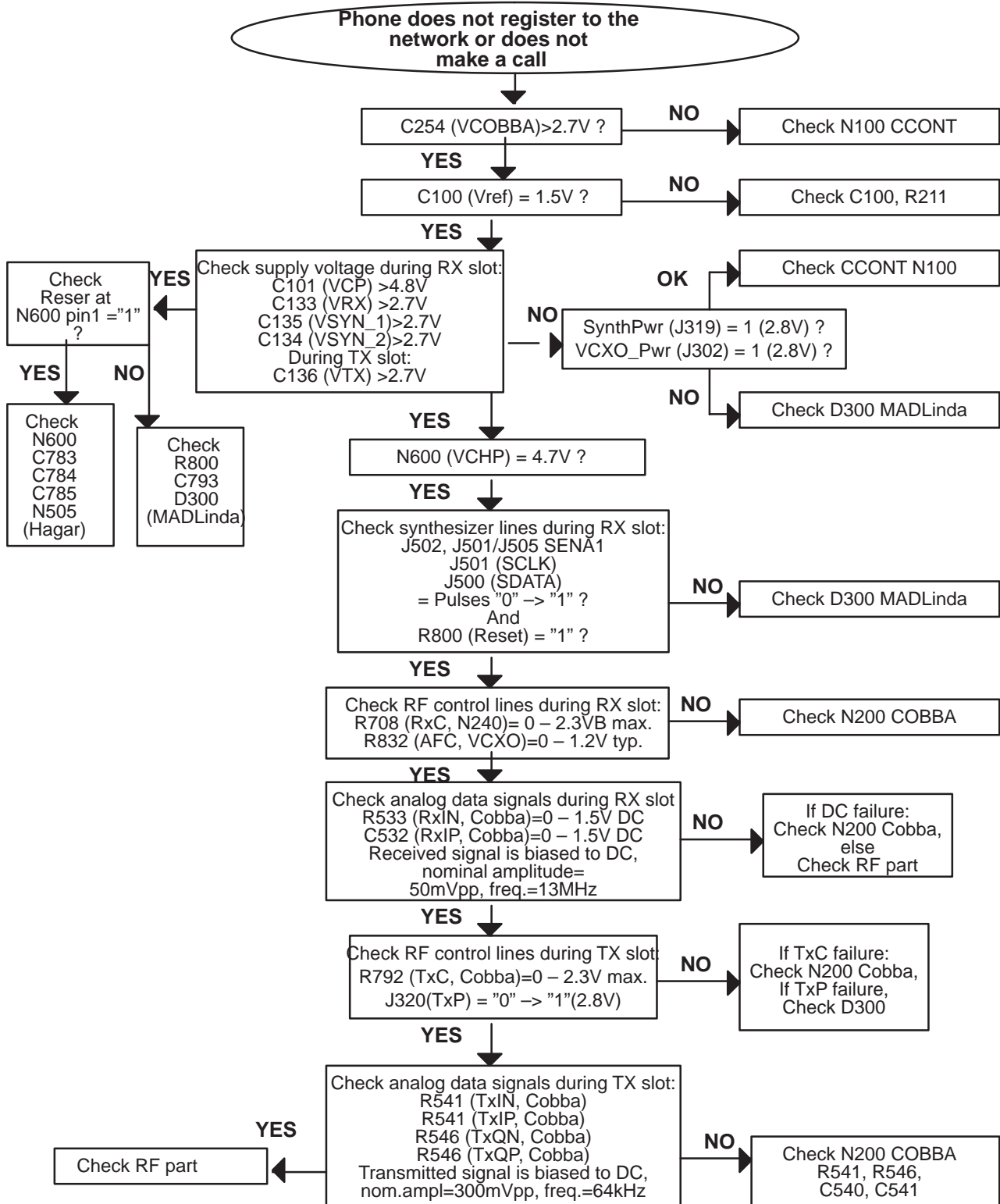


Figure 60.

**2.21 IR Interface Troubleshooting diagram**

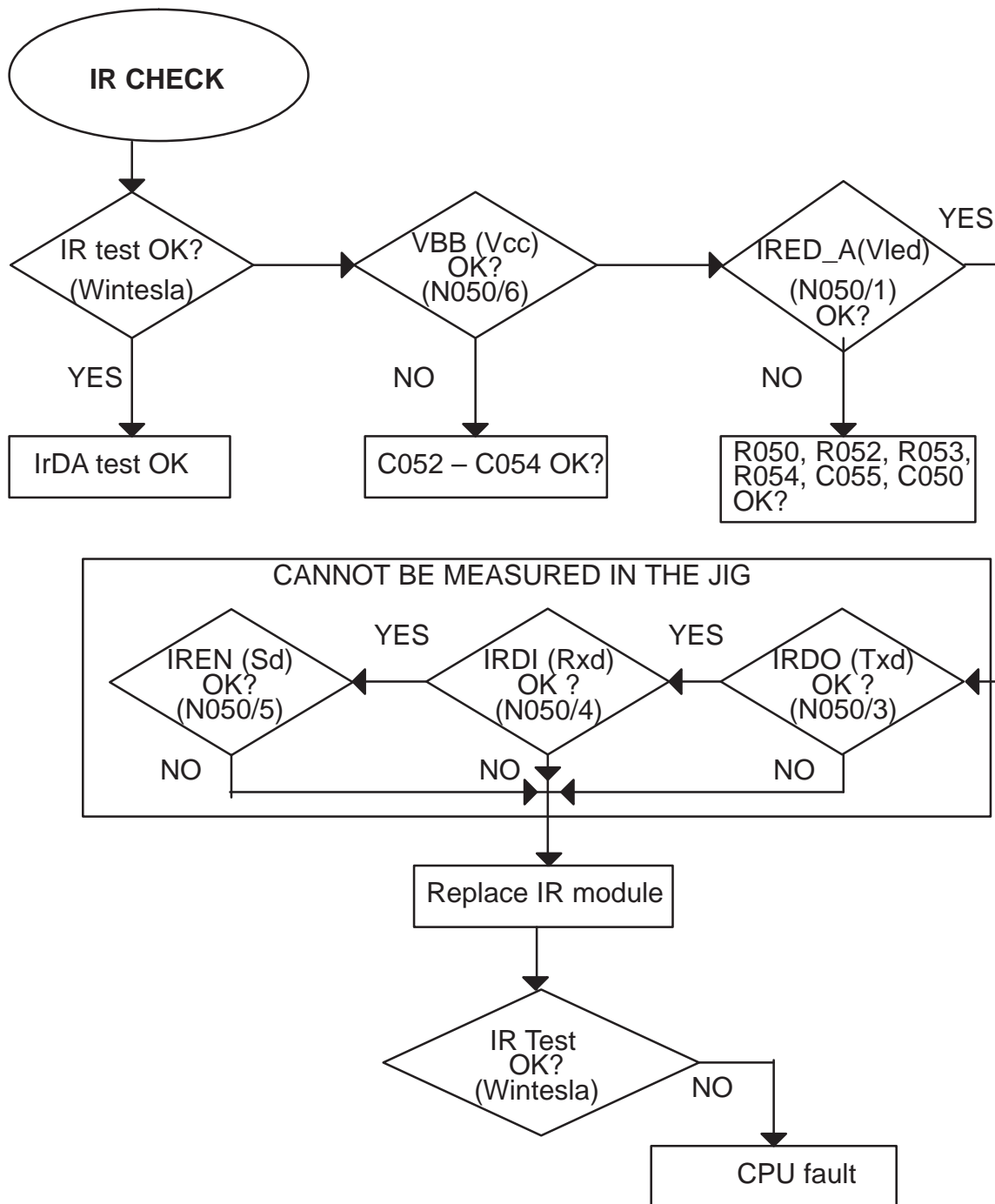
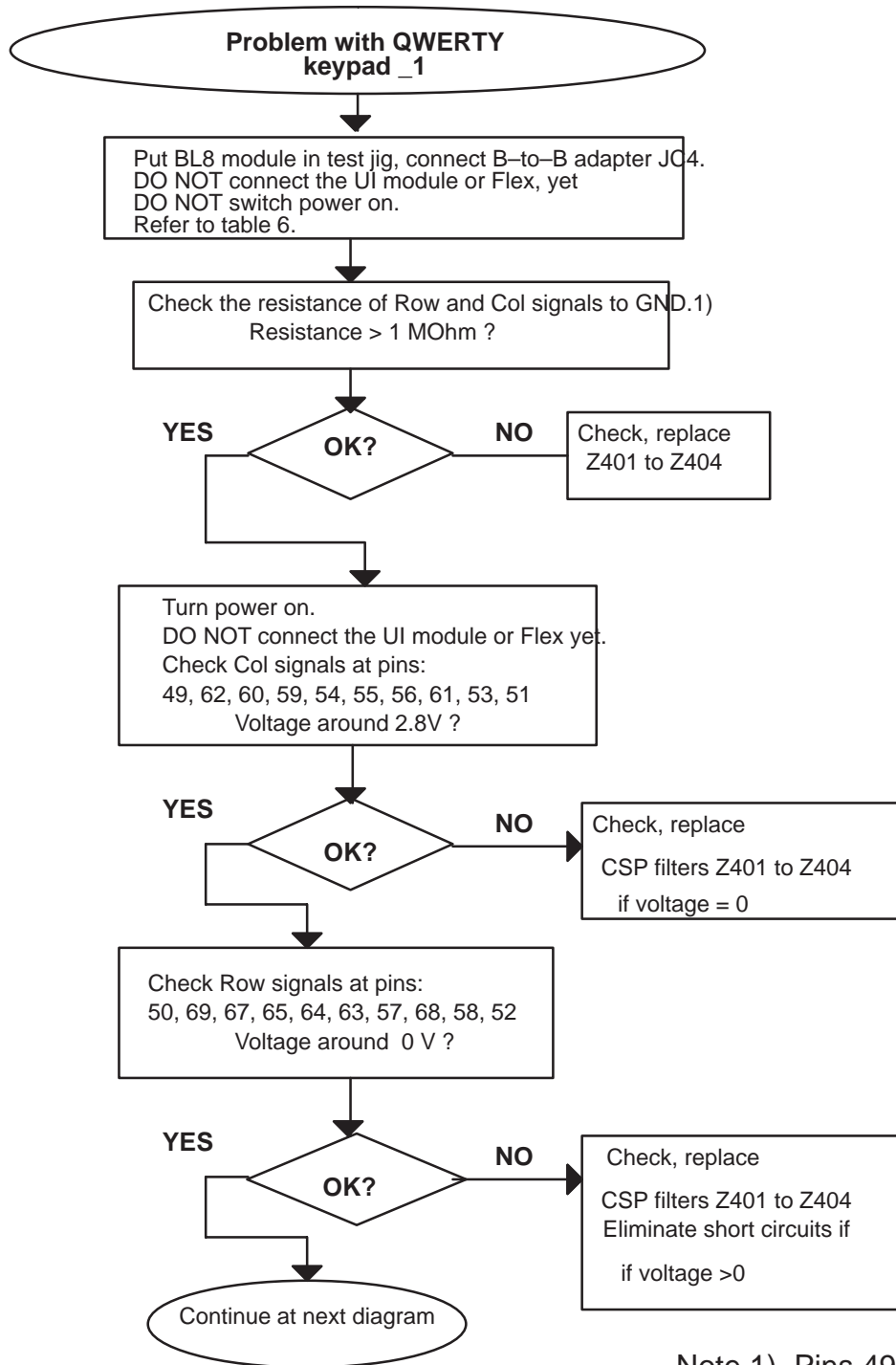


Figure 61.

## 2.22 **KL8 related Keyboard problems**

There may be several types of problems with keyboard. Usually some of the keys (CMT and PDA) are not working, or several key presses happen simultaneously.

If CMT informs "Please close cover", see "Lid switch problems" section.



Note 1) Pins 49–65 and 66–69 against pin 70 (gnd).

Figure 62.

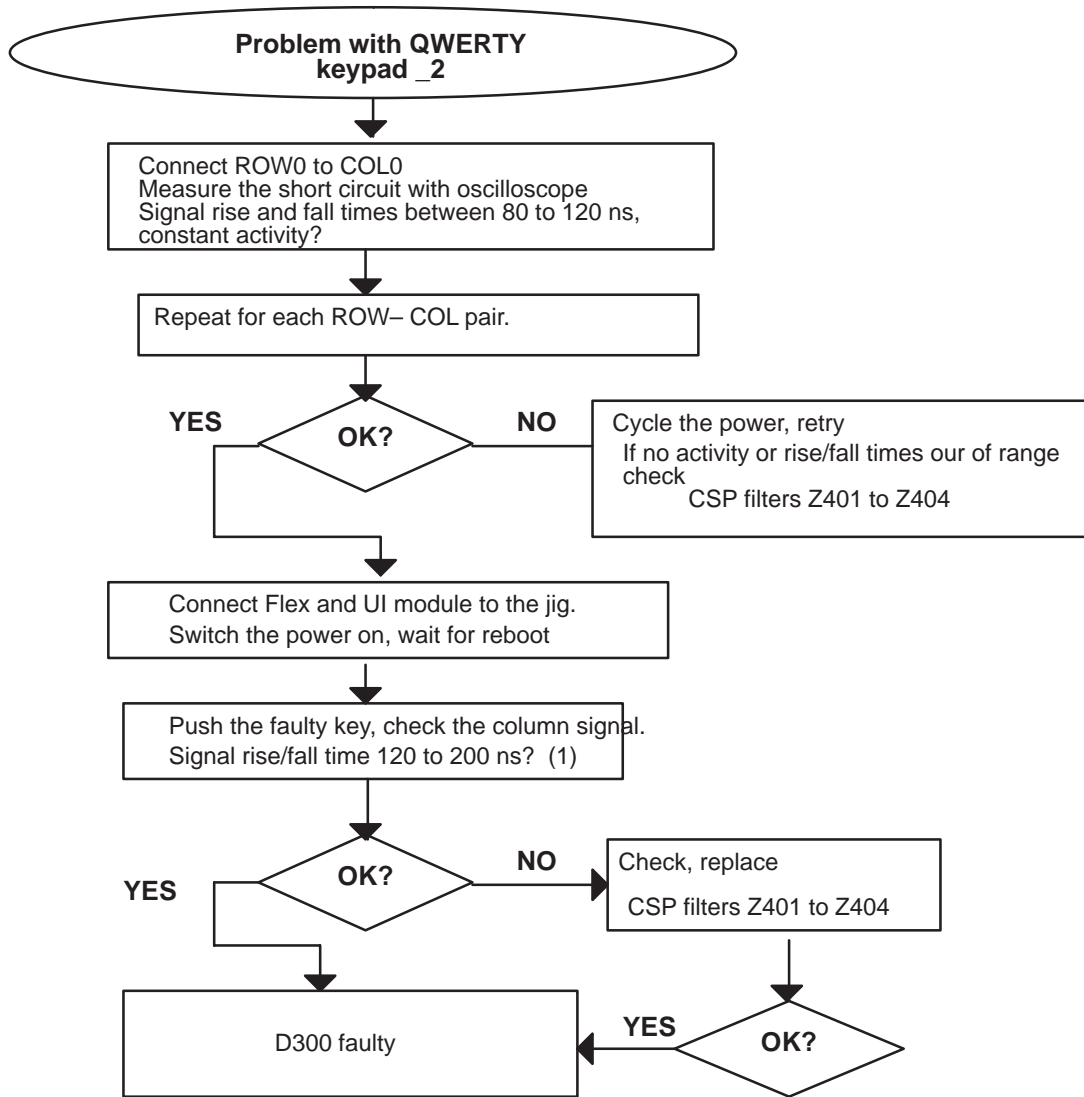


Figure 63.

Table 1. Keyboard matrix (keys on UL2 module highlighted) – English keymat

	Col0	Col1	Col2	Col3	Col4	Col5	Col6	Col7	Col8	Col9
Row0	cmt Soft1	cmt Up	cmt Soft2	pda Soft 3	pda Soft 1			Space	Info <	/ >
Row1	cmt Send	cmt Down	cmt End	pda Soft 4	pda Soft 2		Z	Shift	C	B
Row2	cmt 1	cmt 2	cmt 3	cmt Profile	cmt Power		Chr	N	M	, @
Row3	cmt 4	cmt 5	cmt 6	cmt *	cmt #	Menu	Up	Right	Down	Left
Row4	cmt 7	cmt 8	cmt 9	cmt 0		::	+ -	Back- space		Enter
Row5	ESC	App1	App2	App3	app4	App6	App7	App8		
Row6		Ctrl	V	X	6	App5				
Row7	1	2	3	4	5	7	8	9	0	P
Row8	Tab	Q	W	E	R	T	Y	U	I	O
Row9	Caps	A	S	D	F	G	H	J	K	L

**Table 2. Keyboard line filters**

Z402	Z403	Z404
Col4	Col1	Row1
Col5	Col2	Row2
Col6	Col3	Row3
Col8	Col7	Row4
Col9	Row5	Row7
Row9	Row6	
	Row8	

**2.23 KL8 related PDA UI problems**

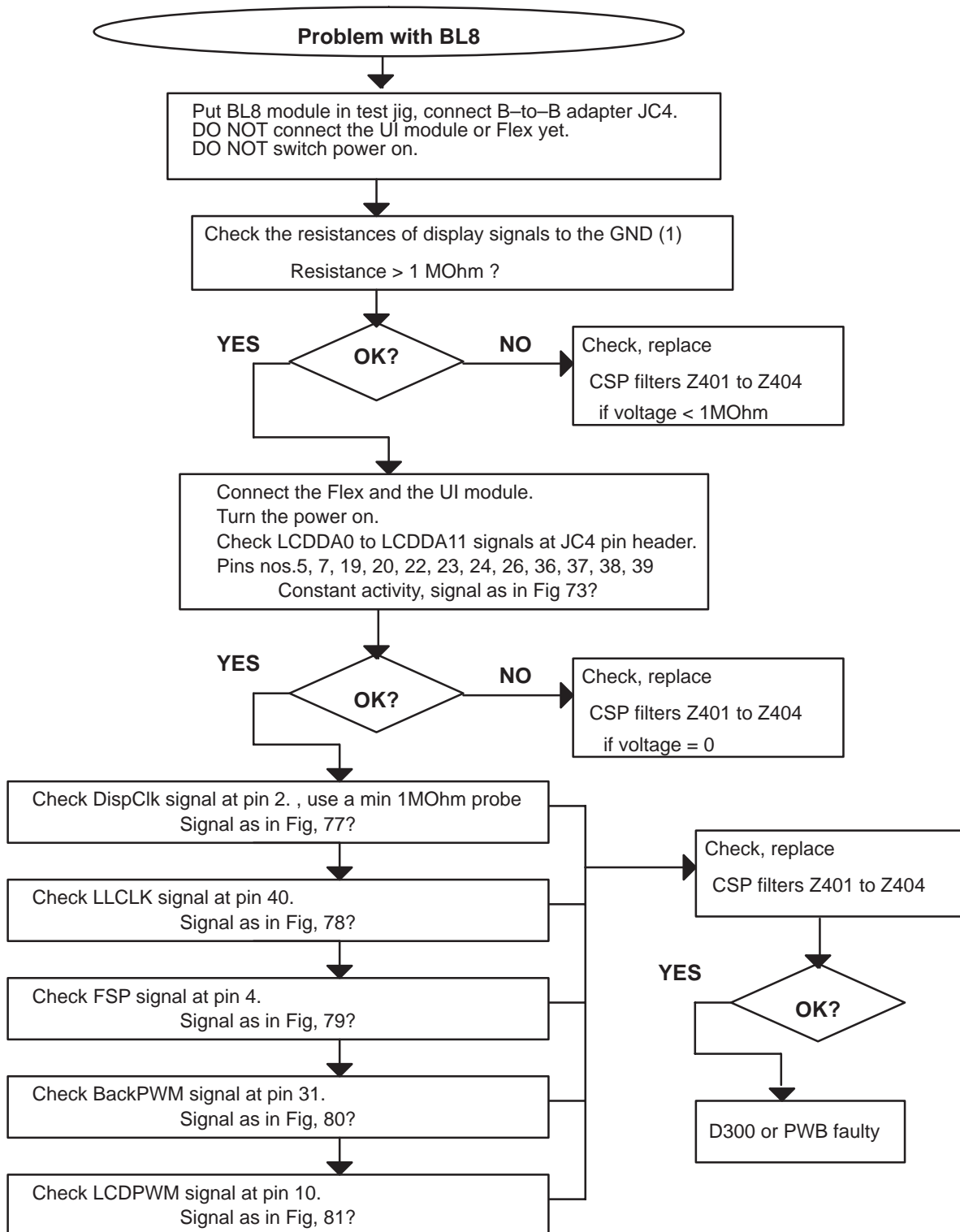


Figure 64.

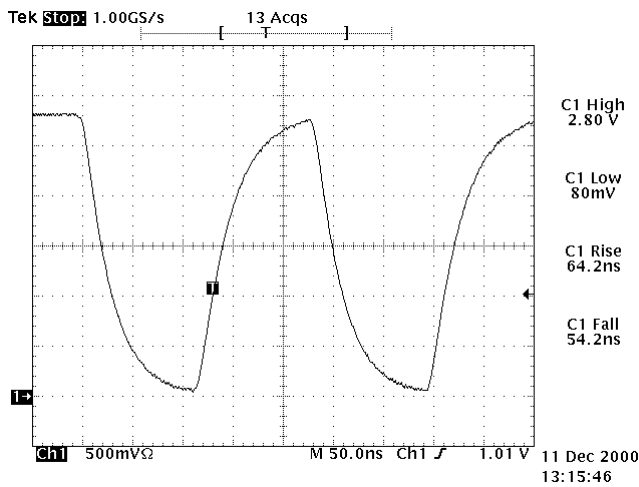


Figure 65. LCDDA0–LCDDA11 signals on the pin header on JC4. The pins are 5, 7, 19, 20, 22–24, 26, 36–39.

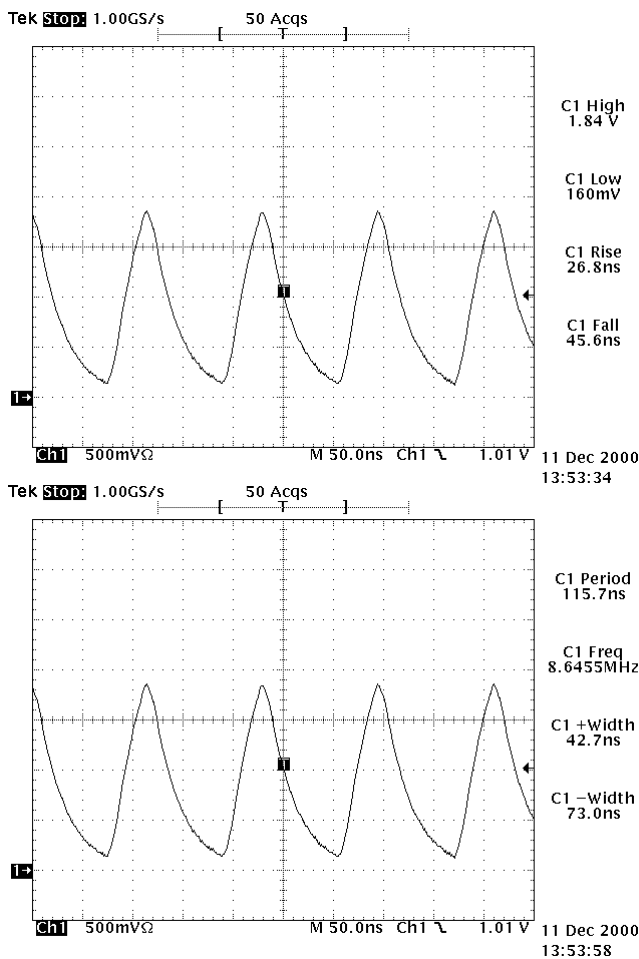


Figure 66. DispClk signal at pin 2

DispClk signal (Figure 66) at pin 2. Use at least 1MΩ probe for this. Note: The more critical values are high 1.8V, frequency 8.645MHz and +Width 42ns. If the signal high time is too small, it will cause errors.



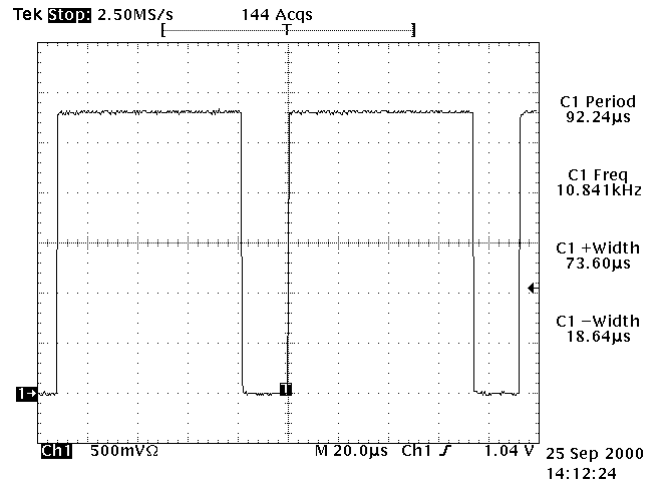


Figure 67. LLCLK signal at pin 40.

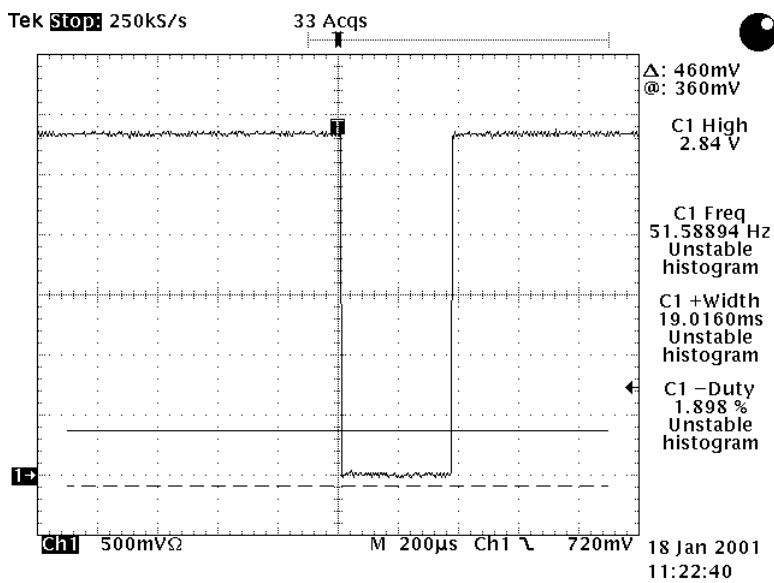
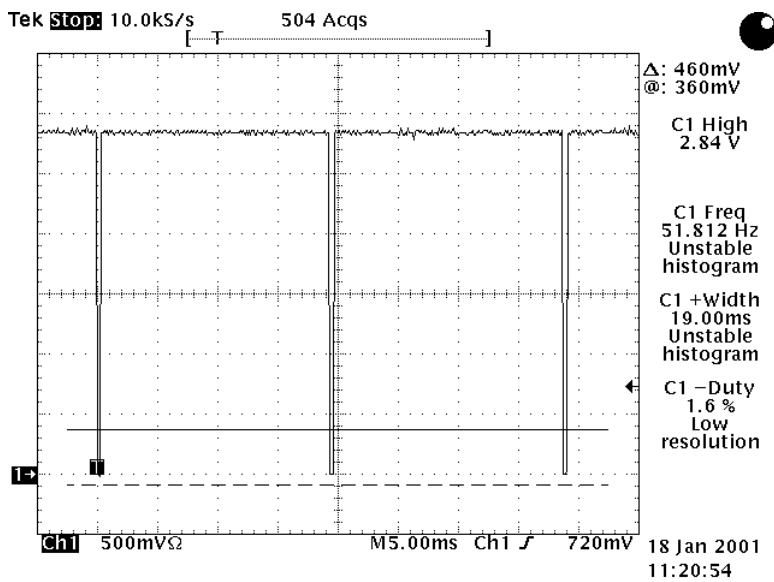


Figure 68. FSP signal at pin 4.

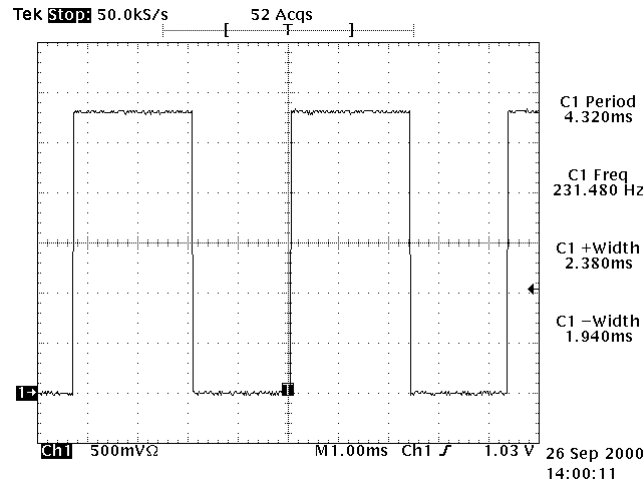


Figure 69. BackPWM signal at pin 31

This signal (Figure 69) is a PWM control for display backlight. The pulse width varies and is constant high for maximum intensity.

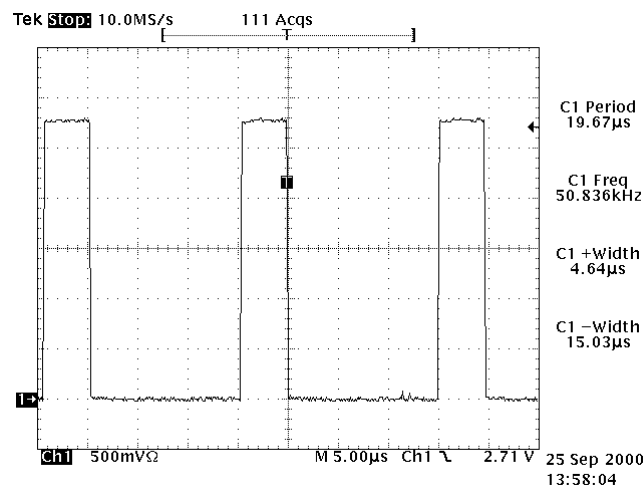


Figure 70. LCDPWM signal at pin 10.

This signal (Figure 70) is a PWM control for display contrast. The pulse width may vary significantly.

Table 3: List of display signals

Table 3. List of display signals

Display Signal	JC4 pin no.	Display Signal	JC4 pin no.
LCDDa0	5	LCDDa10	39
LCDDa1	26	LCDDa11	7
LCDDa2	24	DispClk	2
LCDDa3	38	LLClk	40
LCDDa4	20	FSP	4
LCDDa5	36	DISPON	3

**Table 3. (continued) List of display signals**

Display Signal	JC4 pin no.	Display Signal	JC4 pin no.
LCDDa6	37	LCDM	18
LCDDa7	22	LCD_PWR	6
LCDDa8	19	LCDPWM	10
LCDDa9	23	BackPWM	31

**Table 4. CSP filters and PDA UI signals**

Z400	Z401	Z402	Z403	Z404
DispClk	LCDDa11	LCDM	LCDDa1	BackPWM
LCDDa5	LCDPWM	LCDDa8	LCDDa2	
DISPON		LCDDa4	LCDDa9	
LCDDa6		LCDDa7		
FSP				
LCDDa3				
LCDDa0				
LCDDa10				
LCD_PWR				
LLClk				

**2.24 KL8 related CMT UI problems**

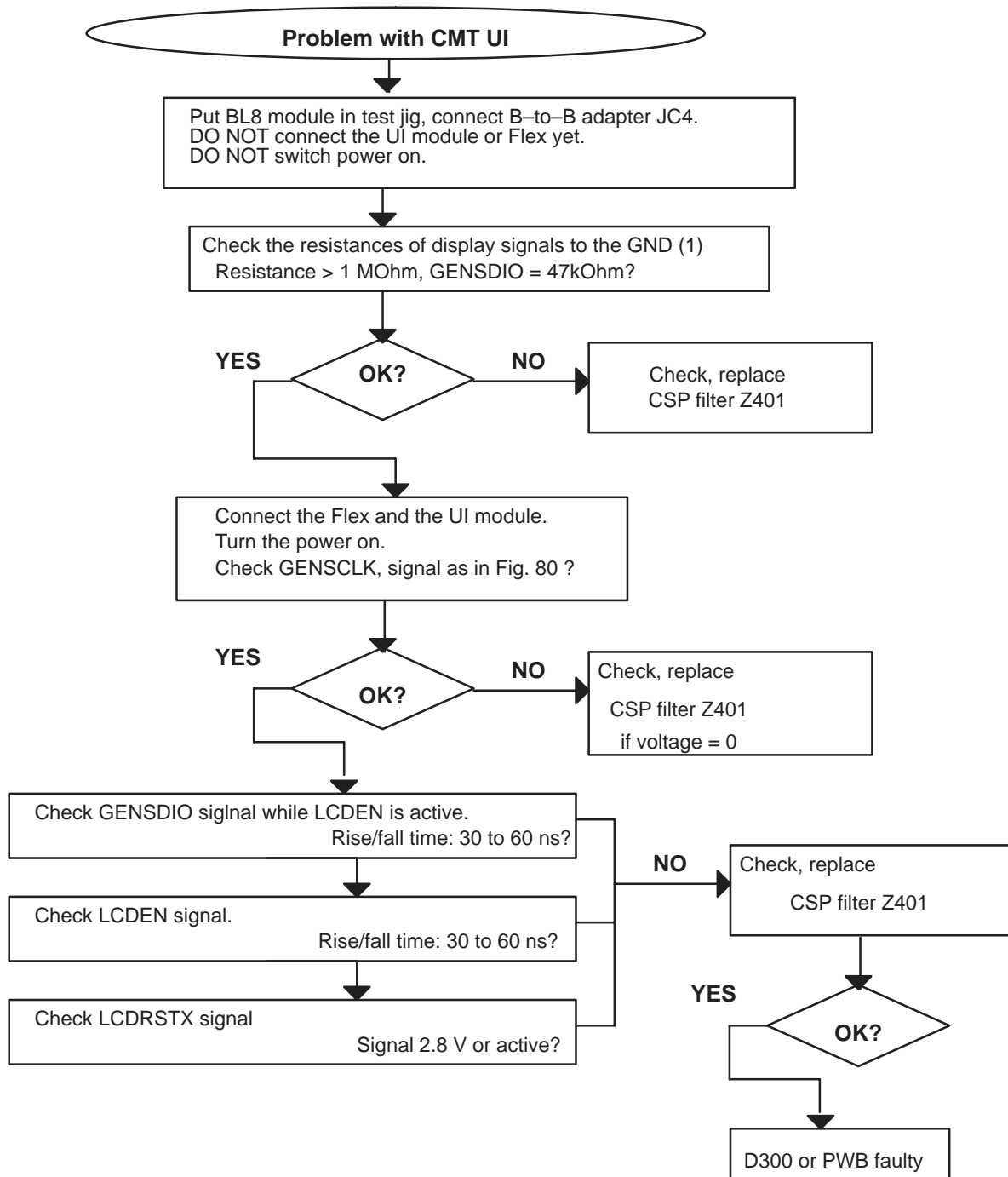


Figure 71.

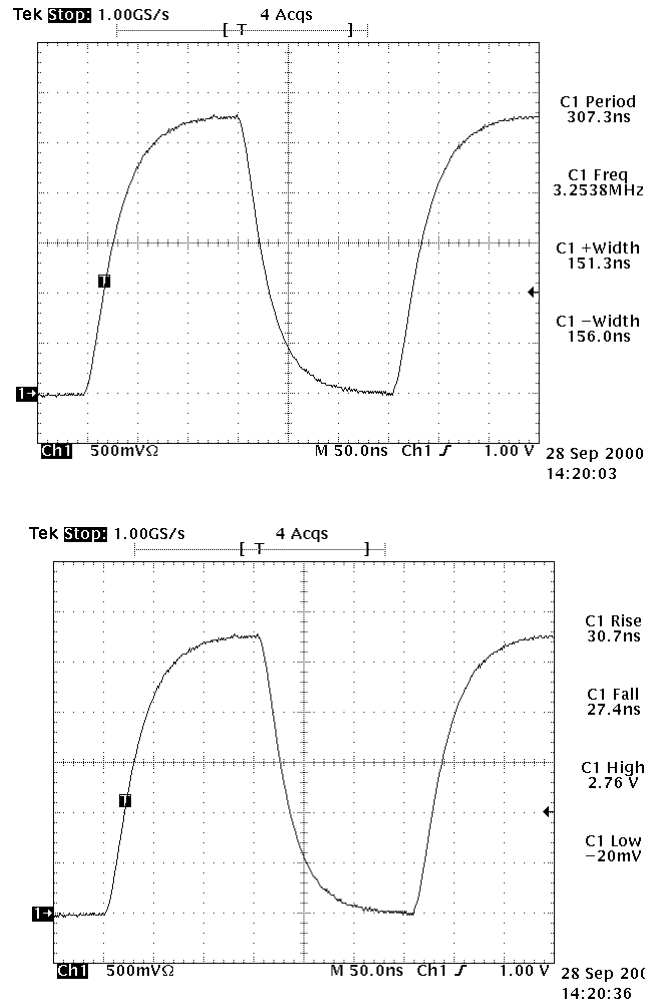


Figure 72. GENSCLK signal.

GENSCLK signal (Figure 72 ). It should look like this when LCDEN signal is active. There is also a 2.16MHz clock signal, but it is targeted for CCONT.

Table 5. Signals and pins

Signal	Pin no.
LCDEN	12
GENSDIO	9
GENSCLK	11
LCDRSTX	14

Table above: Signals and corresponding pins.

### 3 DL1 UI Troubleshooting

#### 3.1 CMT and keypad illumination problems

Each CMT–display and keypad LED has its own driver. If there is problems with one or more

– Keypad–LED: check resistors R203–R208, transistors V213, V203, V204 and the LEDs.

– CMT–LED: check resistors R200–R202, transistor V206 and the LEDs.

If the illumination does not work at all, measure voltages VB and KBLIGHTS. VB should be the same as VBATT and KBLIGHTS approximately 2.5V when the LEDs are supposed to be on. If these voltages are not correct, problem is in hinge flex, connector X001 or on KL8 (see 2.23 in this document).

#### 3.2 CMT LCD Troubleshooting

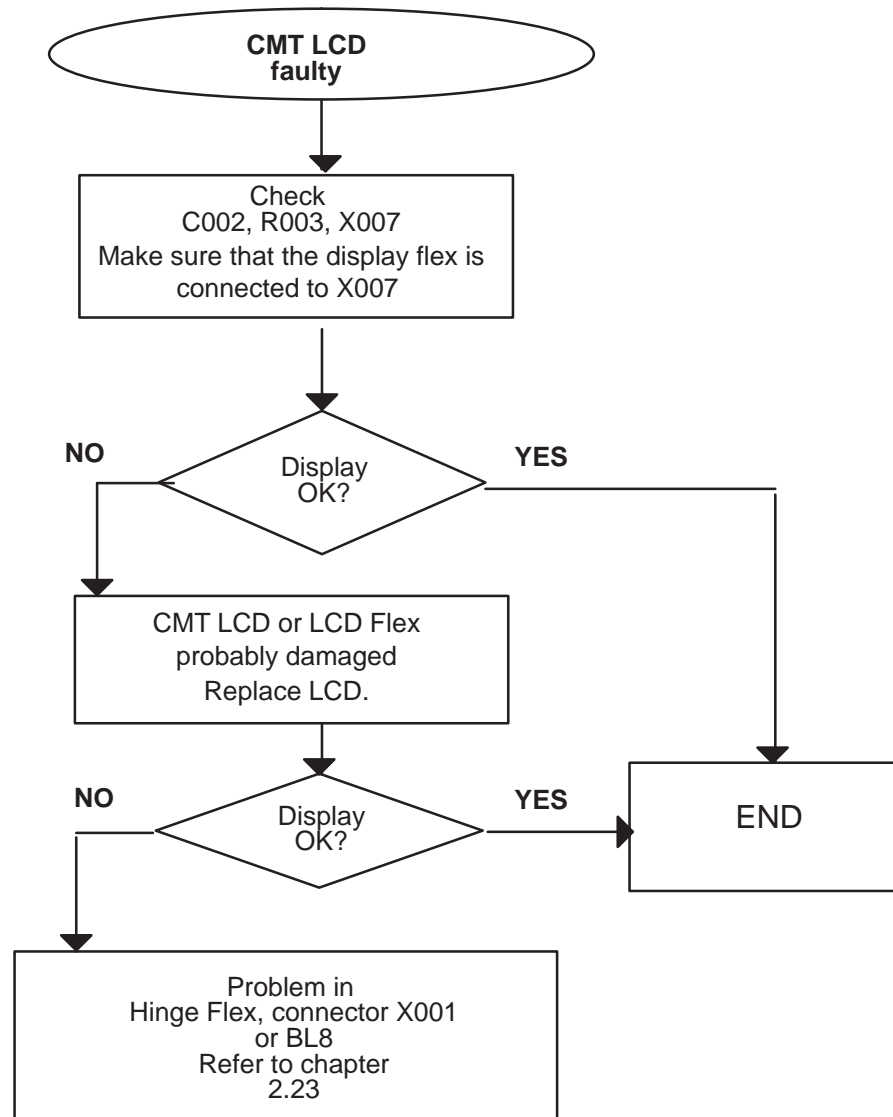


Figure 73.

### 3.3 No picture on PDA LCD or picture is faulty

To start with, check that the flex connector (X001) from KL8 to UL2 is connected properly and that soldering joints are ok.

Check also connectors X002 and X003. Check that PDA display is not mechanically damaged, i.e. pixels missing.

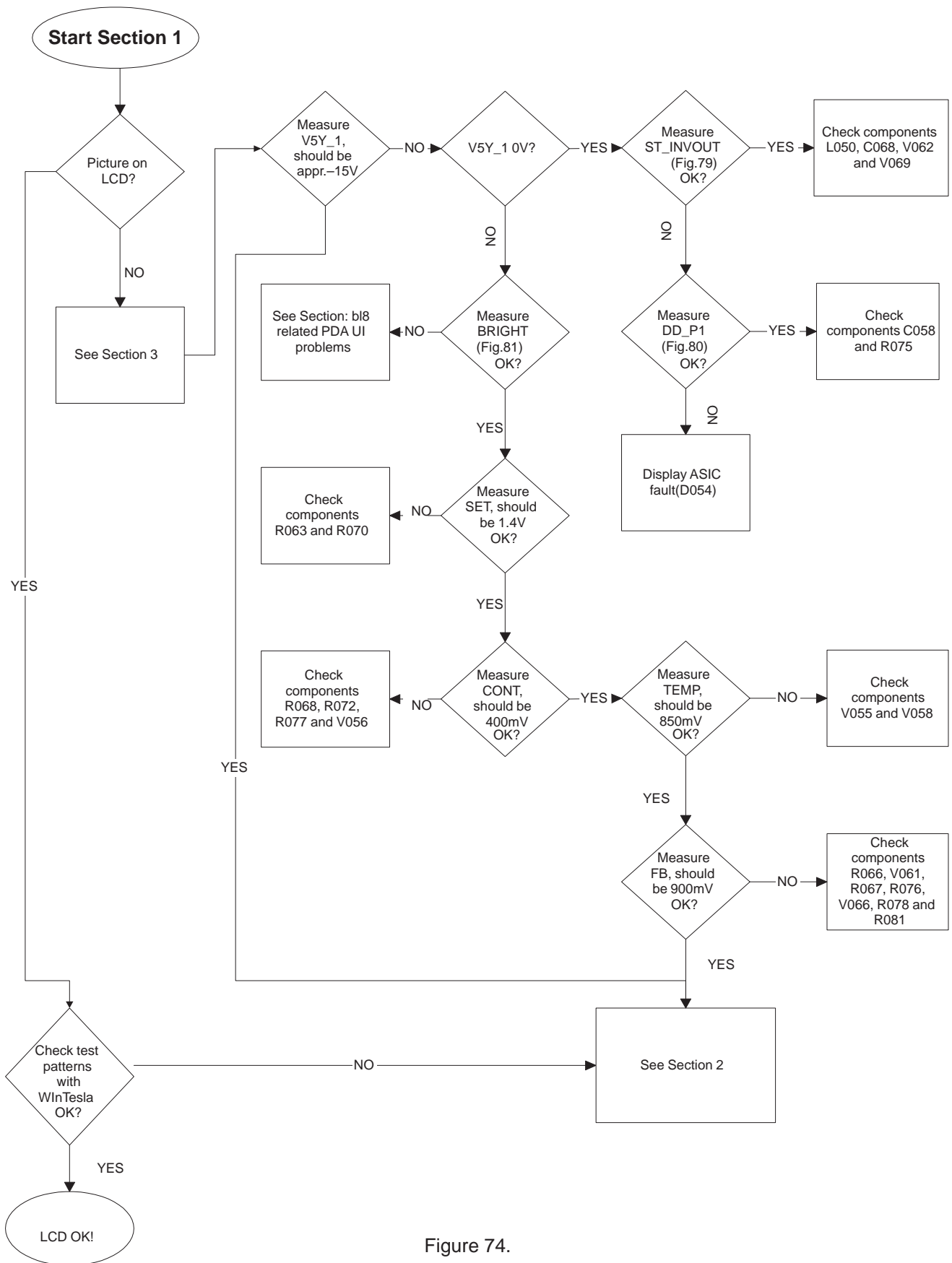


Figure 74.



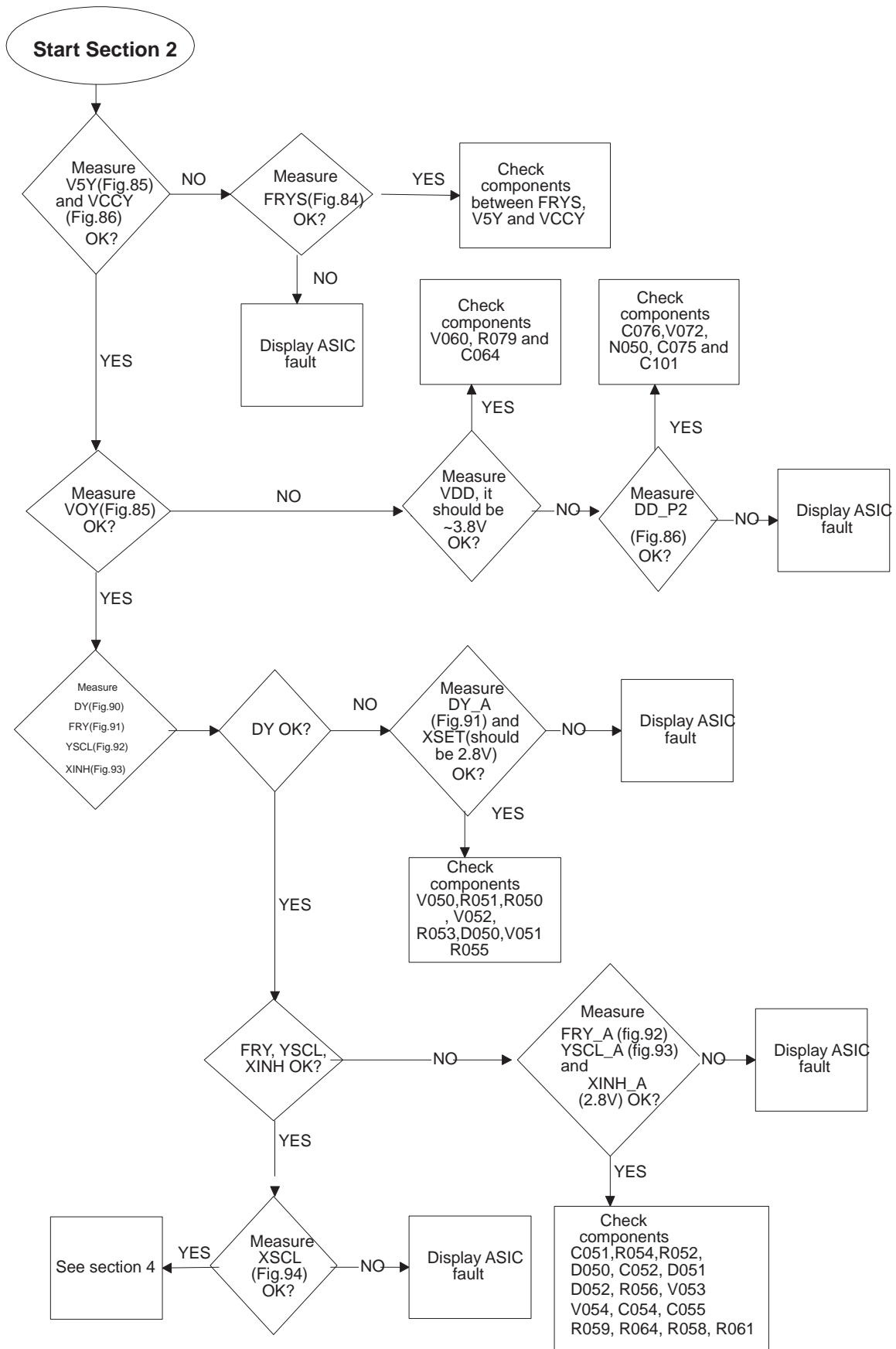


Figure 75.

NOTE!! See section 2.23. There are all the relevant pictures of the signals mentioned below. Measure these signals from UL2 side. This is to make sure that the problem is not in KL8 side.

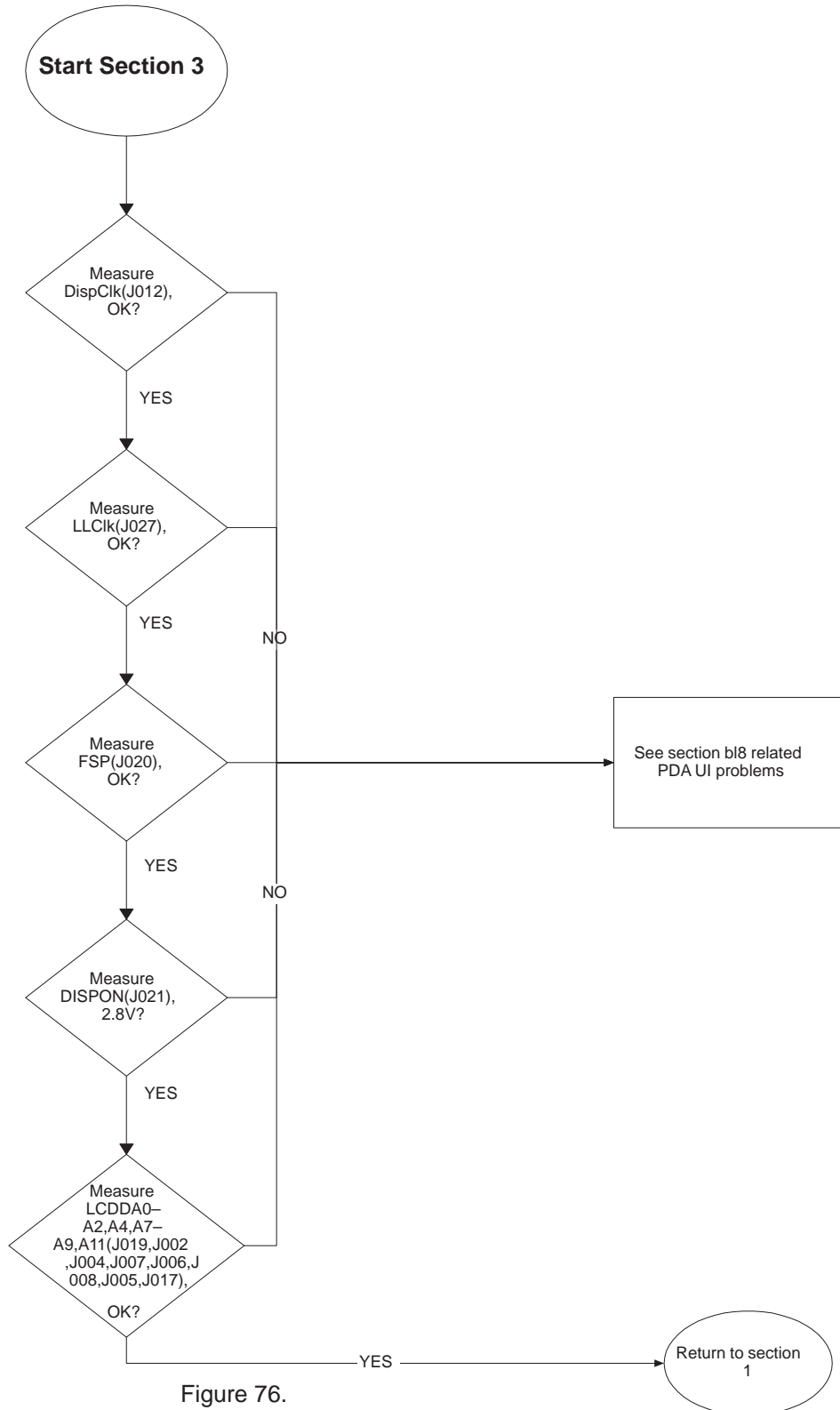


Figure 76.

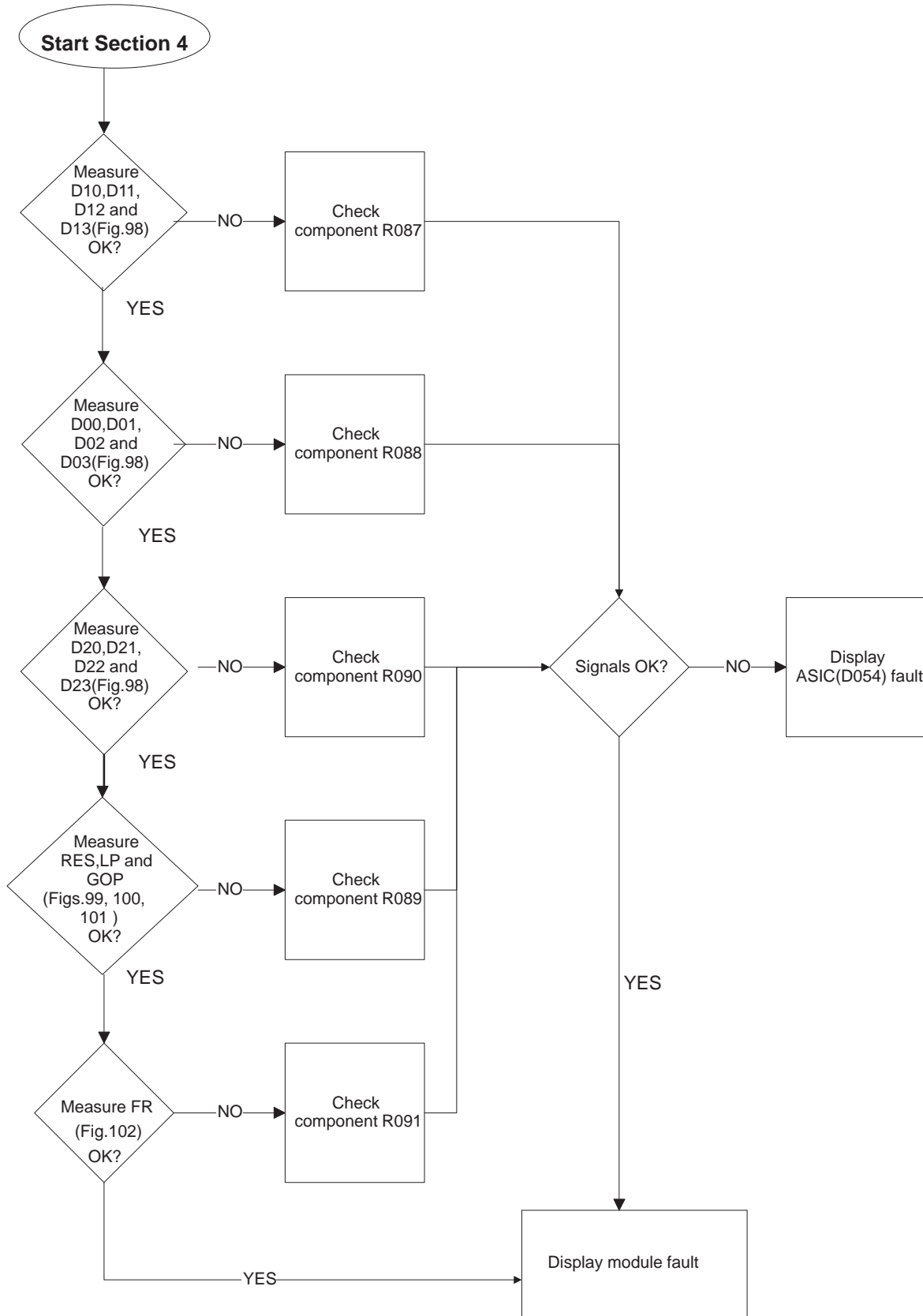


Figure 77.

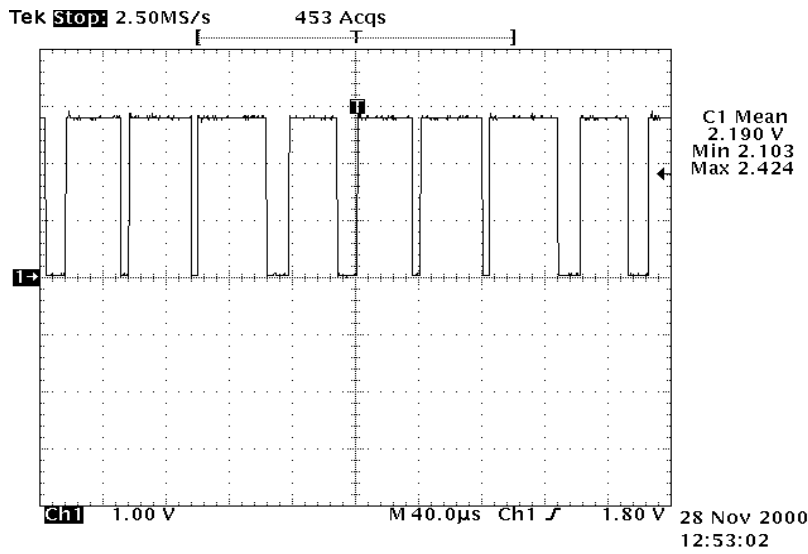


Figure 78. ST\_INVOUT signal

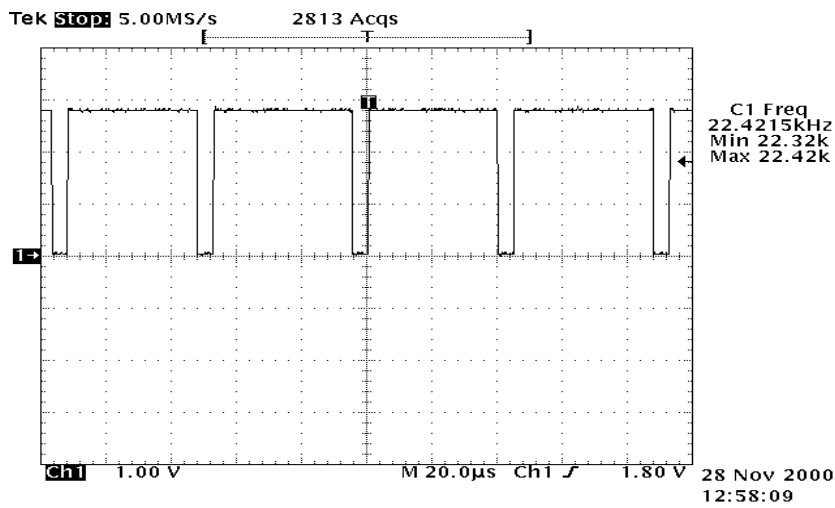


Figure 79. DD\_P1 signal

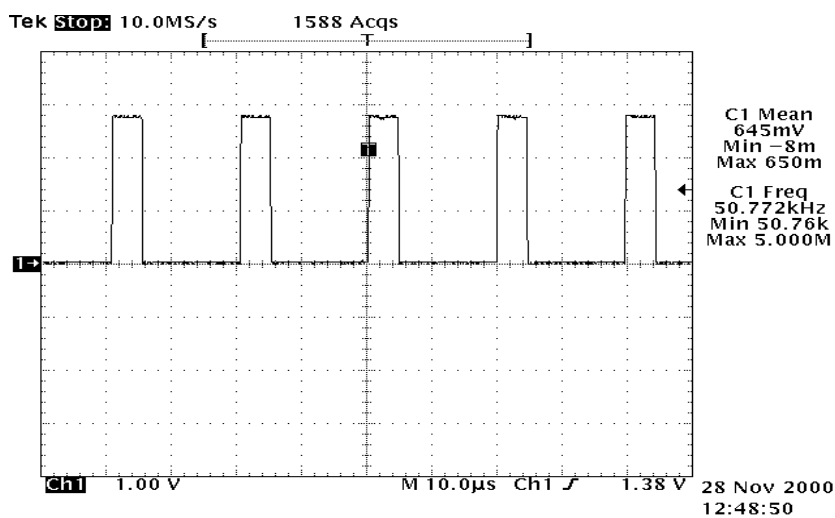


Figure 80. BRIGHT signal

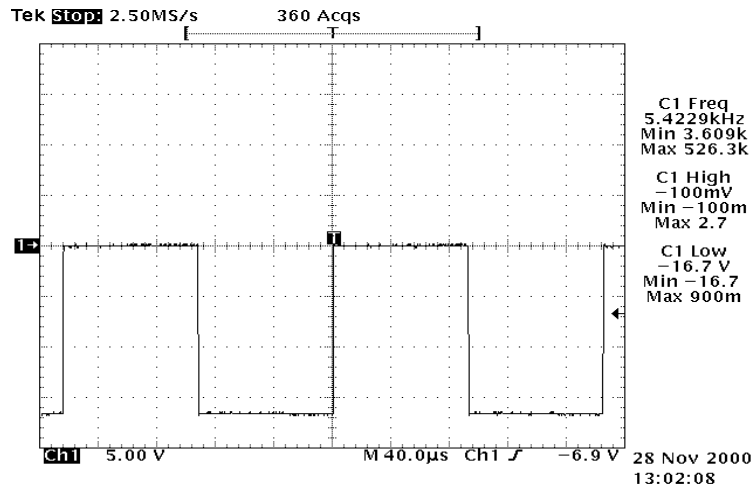


Figure 81. V5Y signal

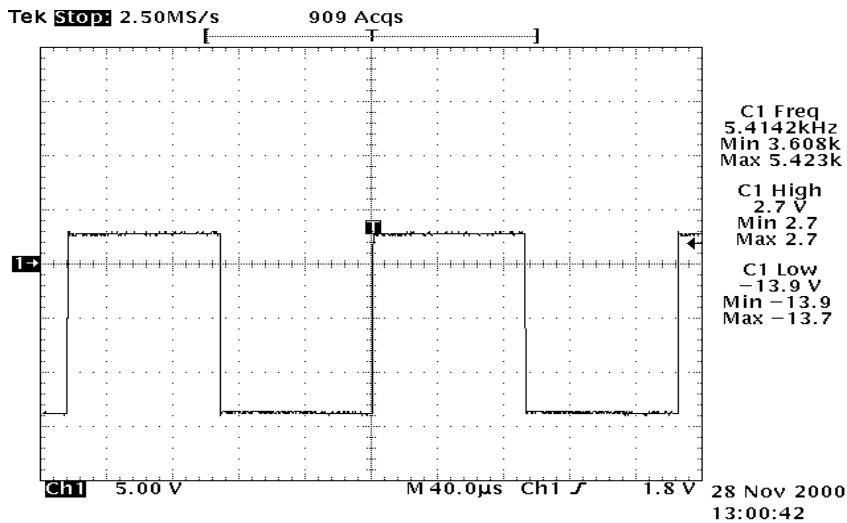


Figure 82. VCCY signal

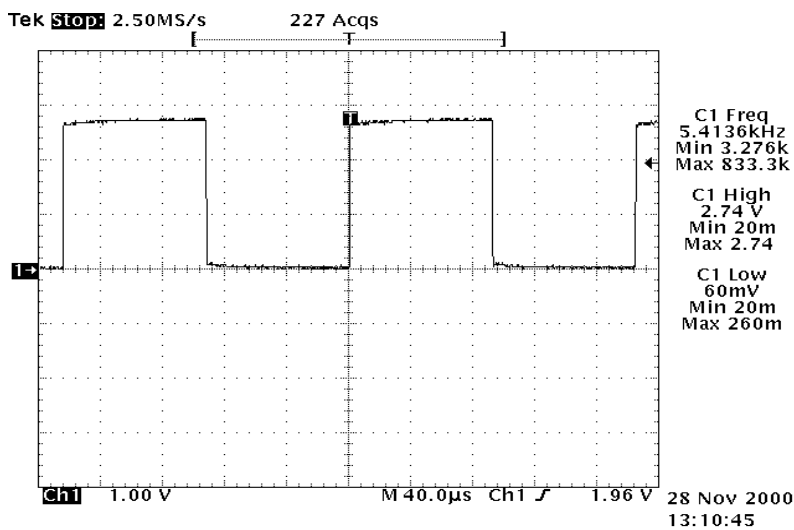


Figure 83. FRYS signal

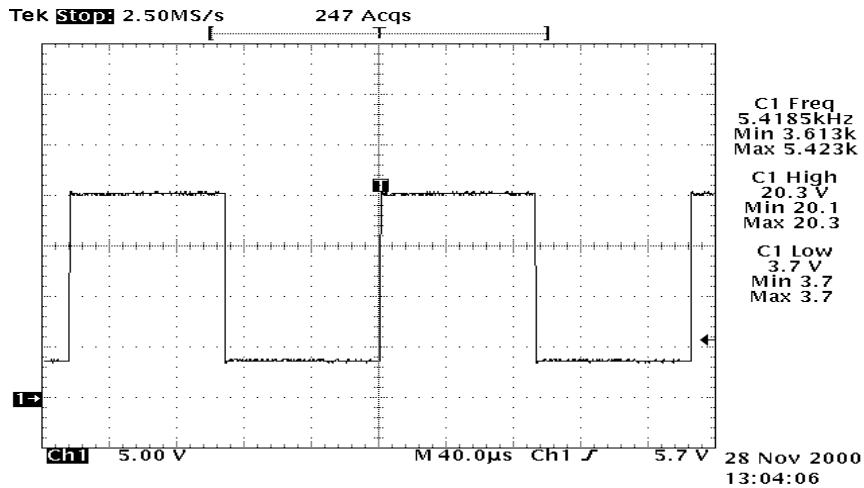


Figure 84. VOY signal

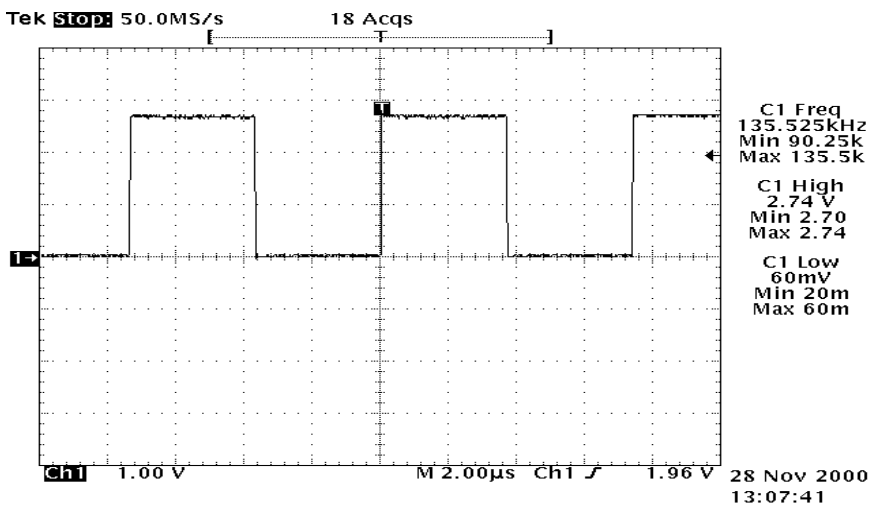


Figure 85. DD\_P2 signal

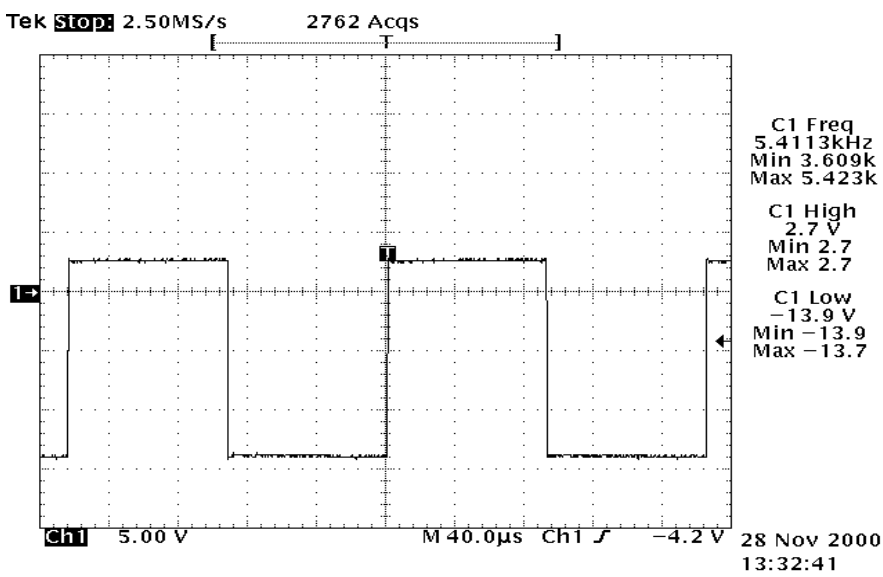


Figure 86. DY signal

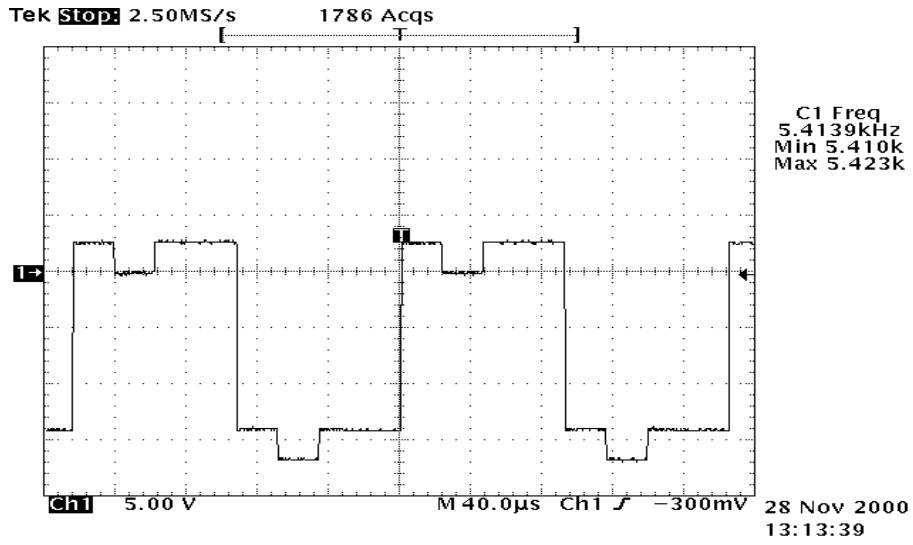


Figure 87. FRY signal

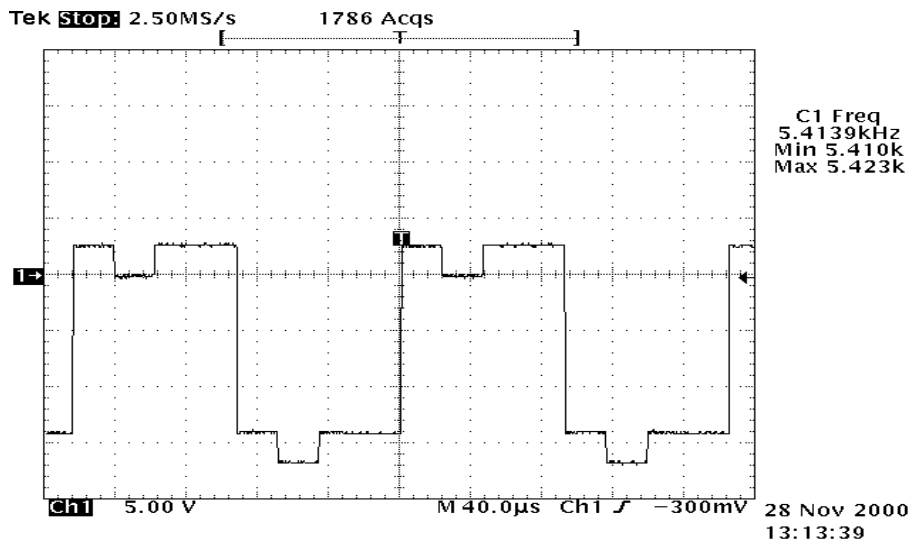


Figure 88. YSCL signal

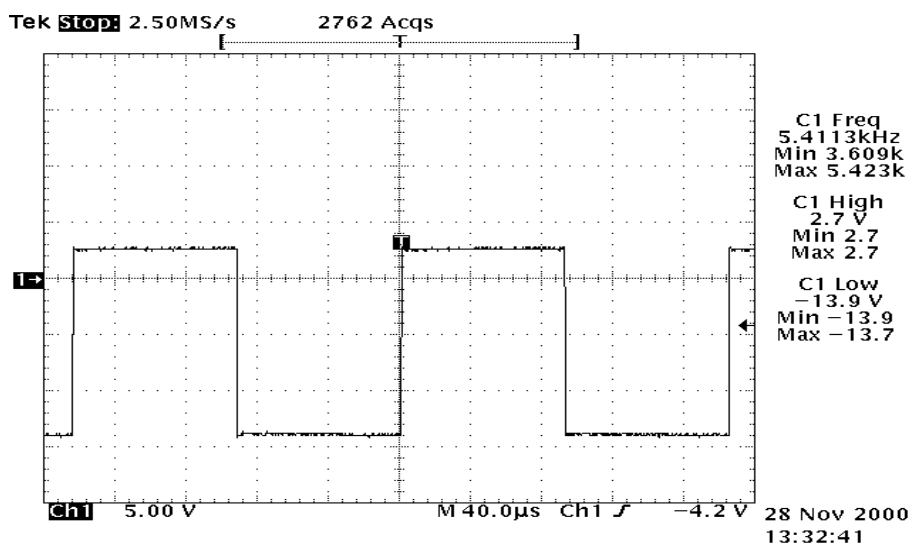


Figure 89. XINH signal

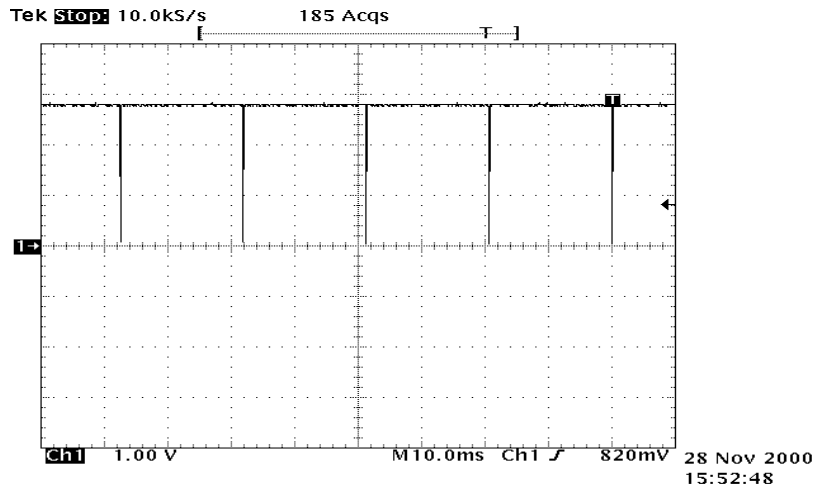


Figure 90. DY\_A signal

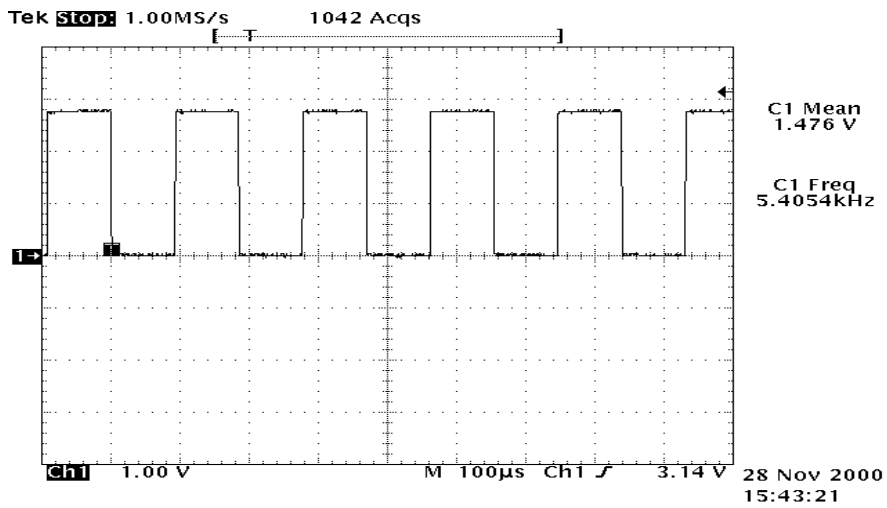


Figure 91. FRY\_A

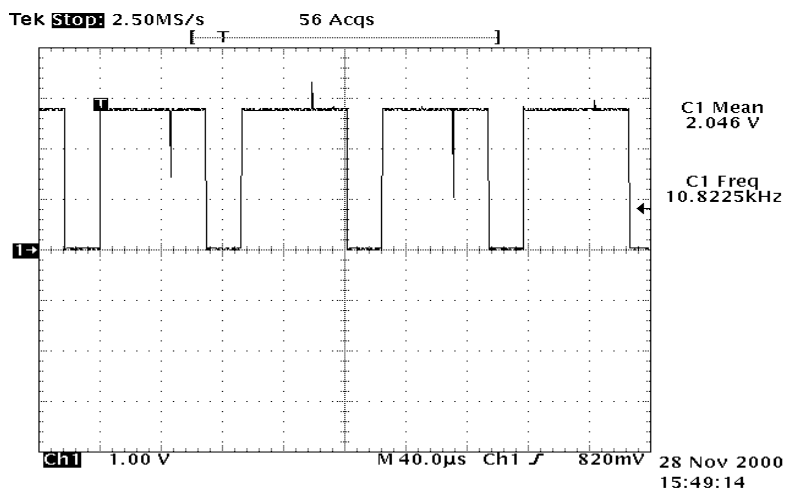


Figure 92. YSCL\_A signal



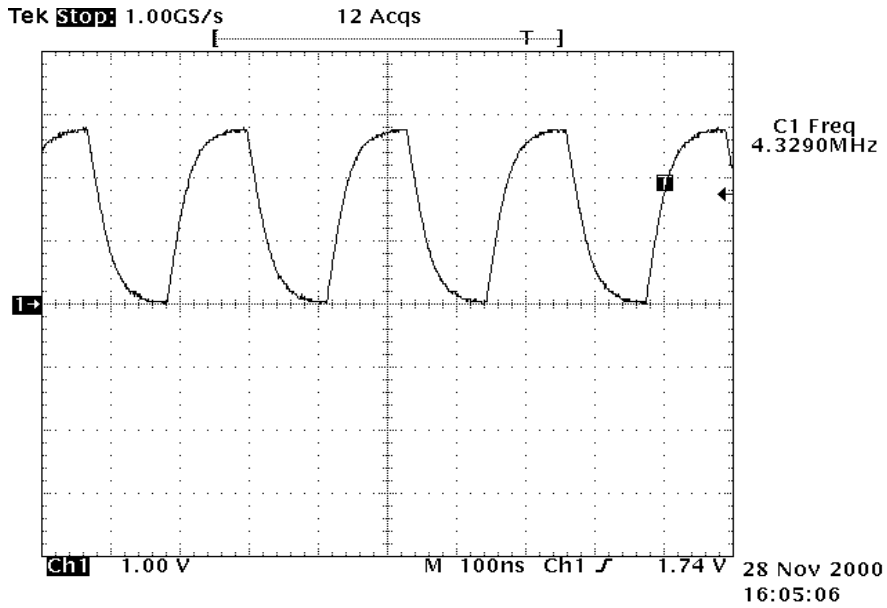


Figure 93. XSCCL signal

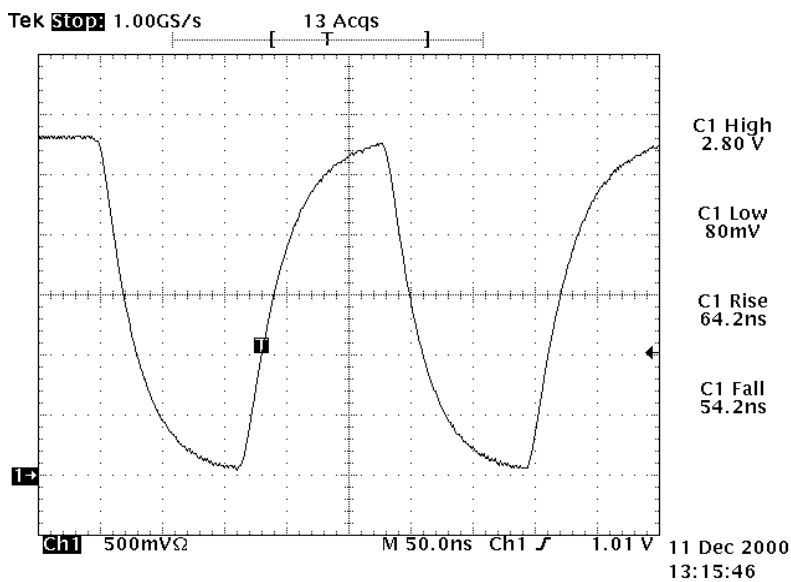


Figure 94. Data signal

**(Note!!** There should be constant activity in the datalines and signals should look something like this.)

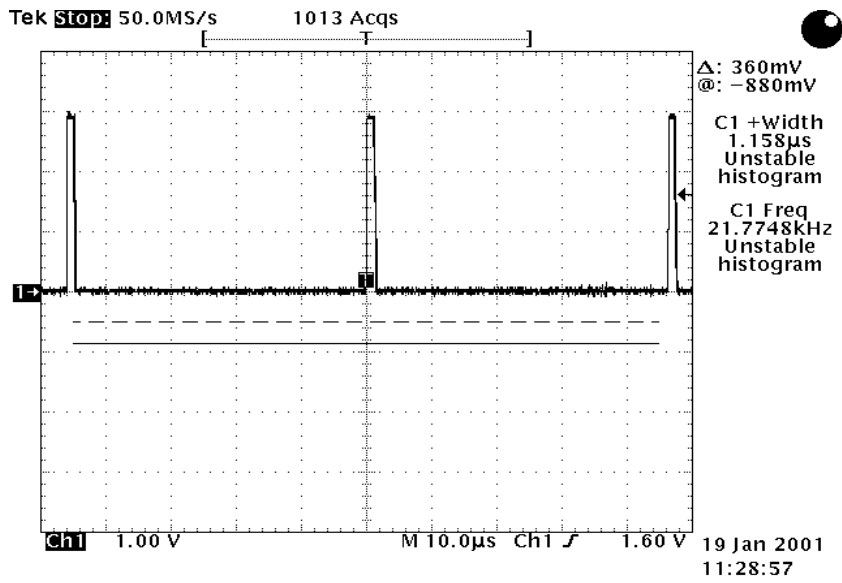


Figure 95. RES signal

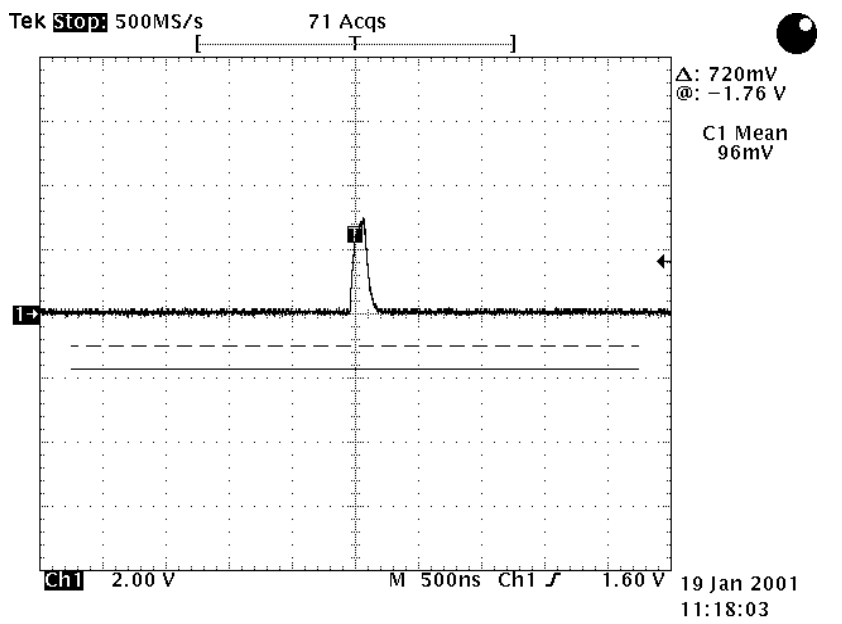


Figure 96. GOP signal

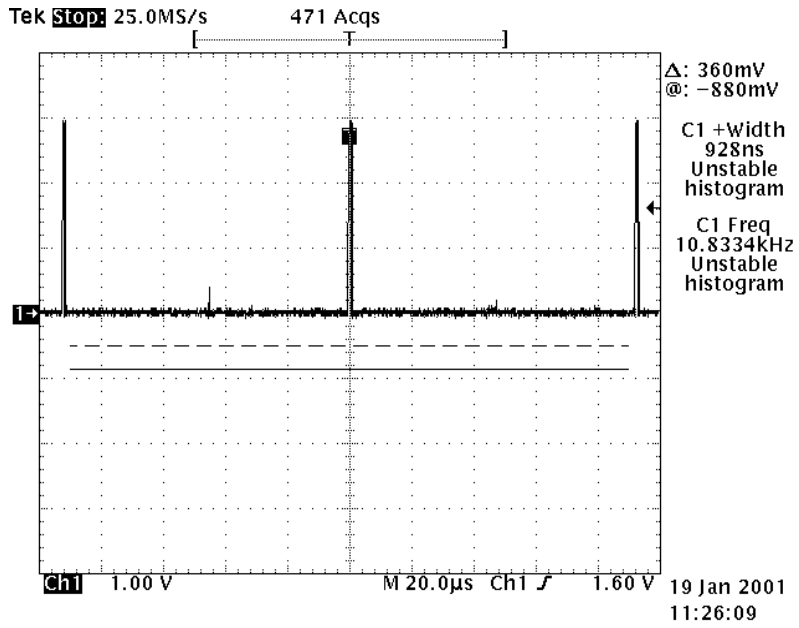


Figure 97. LP signal

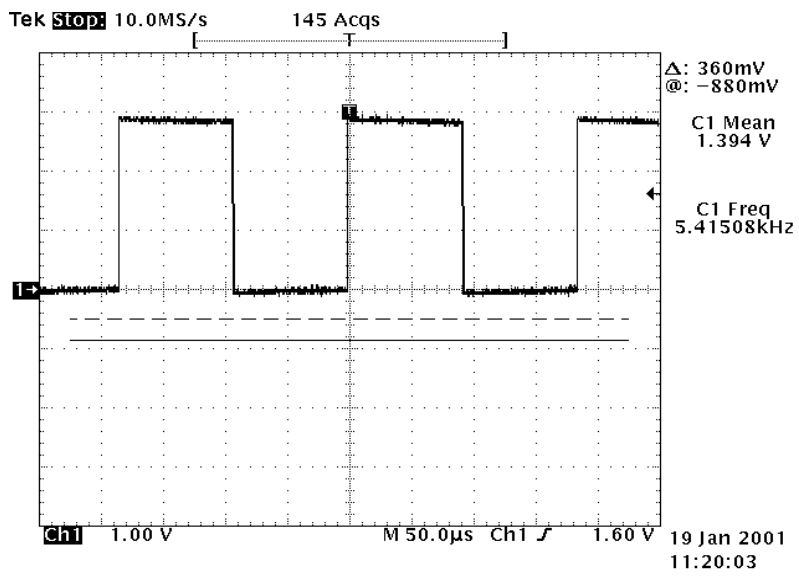
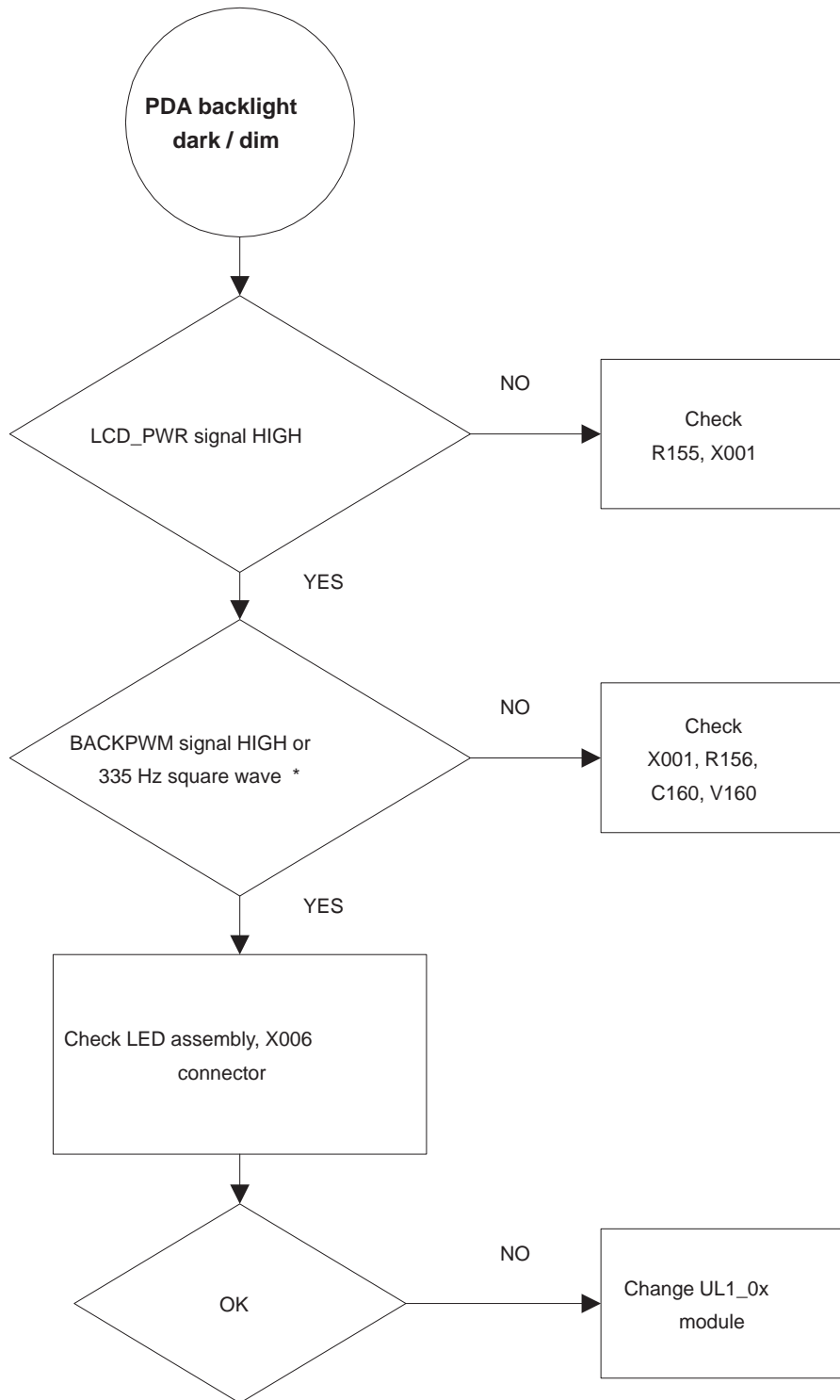
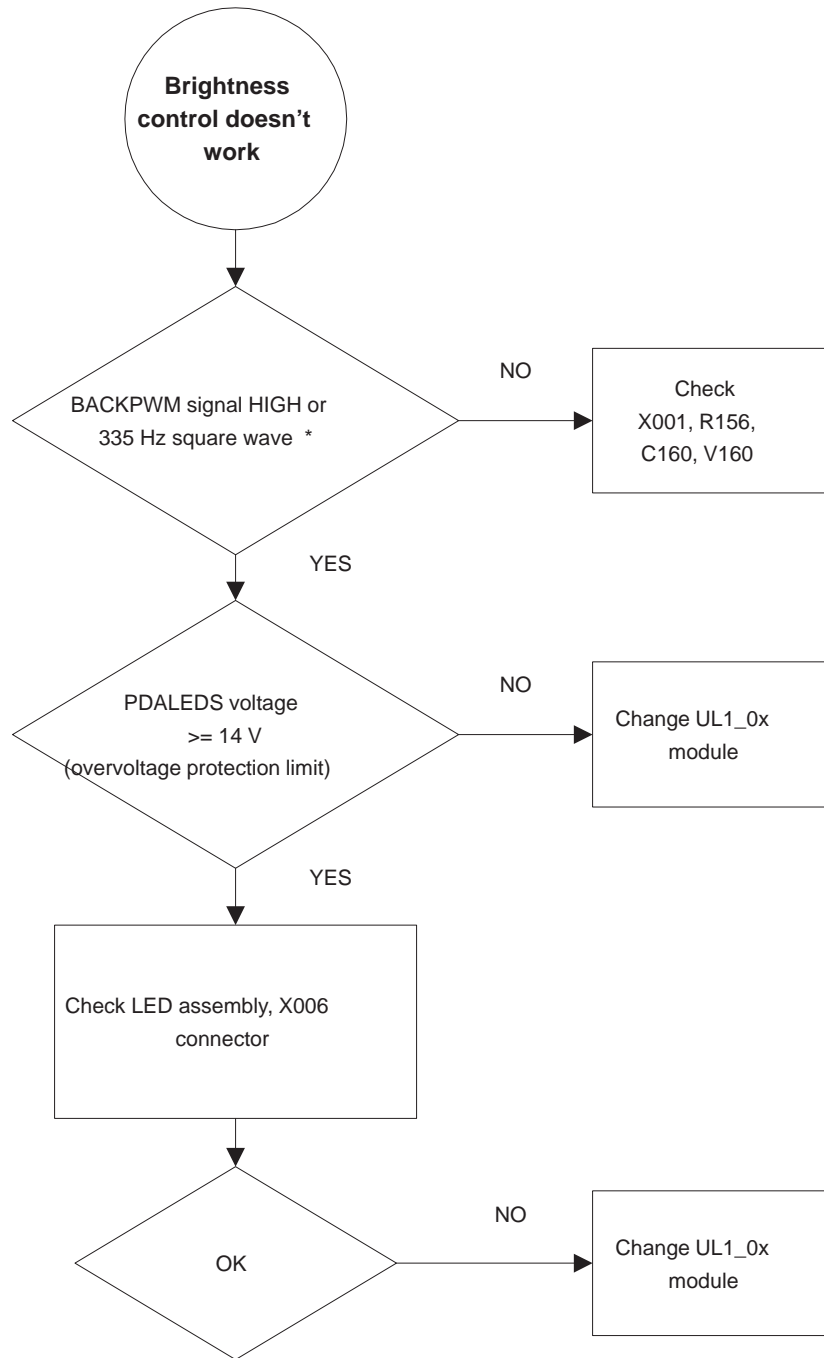


Figure 98. FR signal

### 3.4 Backlight troubleshooting





\* Note! BACKPWM signal HIGH when maximum brightness level setting.

### 3.5 DL1 related keyboard problems

1. Check the 50-way connector solderings and general condition
2. Check PDA softkey switches S250, S251, S260, S261
3. Check keyboard line capacitors C250–C263 (14 pieces) for shorts and breakages
4. Check the key pads for short circuits or dirt. Measure the resistance of each row against all columns and all rows and columns against ground. (Disconnect the 50-way connector first). Result should be > 1Mohm for all combinations.

## 4 UL 8 FLEX related

### 4.1 Audio troubleshooting

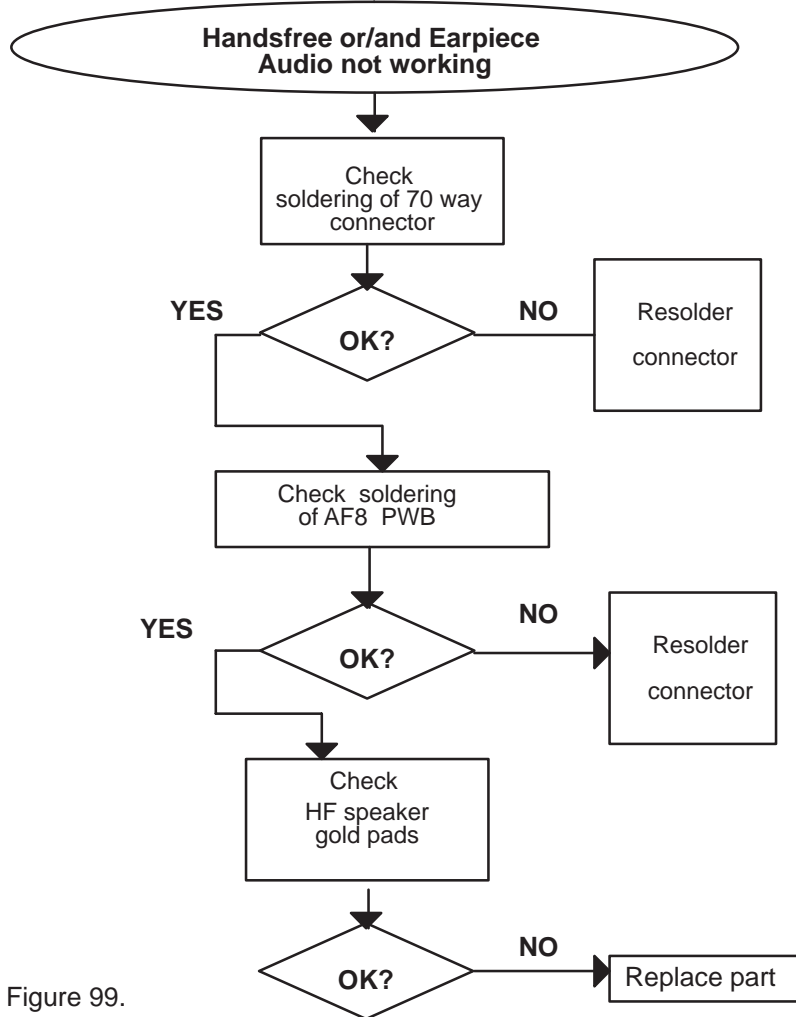


Figure 99.

AF 8 illustrated below (Figure 100).

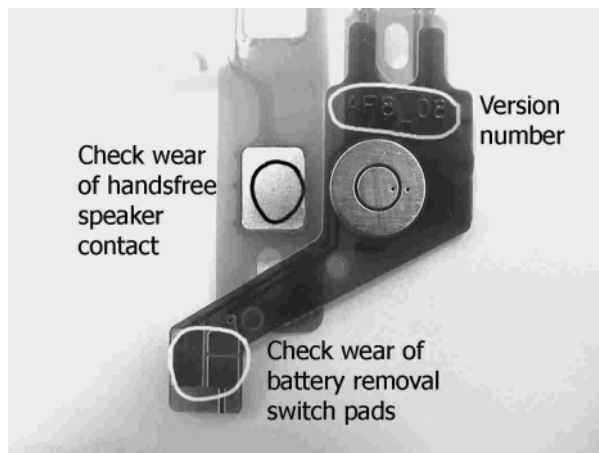


Figure 100. AF8

### 4.2 Display problem

PDA or CMT displays are missing lines or columns, or are not synchronised

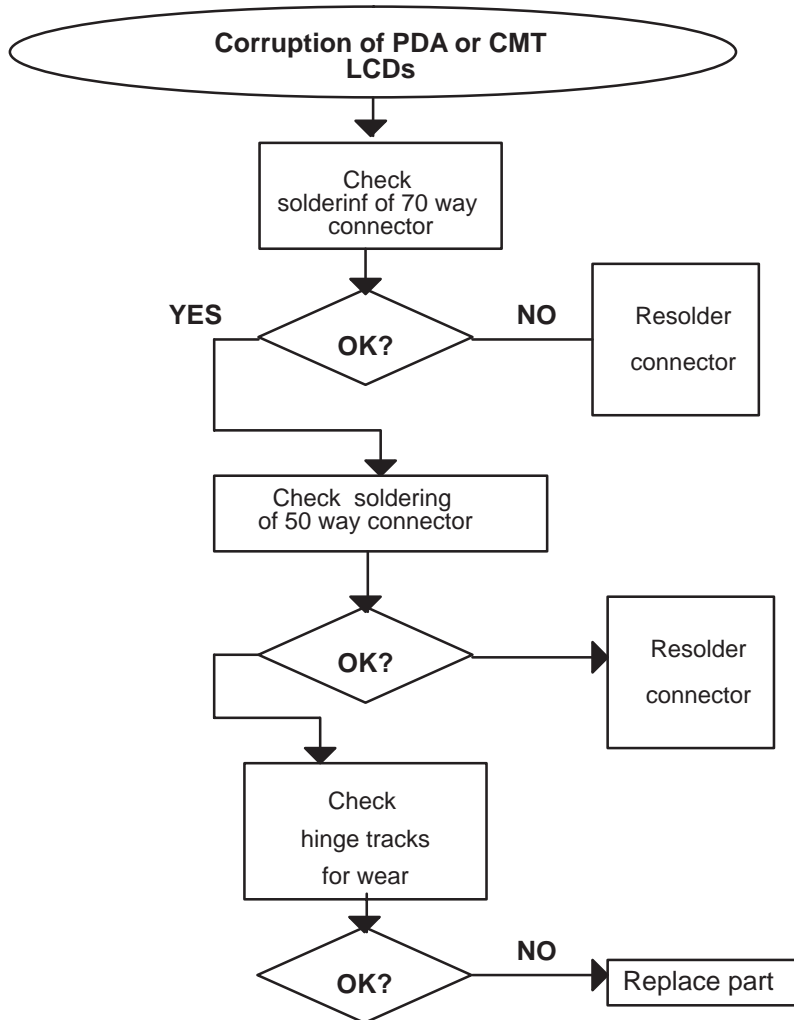


Figure 101.



### 4.3 Battery Removal Switch problem

If the battery removal switch is not functional, check AF 8 for wear, illustrated below. (Check that the RAE-3 software supports the battery removal switch feature.)

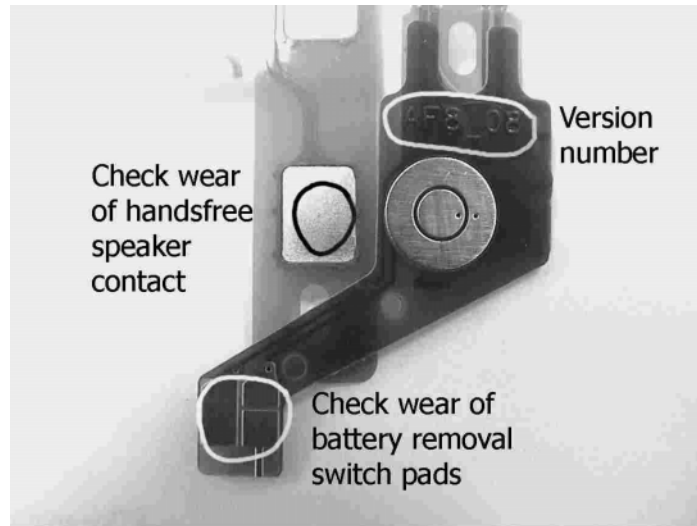


Figure 102. AF8

### 4.4 UL8 related keyboard problems

1. Check the 70-way and 50-way connector solderings and general condition. Re-solder if fault found.
2. Check the keypad surface for short circuits or dirt.
3. Replace the flex.

## 5 RF related troubleshooting

### Introduction to RF troubleshooting

Measurements must be done using Spectrum Analyzer with high–frequency high–impedance passive probe (LO–/reference frequencies and RF–power levels) and Oscilloscope with a 10:1 probe (DC–voltages and low frequency signals).

The RF–section is build around one ASICS Hagar (N505). For easier troubleshooting, this RF troubleshooting document is divided into sections.

Before changing Hagar, please check the following things: Supply voltages are OK and serial communication are coming to Hagar.

Please note that the grounding of the PA–module is directly below PA–module so it is difficult to check or change. **Most RF semiconductors are static discharge sensitive!** So ESD protection must be taken during repair (ground straps and ESD soldering irons). Hagar are moisture sensitive so parts must be pre–baked prior to soldering.

Apart from key–components described in this document here are a lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done by checking if soldering of the component is done properly, for factory repairs (checking if it is missing from PWB). Capacitors can be checked for shortening and resistors for value by means of an ohmmeter, but be aware in–circuit measurements should be evaluated carefully.

Please be aware that all measured voltages or **RF levels in this document are rough figures**. Especially RF levels varies due to different measuring equipment or different grounding of the used probe.

5. RF related :

- 5.1 EGSM receiver
- 5.2 PCN receiver
- 5.3 EGSM transmitter
- 5.4 PCN transmitter
- 5.5 Synthesizer
- 5.6 Frequency lists

### RF Key Component Placement

Figure 103. Parts placement 1

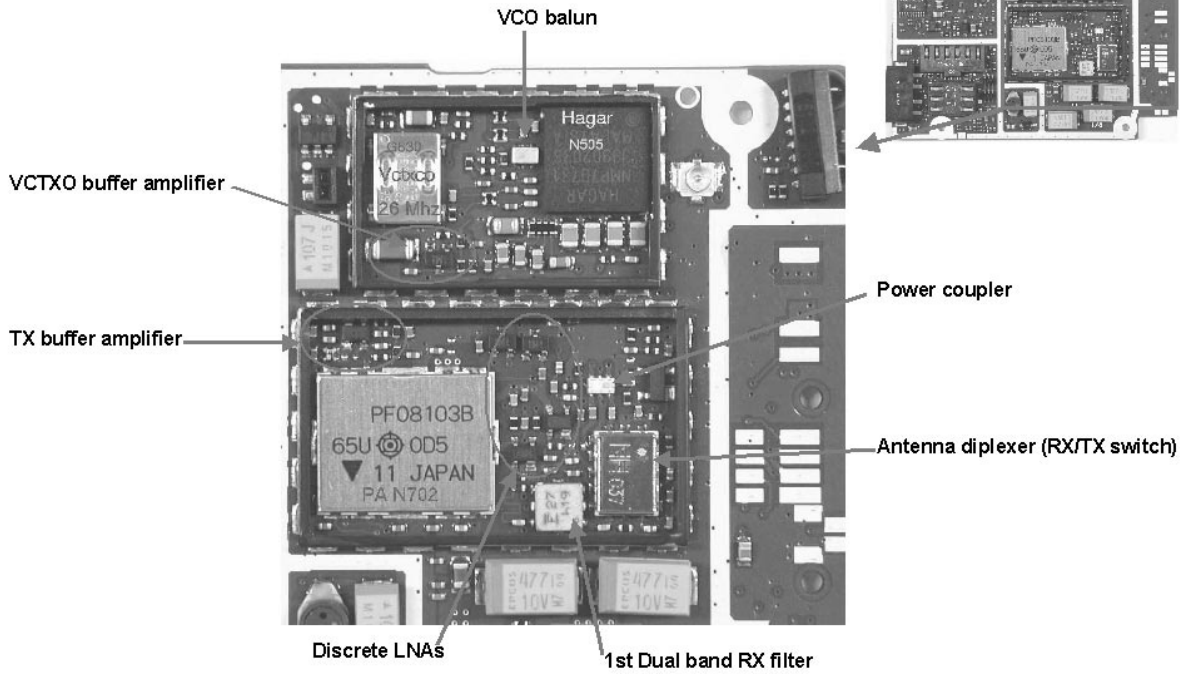
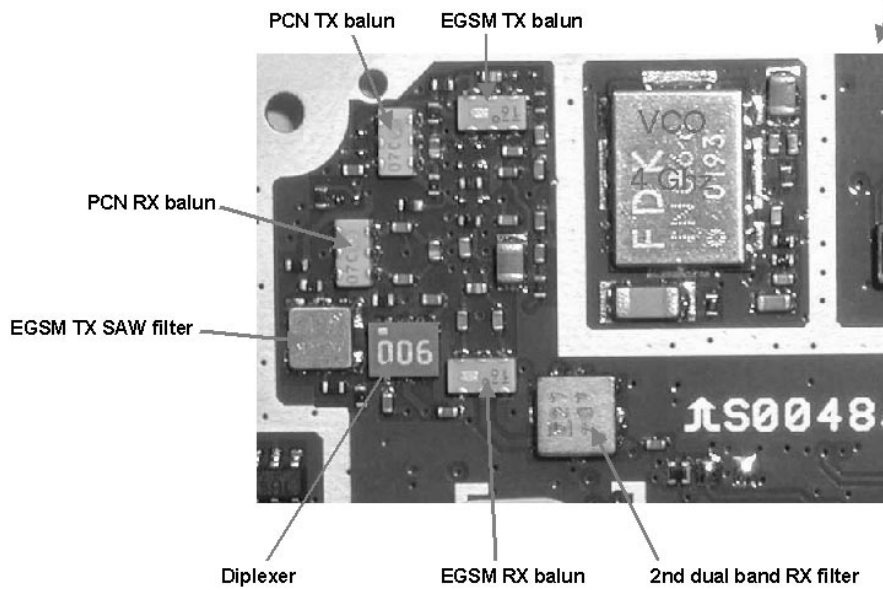


Figure 104. Parts placement 2



### 5.1 EGSM Receiver

#### General Instructions for troubleshooting for EGSM RX

- Select Product Alt+p
  - ..... Open...
  - RAE-3NU\*
- 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: 8
  - Multislot on Alt+u, (if on remove checkmark)
  - Apply

The set-up should now look like this (Figure 105):

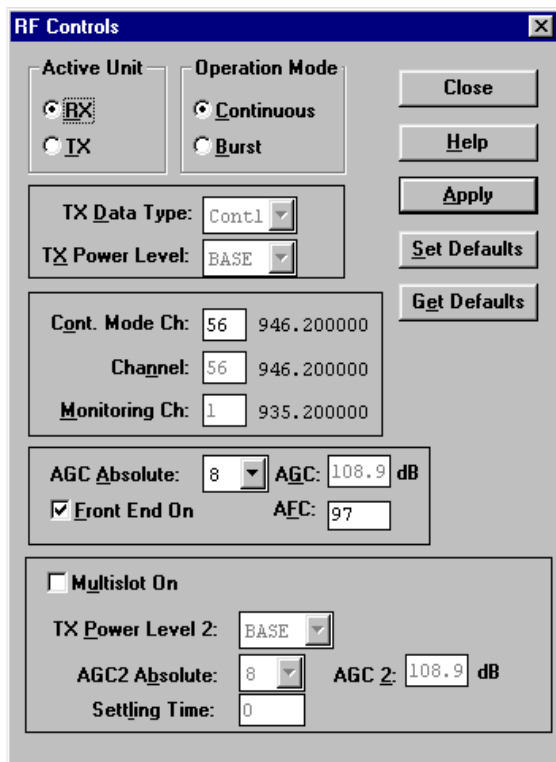


Figure 105.

Apply a 947.06771MHz (channel 60 + 67.710kHz offset) -95 dBm signal to the RF-connector (remember to compensate for cable attenuation).

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

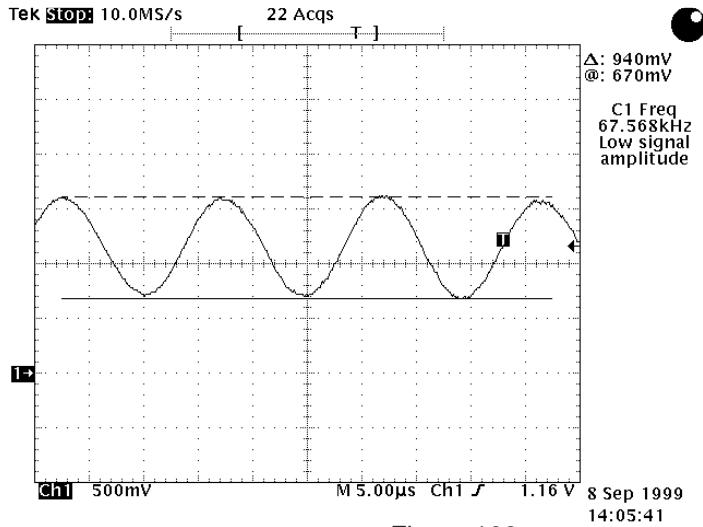


Figure 106.

Signal amplitude 390mV p-p  
 DC offset 1,1V  
 Frequency 67kHz

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

5.1.1 Troubleshooting diagram for EGSM Receiver

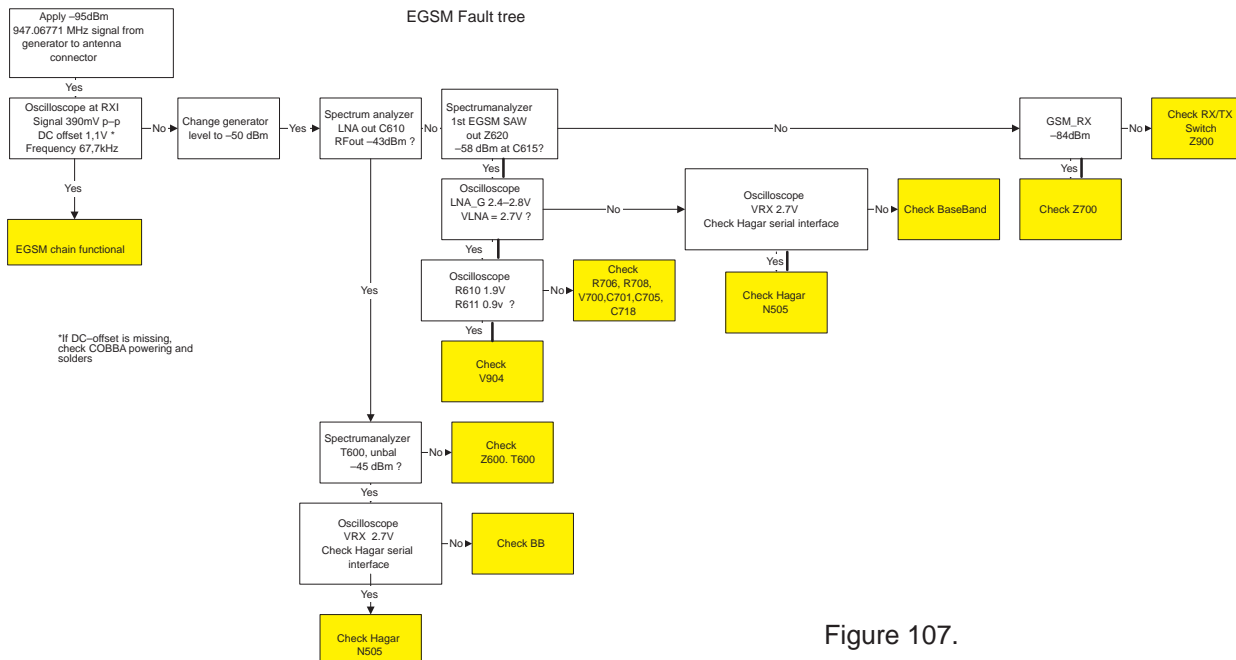


Figure 107.

Note: RF levels measured with HP85024A RF probe.

### 5.1.2 EGSM Signal Path

For easy error tracing it is important to know the signal path of the EGSM receiver. The components can be grouped into blocks and drawn as shown below (Figure 108).

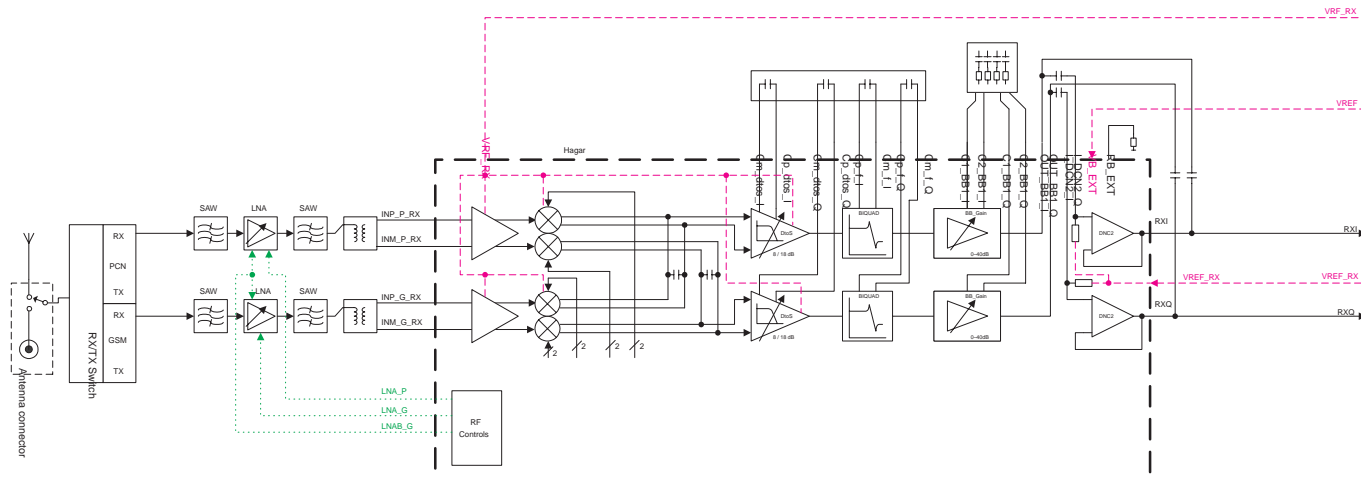


Figure 108.

### 5.1.3 RX/TX Switch

From the internal antenna connector (X499) the RF signal is lead to the RX/ TX switch (Z670) via a mechanical switch, the antenna connector (X450).

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

From GSM\_Rx the EGSM signal is feed to the 1<sup>st</sup> EGSM SAW filter via C614.

### 5.1.4 Front end

The EGSM front–end consists mainly of two SAW filters (Z620 and Z600) and one discrete LNA circuit (V904) in–between and finally one balun (T600). The SAW filters provides out–of–band blocking immunity, the LNA provides front–end gain and the balun provides a balanced signal for Hagar (N505)

The signal–path is through Z620 (In–band insertion–loss 3,5dB), through the matching circuit (C613, Z612, Z613) and to the EGSM LNA transistor base (V700, RFin).

The LNA has about 20dB gain when it is on (LNA\_G = 2.5V and VIna=2.8V). If the signal applied to the antenna–connector is more than –45dBm the AGC will gainstep the LNA (LNA\_G = 0V) which means the LNA Gain will now have negative gain (loss).

From the LNA transistor collector (V904 RF out) the signal is lead through the LNA–output–matching–circuit (R610, Z615, C610), through the 2<sup>nd</sup> EGSM SAW Z600 (In–band insertion–loss 3,5dB) to the EGSM balun T700. From the balun the signal is balanced and is lead to Hagar (N500 IMP\_GSM\_RX and INM\_GSM\_RX).

### 5.1.5 Hagar

The balanced RX signal is mixed with a signal from the local oscillator at the same frequency as the wanted RX signal. After mixing the signal is converted to a singleended signal in the DtoS (Differential to Singleended) amplifier. The signal is now filtered in a BIQUAD filter to provide channelseparation, amplified in the BB\_Gain amplifier and DC compensated in DCN2.

## 5.2 PCN Receiver

### General Instructions for troubleshooting for PCN RX

Connect the phone to a PC with a DAU–9P cable

Start Wintempla–Service–Software and

Select Product Alt+p

Open...

RAE–3NU\*

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: . . . . 8

Multislot on Alt+u, if on remove checkmark

The set–up should now look like this (Figure 109):

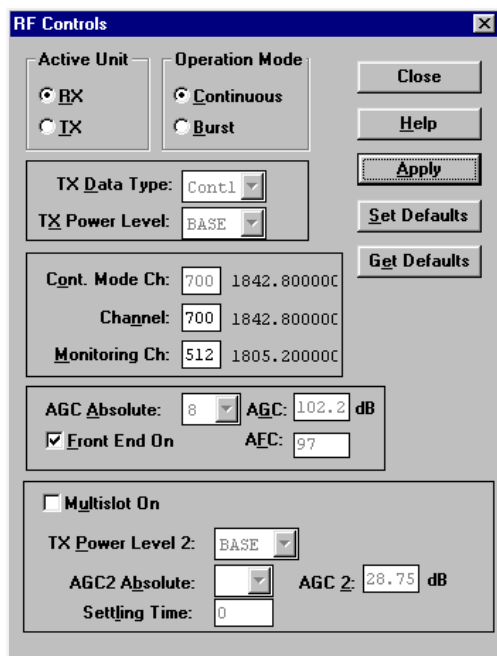


Figure 109.

Apply a 1842.867 MHz (channel 700 + 67.710kHz offset) –95dBm signal to the RF–connector (remember to compensate for cable attenuation).

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



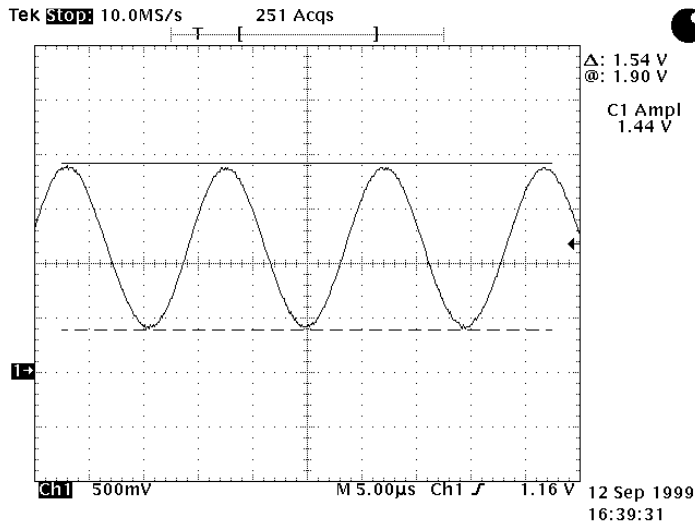


Figure 110.

Signal amplitude 350 mV p-p  
 DC offset 1,1V  
 Frequency 67kHz

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

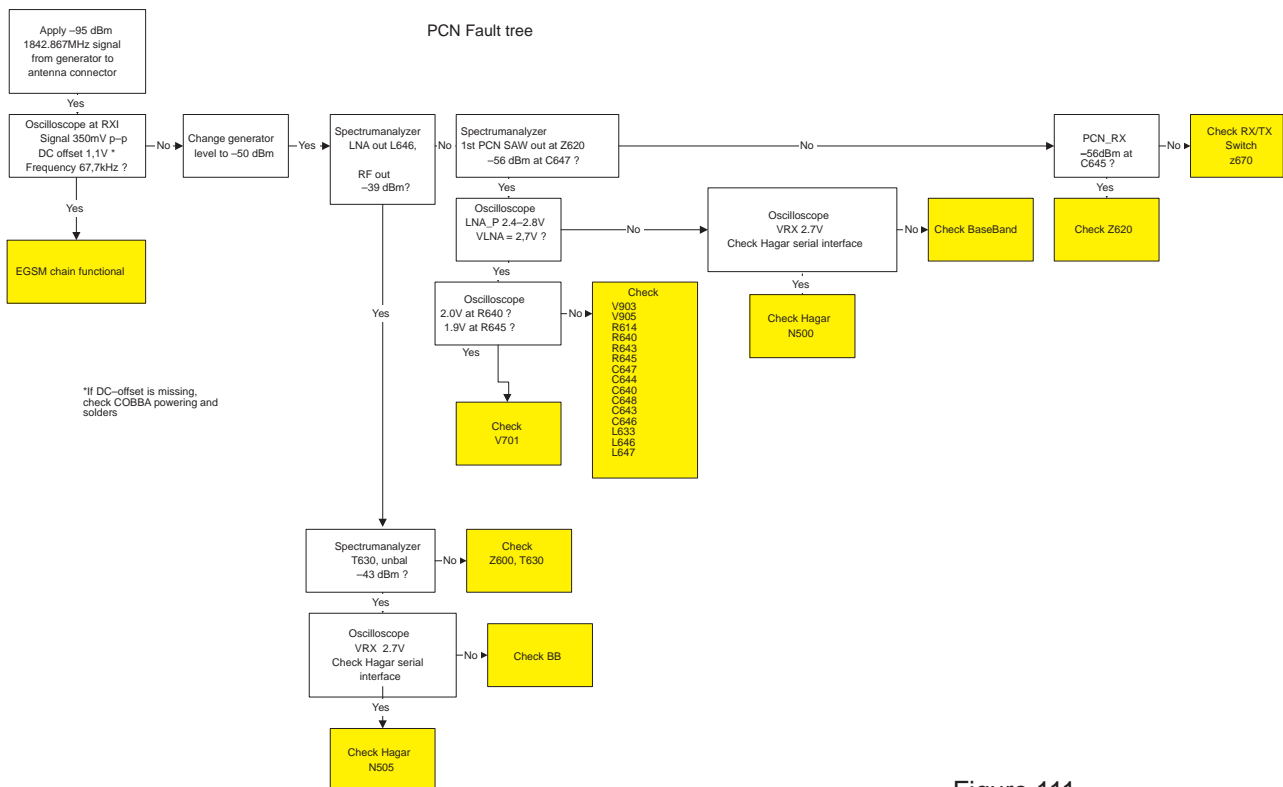


Figure 111.

### 5.2.1 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.

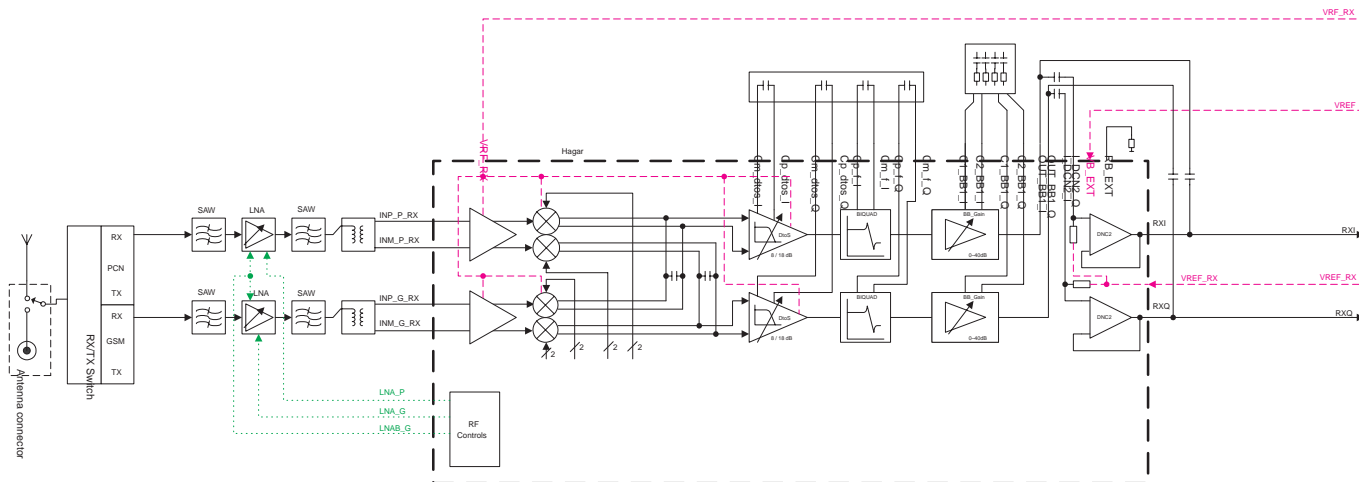


Figure 112. PCN RX signal path

### 5.2.2 RX/TX Switch

From the internal antenna connector (X499) the RF signal is lead to the RX/TX switch (Z670) via a mechanical switch, the antenna connector (X900).

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

From DCS\_Rx the PCN signal is feed to the 1<sup>st</sup> PCN SAW filter via C645.

### 5.2.3 Front end

The PCN front–end consists mainly of two SAW filters (Z620 and Z600) and one discrete LNA (V903) in–between and finally one balun (T630). The SAW filters provides out–of–band blocking immunity, the LNA provides front–end gain and the balun provides a balanced signal for Hagar (N505)

The signal–path is Through Z620 (In–band insertion–loss max 4dB), through the matching circuit (C674, C644, L647) and to the PCN LNA (V903, RFin).

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

From the LNA transistor collector (V904 RF out) the signal is lead through the LNA–output–matching–circuit (R640, L633, C640, L646), through the 2<sup>nd</sup> PCN SAW Z600 (In–band insertion–loss max 4dB) through a matching–network (C720 and L706) and to the PCN balun T630. From the balun the signal is balanced and is lead to Hagar (N505 IMP\_PCN\_RX and INM\_PCN\_RX).

### 5.2.4 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.

### 5.3 EGSM Transmitter

#### General troubleshooting instructions for EGSM TX

Apply a RF-cable to the RF-connector to allow the transmitted signal to act as normal. RF-cable should be connected to measurement equipment or to at least a 10-dB attenuator, otherwise the PA may be damaged.

Start Wintesla-Service-Software and

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

#### 5.3.1 Path of transmitted EGSM signal

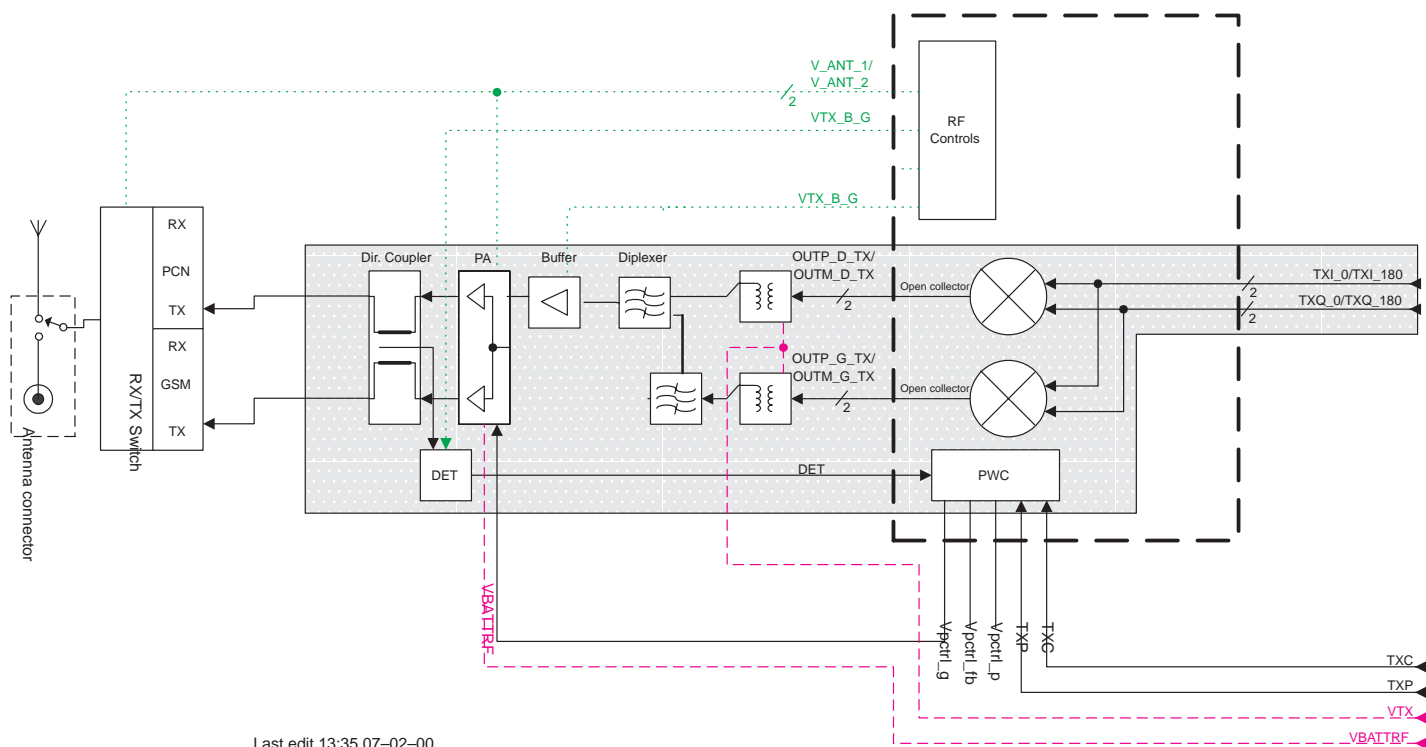


Figure 113. EGSM TX signal

5.3.2 Troubleshooting diagram for EGSM Transmitter

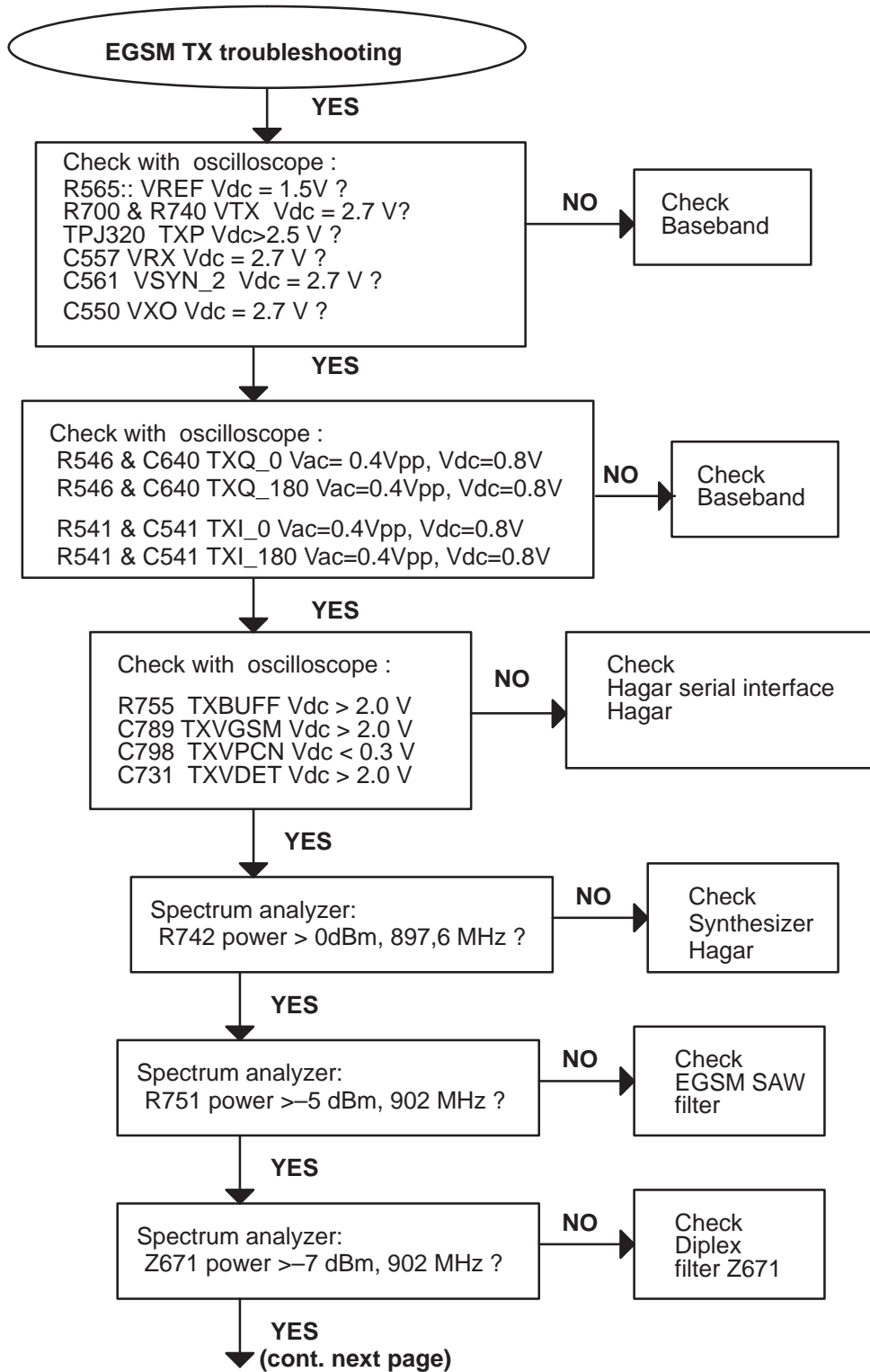


Figure 114.

(EGSM TX troubleshooting continued)

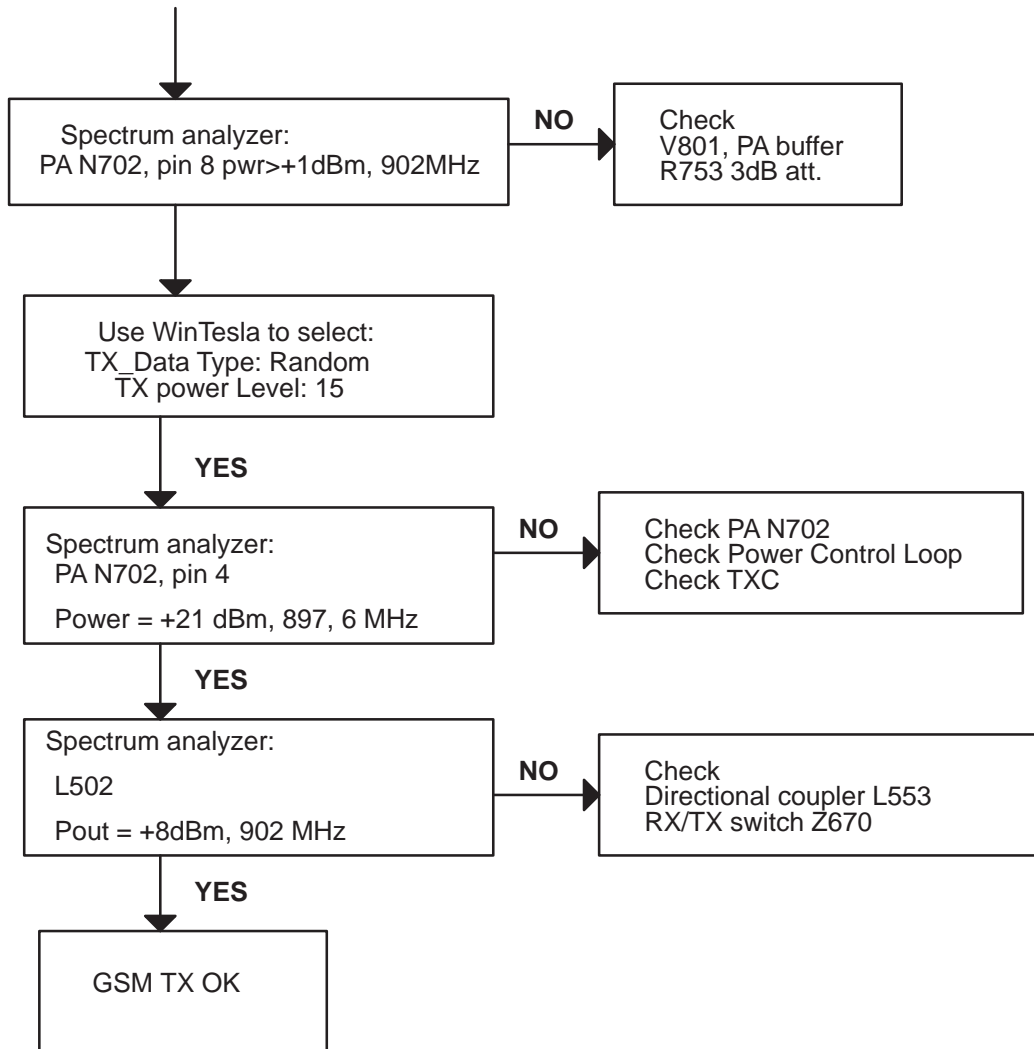


Figure 115.

### 5.4 PCN Transmitter

#### General troubleshooting instructions for PCN TX

Apply a RF-cable to the RF-connector to allow the transmitted signal to act as normal. RF-cable should be connected to measurement equipment or to at least a 10-dB attenuator, otherwise the PA may be damaged.

Start Wintesla-Service-Software and

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

#### 5.4.1 Path of the transmitted PCN signal

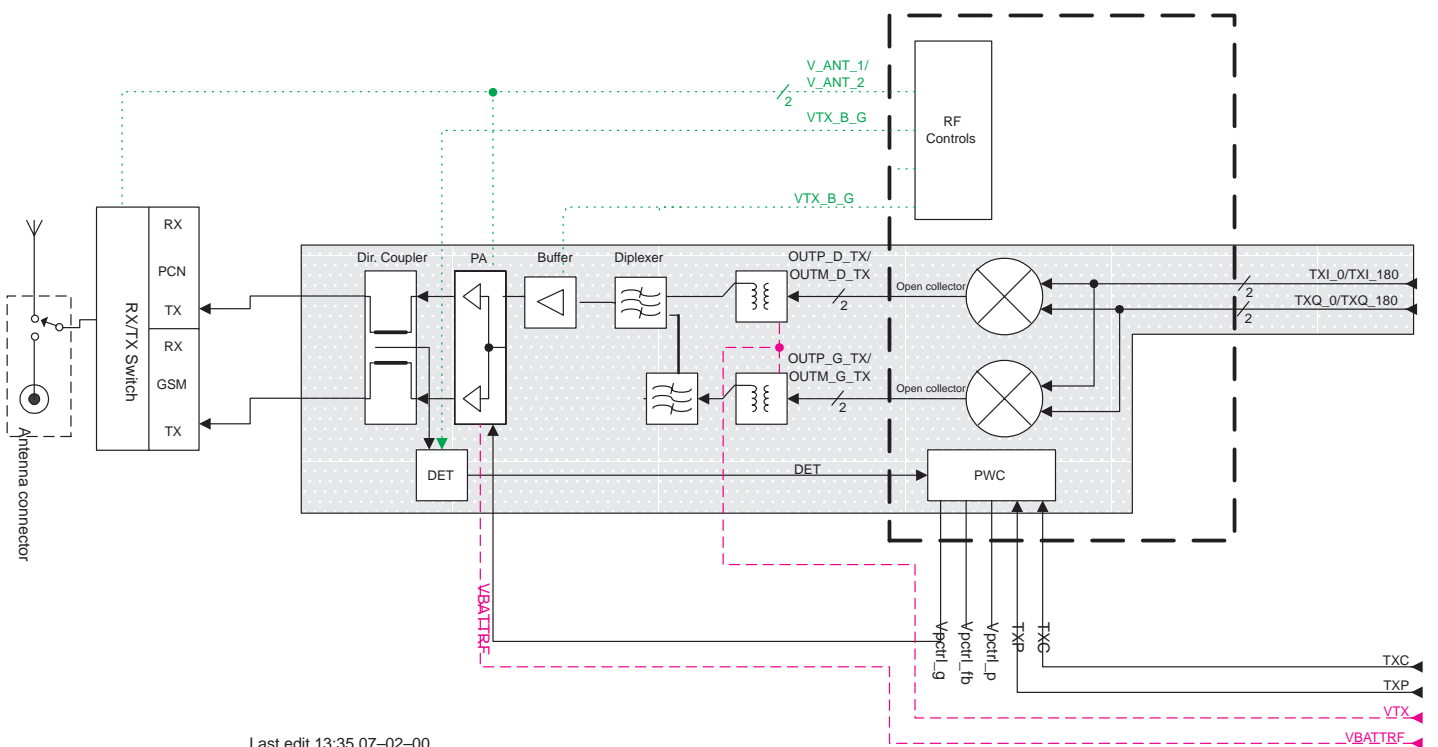


Figure 116. EGSM TX signal

5.4.2 Troubleshooting diagram for PCN Transmitter

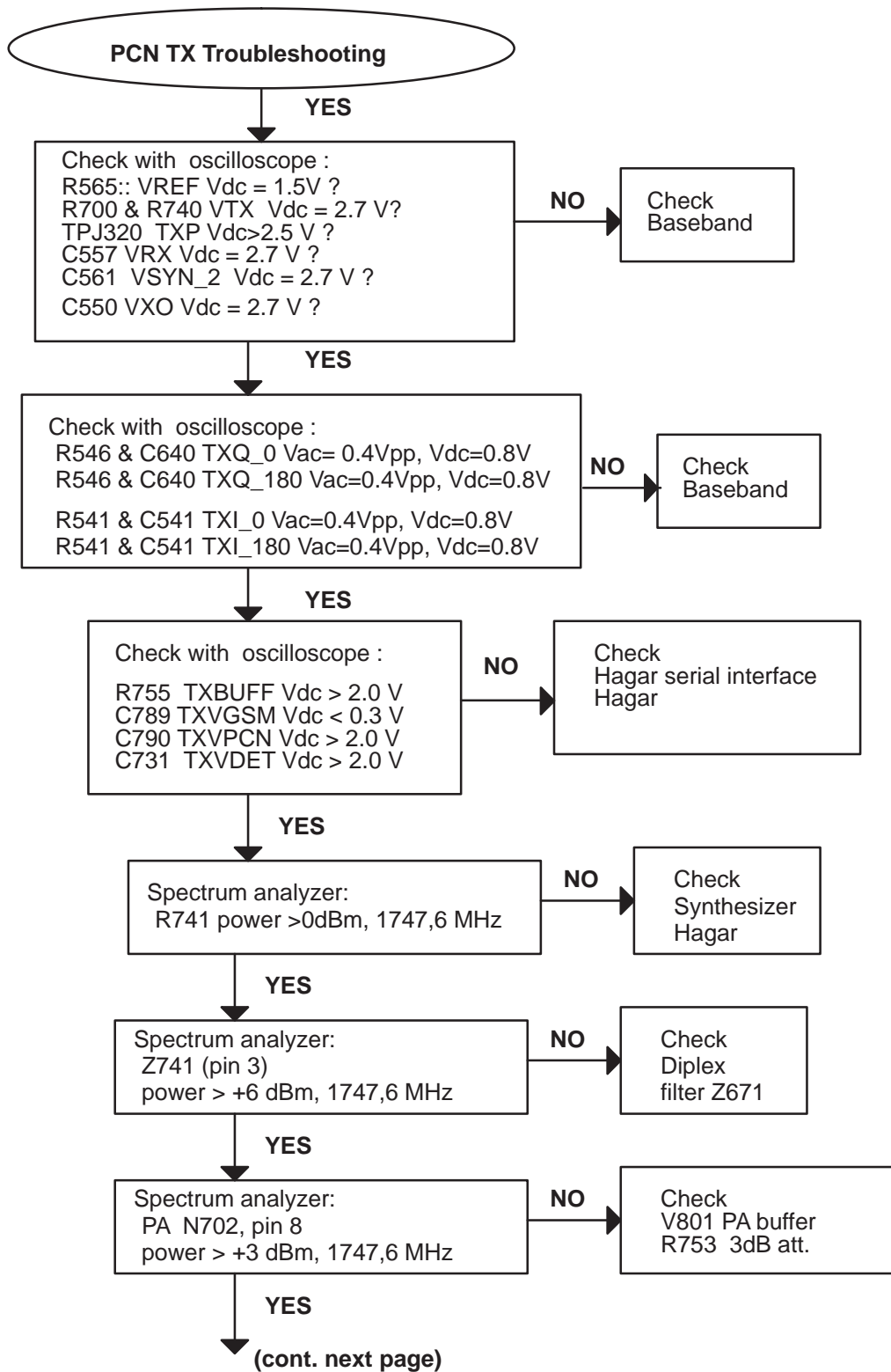


Figure 117.



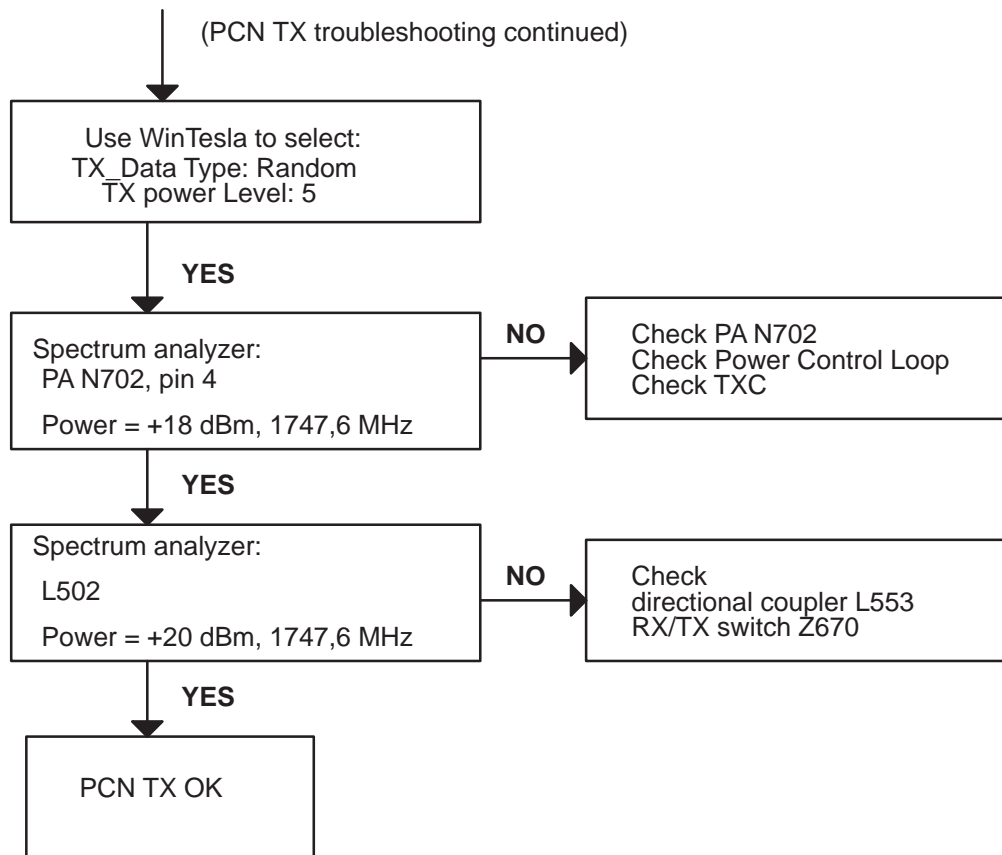


Figure 118.

## 5.5 Synthesizer

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

### General troubleshooting instructions for Synthesizer

Start Wintesla–Service–Software and

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

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

#### 5.5.1 26 MHz reference oscillator ( VCTCXO )

The 26 MHz oscillator (G803) is used as a reference frequency for the PLL synthesiser and as the system clock for BB ( 13 MHz) after it is divided by 2 in HAGAR. 26 MHz signal from the VCTCXO is approx. 0,8 Vpp. Frequency of this oscillator is adjusted by dc voltage ( Vcon ) coming from the DAC in COBBA. Range of Vcon is 0.3 – 2.3 V.

#### 5.5.2 VCO

The VCO is generating frequencies in the range of 3420 – 3840 MHz when PLL is in function. These are divided by 2 or by 4 in HAGAR so that they can generate all channels in GSM and PCN. Frequency of the VCO is controlled by dc voltage ( Vc ) coming from the loop filter. Range of the Vc when PLL is in function is 0.7 – 3.8 V. Even if PLL is not working ( Vc out of range ) there is some frequency at the output of the VCO ( G600) which is between 3 and 4 GHz, of course if the VCO is working.

**5.5.3 Troubleshooting diagram for PLL Synthesizer**

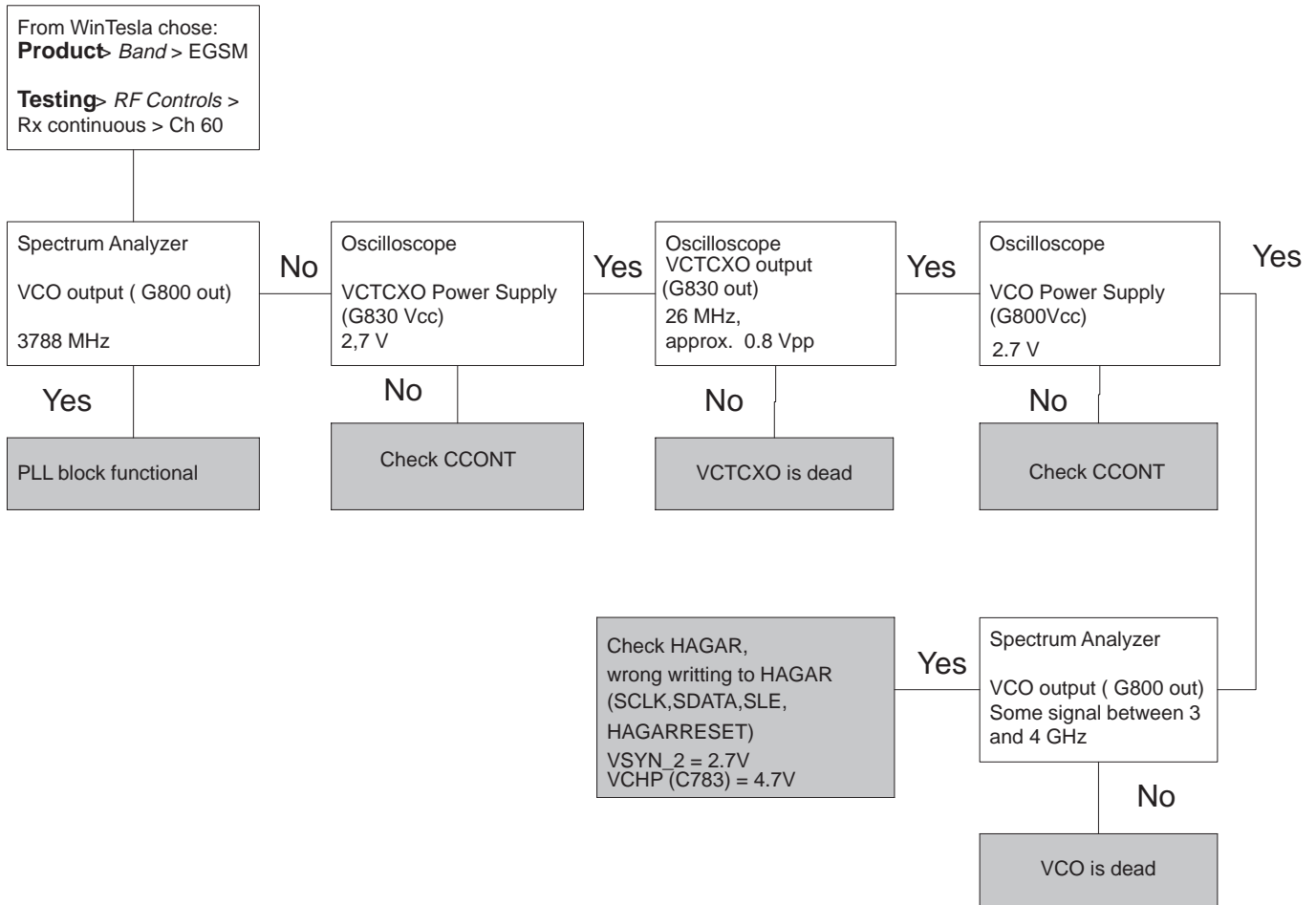


Figure 119.

It is important to say that power supply for VCTCXO ( VXO) is OFF only in 'Deep Sleep Mode' and power supply for VCO ( G800 Vcc) is OFF in 'Sleep Mode'.

If the phone goes '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.

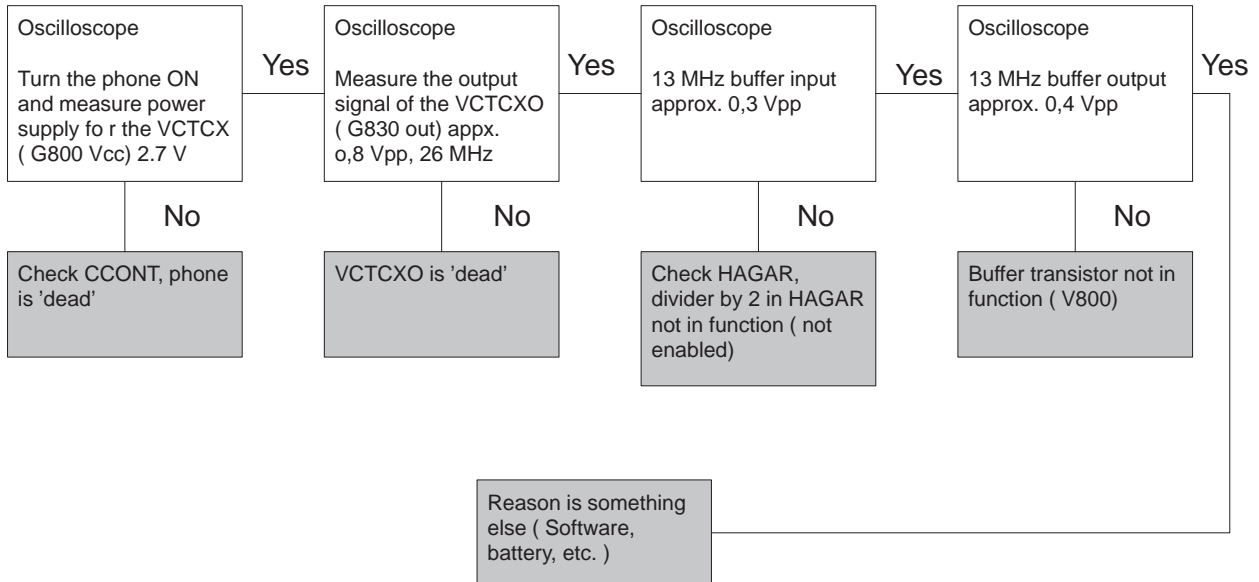


Figure 120.

5.5.4 PLL Block Diagram

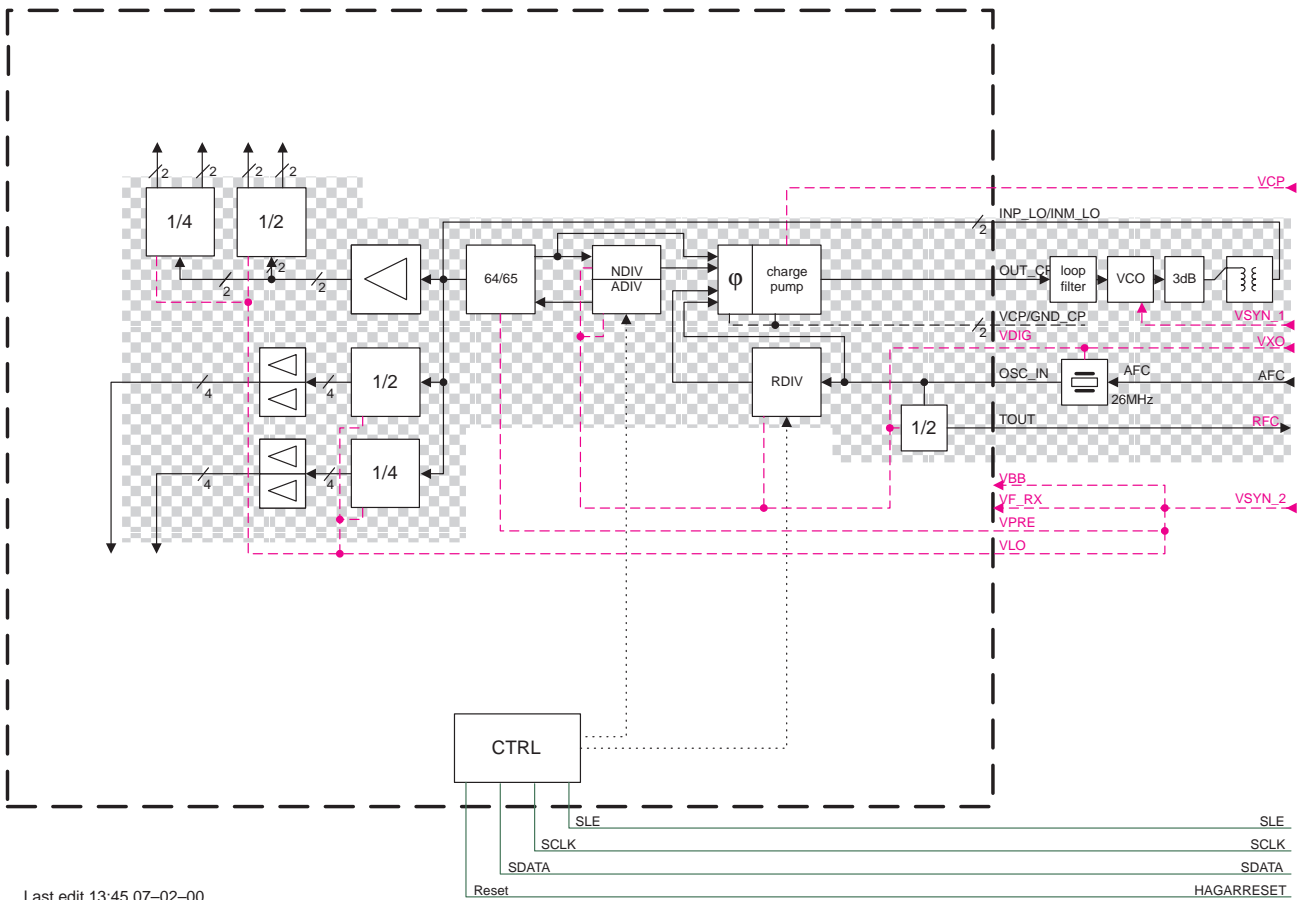


Figure 121. PLL

## 5.6 Frequency lists

Table 6. PCN frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
512	1710.2	3420.4	1805.2	3610.4
513	1710.4	3420.8	1805.4	3610.8
514	1710.6	3421.2	1805.6	3611.2
515	1710.8	3421.6	1805.8	3611.6
516	1711.0	3422.0	1806.0	3612.0
517	1711.2	3422.4	1806.2	3612.4
518	1711.4	3422.8	1806.4	3612.8
519	1711.6	3423.2	1806.6	3613.2
520	1711.8	3423.6	1806.8	3613.6
521	1712.0	3424.0	1807.0	3614.0
522	1712.2	3424.4	1807.2	3614.4
523	1712.4	3424.8	1807.4	3614.8
524	1712.6	3425.2	1807.6	3615.2
525	1712.8	3425.6	1807.8	3615.6
526	1713.0	3426.0	1808.0	3616.0
527	1713.2	3426.4	1808.2	3616.4
528	1713.4	3426.8	1808.4	3616.8
529	1713.6	3427.2	1808.6	3617.2
530	1713.8	3427.6	1808.8	3617.6
531	1714.0	3428.0	1809.0	3618.0
532	1714.2	3428.4	1809.2	3618.4
533	1714.4	3428.8	1809.4	3618.8
534	1714.6	3429.2	1809.6	3619.2
535	1714.8	3429.6	1809.8	3619.6
536	1715.0	3430.0	1810.0	3620.0
537	1715.2	3430.4	1810.2	3620.4
538	1715.4	3430.8	1810.4	3620.8
539	1715.6	3431.2	1810.6	3621.2
540	1715.8	3431.6	1810.8	3621.6
541	1716.0	3432.0	1811.0	3622.0
542	1716.2	3432.4	1811.2	3622.4
543	1716.4	3432.8	1811.4	3622.8
544	1716.6	3433.2	1811.6	3623.2
545	1716.8	3433.6	1811.8	3623.6
546	1717.0	3434.0	1812.0	3624.0
547	1717.2	3434.4	1812.2	3624.4
548	1717.4	3434.8	1812.4	3624.8

CH	TX	vco	RX (TX+95)	VCO
549	1717.6	3435.2	1812.6	3625.2
550	1717.8	3435.6	1812.8	3625.6
551	1718.0	3436.0	1813.0	3626.0
552	1718.2	3436.4	1813.2	3626.4
553	1718.4	3436.8	1813.4	3626.8
554	1718.6	3437.2	1813.6	3627.2
555	1718.8	3437.6	1813.8	3627.6
556	1719.0	3438.0	1814.0	3628.0
557	1719.2	3438.4	1814.2	3628.4
558	1719.4	3438.8	1814.4	3628.8
559	1719.6	3439.2	1814.6	3629.2
560	1719.8	3439.6	1814.8	3629.6
561	1720.0	3440.0	1815.0	3630.0
562	1720.2	3440.4	1815.2	3630.4
563	1720.4	3440.8	1815.4	3630.8
564	1720.6	3441.2	1815.6	3631.2
565	1720.8	3441.6	1815.8	3631.6
566	1721.0	3442.0	1816.0	3632.0
567	1721.2	3442.4	1816.2	3632.4
568	1721.4	3442.8	1816.4	3632.8
569	1721.6	3443.2	1816.6	3633.2
570	1721.8	3443.6	1816.8	3633.6
571	1722.0	3444.0	1817.0	3634.0
572	1722.2	3444.4	1817.2	3634.4
573	1722.4	3444.8	1817.4	3634.8
574	1722.6	3445.2	1817.6	3635.2
575	1722.8	3445.6	1817.8	3635.6
576	1723.0	3446.0	1818.0	3636.0
577	1723.2	3446.4	1818.2	3636.4
578	1723.4	3446.8	1818.4	3636.8
579	1723.6	3447.2	1818.6	3637.2
580	1723.8	3447.6	1818.8	3637.6
581	1724.0	3448.0	1819.0	3638.0
582	1724.2	3448.4	1819.2	3638.4
583	1724.4	3448.8	1819.4	3638.8
584	1724.6	3449.2	1819.6	3639.2
585	1724.8	3449.6	1819.8	3639.6
586	1725.0	3450.0	1820.0	3640.0
587	1725.2	3450.4	1820.2	3640.4
588	1725.4	3450.8	1820.4	3640.8
589	1725.6	3451.2	1820.6	3641.2
590	1725.8	3451.6	1820.8	3641.6

## 8. Troubleshooting

## Technical Documentation

CH	TX	vco	RX (TX+95)	VCO
591	1726.0	3452.0	1821.0	3642.0
592	1726.2	3452.4	1821.2	3642.4
593	1726.4	3452.8	1821.4	3642.8
594	1726.6	3453.2	1821.6	3643.2
595	1726.8	3453.6	1821.8	3643.6
596	1727.0	3454.0	1822.0	3644.0
597	1727.2	3454.4	1822.2	3644.4
598	1727.4	3454.8	1822.4	3644.8
599	1727.6	3455.2	1822.6	3645.2
600	1727.8	3455.6	1822.8	3645.6
601	1728.0	3456.0	1823.0	3646.0
602	1728.2	3456.4	1823.2	3646.4
603	1728.4	3456.8	1823.4	3646.8
604	1728.6	3457.2	1823.6	3647.2
605	1728.8	3457.6	1823.8	3647.6
606	1729.0	3458.0	1824.0	3648.0
607	1729.2	3458.4	1824.2	3648.4
608	1729.4	3458.8	1824.4	3648.8
609	1729.6	3459.2	1824.6	3649.2
610	1729.8	3459.6	1824.8	3649.6
611	1730.0	3460.0	1825.0	3650.0
612	1730.2	3460.4	1825.2	3650.4
613	1730.4	3460.8	1825.4	3650.8
614	1730.6	3461.2	1825.6	3651.2
615	1730.8	3461.6	1825.8	3651.6
616	1731.0	3462.0	1826.0	3652.0
617	1731.2	3462.4	1826.2	3652.4
618	1731.4	3462.8	1826.4	3652.8
619	1731.6	3463.2	1826.6	3653.2
620	1731.8	3463.6	1826.8	3653.6
621	1732.0	3464.0	1827.0	3654.0
622	1732.2	3464.4	1827.2	3654.4
623	1732.4	3464.8	1827.4	3654.8
624	1732.6	3465.2	1827.6	3655.2
625	1732.8	3465.6	1827.8	3655.6
626	1733.0	3466.0	1828.0	3656.0
627	1733.2	3466.4	1828.2	3656.4
628	1733.4	3466.8	1828.4	3656.8
629	1733.6	3467.2	1828.6	3657.2
630	1733.8	3467.6	1828.8	3657.6
631	1734.0	3468.0	1829.0	3658.0
632	1734.2	3468.4	1829.2	3658.4



CH	TX	vco	RX (TX+95)	VCO
633	1734.4	3468.8	1829.4	3658.8
634	1734.6	3469.2	1829.6	3659.2
635	1734.8	3469.6	1829.8	3659.6
636	1735.0	3470.0	1830.0	3660.0
637	1735.2	3470.4	1830.2	3660.4
638	1735.4	3470.8	1830.4	3660.8
639	1735.6	3471.2	1830.6	3661.2
640	1735.8	3471.6	1830.8	3661.6
641	1736.0	3472.0	1831.0	3662.0
642	1736.2	3472.4	1831.2	3662.4
643	1736.4	3472.8	1831.4	3662.8
644	1736.6	3473.2	1831.6	3663.2
645	1736.8	3473.6	1831.8	3663.6
646	1737.0	3474.0	1832.0	3664.0
647	1737.2	3474.4	1832.2	3664.4
648	1737.4	3474.8	1832.4	3664.8
649	1737.6	3475.2	1832.6	3665.2
650	1737.8	3475.6	1832.8	3665.6
651	1738.0	3476.0	1833.0	3666.0
652	1738.2	3476.4	1833.2	3666.4
653	1738.4	3476.8	1833.4	3666.8
654	1738.6	3477.2	1833.6	3667.2
655	1738.8	3477.6	1833.8	3667.6
656	1739.0	3478.0	1834.0	3668.0
657	1739.2	3478.4	1834.2	3668.4
658	1739.4	3478.8	1834.4	3668.8
659	1739.6	3479.2	1834.6	3669.2
660	1739.8	3479.6	1834.8	3669.6
661	1740.0	3480.0	1835.0	3670.0
662	1740.2	3480.4	1835.2	3670.4
663	1740.4	3480.8	1835.4	3670.8
664	1740.6	3481.2	1835.6	3671.2
665	1740.8	3481.6	1835.8	3671.6
666	1741.0	3482.0	1836.0	3672.0
667	1741.2	3482.4	1836.2	3672.4
668	1741.4	3482.8	1836.4	3672.8
669	1741.6	3483.2	1836.6	3673.2
670	1741.8	3483.6	1836.8	3673.6
671	1742.0	3484.0	1837.0	3674.0
672	1742.2	3484.4	1837.2	3674.4
673	1742.4	3484.8	1837.4	3674.8
674	1742.6	3485.2	1837.6	3675.2

## 8. Troubleshooting

## Technical Documentation

CH	TX	vco	RX (TX+95)	VCO
675	1742.8	3485.6	1837.8	3675.6
676	1743.0	3486.0	1838.0	3676.0
677	1743.2	3486.4	1838.2	3676.4
678	1743.4	3486.8	1838.4	3676.8
679	1743.6	3487.2	1838.6	3677.2
680	1743.8	3487.6	1838.8	3677.6
681	1744.0	3488.0	1839.0	3678.0
682	1744.2	3488.4	1839.2	3678.4
683	1744.4	3488.8	1839.4	3678.8
684	1744.6	3489.2	1839.6	3679.2
685	1744.8	3489.6	1839.8	3679.6
686	1745.0	3490.0	1840.0	3680.0
687	1745.2	3490.4	1840.2	3680.4
688	1745.4	3490.8	1840.4	3680.8
689	1745.6	3491.2	1840.6	3681.2
690	1745.8	3491.6	1840.8	3681.6
691	1746.0	3492.0	1841.0	3682.0
692	1746.2	3492.4	1841.2	3682.4
693	1746.4	3492.8	1841.4	3682.8
694	1746.6	3493.2	1841.6	3683.2
695	1746.8	3493.6	1841.8	3683.6
696	1747.0	3494.0	1842.0	3684.0
697	1747.2	3494.4	1842.2	3684.4
698	1747.4	3494.8	1842.4	3684.8
699	1747.6	3495.2	1842.6	3685.2
700	1747.8	3495.6	1842.8	3685.6
701	1748.0	3496.0	1843.0	3686.0
702	1748.2	3496.4	1843.2	3686.4
703	1748.4	3496.8	1843.4	3686.8
704	1748.6	3497.2	1843.6	3687.2
705	1748.8	3497.6	1843.8	3687.6
706	1749.0	3498.0	1844.0	3688.0
707	1749.2	3498.4	1844.2	3688.4
708	1749.4	3498.8	1844.4	3688.8
709	1749.6	3499.2	1844.6	3689.2
710	1749.8	3499.6	1844.8	3689.6
711	1750.0	3500.0	1845.0	3690.0
712	1750.2	3500.4	1845.2	3690.4
713	1750.4	3500.8	1845.4	3690.8
714	1750.6	3501.2	1845.6	3691.2
715	1750.8	3501.6	1845.8	3691.6
716	1751.0	3502.0	1846.0	3692.0

CH	TX	vco	RX (TX+95)	VCO
717	1751.2	3502.4	1846.2	3692.4
718	1751.4	3502.8	1846.4	3692.8
719	1751.6	3503.2	1846.6	3693.2
720	1751.8	3503.6	1846.8	3693.6
721	1752.0	3504.0	1847.0	3694.0
722	1752.2	3504.4	1847.2	3694.4
723	1752.4	3504.8	1847.4	3694.8
724	1752.6	3505.2	1847.6	3695.2
725	1752.8	3505.6	1847.8	3695.6
726	1753.0	3506.0	1848.0	3696.0
727	1753.2	3506.4	1848.2	3696.4
728	1753.4	3506.8	1848.4	3696.8
729	1753.6	3507.2	1848.6	3697.2
730	1753.8	3507.6	1848.8	3697.6
731	1754.0	3508.0	1849.0	3698.0
732	1754.2	3508.4	1849.2	3698.4
733	1754.4	3508.8	1849.4	3698.8
734	1754.6	3509.2	1849.6	3699.2
735	1754.8	3509.6	1849.8	3699.6
736	1755.0	3510.0	1850.0	3700.0
737	1755.2	3510.4	1850.2	3700.4
738	1755.4	3510.8	1850.4	3700.8
739	1755.6	3511.2	1850.6	3701.2
740	1755.8	3511.6	1850.8	3701.6
741	1756.0	3512.0	1851.0	3702.0
742	1756.2	3512.4	1851.2	3702.4
743	1756.4	3512.8	1851.4	3702.8
744	1756.6	3513.2	1851.6	3703.2
745	1756.8	3513.6	1851.8	3703.6
746	1757.0	3514.0	1852.0	3704.0
747	1757.2	3514.4	1852.2	3704.4
748	1757.4	3514.8	1852.4	3704.8
749	1757.6	3515.2	1852.6	3705.2
750	1757.8	3515.6	1852.8	3705.6
751	1758.0	3516.0	1853.0	3706.0
752	1758.2	3516.4	1853.2	3706.4
753	1758.4	3516.8	1853.4	3706.8
754	1758.6	3517.2	1853.6	3707.2
755	1758.8	3517.6	1853.8	3707.6
756	1759.0	3518.0	1854.0	3708.0
757	1759.2	3518.4	1854.2	3708.4
758	1759.4	3518.8	1854.4	3708.8

## 8. Troubleshooting

## Technical Documentation

CH	TX	vco	RX (TX+95)	VCO
759	1759.6	3519.2	1854.6	3709.2
760	1759.8	3519.6	1854.8	3709.6
761	1760.0	3520.0	1855.0	3710.0
762	1760.2	3520.4	1855.2	3710.4
763	1760.4	3520.8	1855.4	3710.8
764	1760.6	3521.2	1855.6	3711.2
765	1760.8	3521.6	1855.8	3711.6
766	1761.0	3522.0	1856.0	3712.0
767	1761.2	3522.4	1856.2	3712.4
768	1761.4	3522.8	1856.4	3712.8
769	1761.6	3523.2	1856.6	3713.2
770	1761.8	3523.6	1856.8	3713.6
771	1762.0	3524.0	1857.0	3714.0
772	1762.2	3524.4	1857.2	3714.4
773	1762.4	3524.8	1857.4	3714.8
774	1762.6	3525.2	1857.6	3715.2
775	1762.8	3525.6	1857.8	3715.6
776	1763.0	3526.0	1858.0	3716.0
777	1763.2	3526.4	1858.2	3716.4
778	1763.4	3526.8	1858.4	3716.8
779	1763.6	3527.2	1858.6	3717.2
780	1763.8	3527.6	1858.8	3717.6
781	1764.0	3528.0	1859.0	3718.0
782	1764.2	3528.4	1859.2	3718.4
783	1764.4	3528.8	1859.4	3718.8
784	1764.6	3529.2	1859.6	3719.2
785	1764.8	3529.6	1859.8	3719.6
786	1765.0	3530.0	1860.0	3720.0
787	1765.2	3530.4	1860.2	3720.4
788	1765.4	3530.8	1860.4	3720.8
789	1765.6	3531.2	1860.6	3721.2
790	1765.8	3531.6	1860.8	3721.6
791	1766.0	3532.0	1861.0	3722.0
792	1766.2	3532.4	1861.2	3722.4
793	1766.4	3532.8	1861.4	3722.8
794	1766.6	3533.2	1861.6	3723.2
795	1766.8	3533.6	1861.8	3723.6
796	1767.0	3534.0	1862.0	3724.0
797	1767.2	3534.4	1862.2	3724.4
798	1767.4	3534.8	1862.4	3724.8
799	1767.6	3535.2	1862.6	3725.2
800	1767.8	3535.6	1862.8	3725.6

CH	TX	vco	RX (TX+95)	VCO
801	1768.0	3536.0	1863.0	3726.0
802	1768.2	3536.4	1863.2	3726.4
803	1768.4	3536.8	1863.4	3726.8
804	1768.6	3537.2	1863.6	3727.2
805	1768.8	3537.6	1863.8	3727.6
806	1769.0	3538.0	1864.0	3728.0
807	1769.2	3538.4	1864.2	3728.4
808	1769.4	3538.8	1864.4	3728.8
809	1769.6	3539.2	1864.6	3729.2
810	1769.8	3539.6	1864.8	3729.6
811	1770.0	3540.0	1865.0	3730.0
812	1770.2	3540.4	1865.2	3730.4
813	1770.4	3540.8	1865.4	3730.8
814	1770.6	3541.2	1865.6	3731.2
815	1770.8	3541.6	1865.8	3731.6
816	1771.0	3542.0	1866.0	3732.0
817	1771.2	3542.4	1866.2	3732.4
818	1771.4	3542.8	1866.4	3732.8
819	1771.6	3543.2	1866.6	3733.2
820	1771.8	3543.6	1866.8	3733.6
821	1772.0	3544.0	1867.0	3734.0
822	1772.2	3544.4	1867.2	3734.4
823	1772.4	3544.8	1867.4	3734.8
824	1772.6	3545.2	1867.6	3735.2
825	1772.8	3545.6	1867.8	3735.6
826	1773.0	3546.0	1868.0	3736.0
827	1773.2	3546.4	1868.2	3736.4
828	1773.4	3546.8	1868.4	3736.8
829	1773.6	3547.2	1868.6	3737.2
830	1773.8	3547.6	1868.8	3737.6
831	1774.0	3548.0	1869.0	3738.0
832	1774.2	3548.4	1869.2	3738.4
833	1774.4	3548.8	1869.4	3738.8
834	1774.6	3549.2	1869.6	3739.2
835	1774.8	3549.6	1869.8	3739.6
836	1775.0	3550.0	1870.0	3740.0
837	1775.2	3550.4	1870.2	3740.4
838	1775.4	3550.8	1870.4	3740.8
839	1775.6	3551.2	1870.6	3741.2
840	1775.8	3551.6	1870.8	3741.6
841	1776.0	3552.0	1871.0	3742.0
842	1776.2	3552.4	1871.2	3742.4

## 8. Troubleshooting

## Technical Documentation

CH	TX	vco	RX (TX+95)	VCO
843	1776.4	3552.8	1871.4	3742.8
844	1776.6	3553.2	1871.6	3743.2
845	1776.8	3553.6	1871.8	3743.6
846	1777.0	3554.0	1872.0	3744.0
847	1777.2	3554.4	1872.2	3744.4
848	1777.4	3554.8	1872.4	3744.8
849	1777.6	3555.2	1872.6	3745.2
850	1777.8	3555.6	1872.8	3745.6
851	1778.0	3556.0	1873.0	3746.0
852	1778.2	3556.4	1873.2	3746.4
853	1778.4	3556.8	1873.4	3746.8
854	1778.6	3557.2	1873.6	3747.2
855	1778.8	3557.6	1873.8	3747.6
856	1779.0	3558.0	1874.0	3748.0
857	1779.2	3558.4	1874.2	3748.4
858	1779.4	3558.8	1874.4	3748.8
859	1779.6	3559.2	1874.6	3749.2
860	1779.8	3559.6	1874.8	3749.6
861	1780.0	3560.0	1875.0	3750.0
862	1780.2	3560.4	1875.2	3750.4
863	1780.4	3560.8	1875.4	3750.8
864	1780.6	3561.2	1875.6	3751.2
865	1780.8	3561.6	1875.8	3751.6
866	1781.0	3562.0	1876.0	3752.0
867	1781.2	3562.4	1876.2	3752.4
868	1781.4	3562.8	1876.4	3752.8
869	1781.6	3563.2	1876.6	3753.2
870	1781.8	3563.6	1876.8	3753.6
871	1782.0	3564.0	1877.0	3754.0
872	1782.2	3564.4	1877.2	3754.4
873	1782.4	3564.8	1877.4	3754.8
874	1782.6	3565.2	1877.6	3755.2
875	1782.8	3565.6	1877.8	3755.6
876	1783.0	3566.0	1878.0	3756.0
877	1783.2	3566.4	1878.2	3756.4
878	1783.4	3566.8	1878.4	3756.8
879	1783.6	3567.2	1878.6	3757.2
880	1783.8	3567.6	1878.8	3757.6
881	1784.0	3568.0	1879.0	3758.0
882	1784.2	3568.4	1879.2	3758.4
883	1784.4	3568.8	1879.4	3758.8

CH	TX	vco	RX (TX+95)	VCO
884	1784.6	3569.2	1879.6	3759.2
885	1784.8	3569.6	1879.8	3759.6

Table 7. GSM frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
975	880.2	3520.8	925.2	3700.8
976	880.4	3521.6	925.4	3701.6
977	880.6	3522.4	925.6	3702.4
978	880.8	3523.2	925.8	3703.2
979	881.0	3524.0	926.0	3704.0
980	881.2	3524.8	926.2	3704.8
981	881.4	3525.6	926.4	3705.6
982	881.6	3526.4	926.6	3706.4
983	881.8	3527.2	926.8	3707.2
984	882.0	3528.0	927.0	3708.0
985	882.2	3528.8	927.2	3708.8
986	882.4	3529.6	927.4	3709.6
987	882.6	3530.4	927.6	3710.4
988	882.8	3531.2	927.8	3711.2
989	883.0	3532.0	928.0	3712.0
990	883.2	3532.8	928.2	3712.8
991	883.4	3533.6	928.4	3713.6
992	883.6	3534.4	928.6	3714.4
993	883.8	3535.2	928.8	3715.2
994	884.0	3536.0	929.0	3716.0
995	884.2	3536.8	929.2	3716.8
996	884.4	3537.6	929.4	3717.6
997	884.6	3538.4	929.6	3718.4
998	884.8	3539.2	929.8	3719.2
999	885.0	3540.0	930.0	3720.0
1000	885.2	3540.8	930.2	3720.8
1001	885.4	3541.6	930.4	3721.6
1002	885.6	3542.4	930.6	3722.4
1003	885.8	3543.2	930.8	3723.2
1004	886.0	3544.0	931.0	3724.0
1005	886.2	3544.8	931.2	3724.8
1006	886.4	3545.6	931.4	3725.6
1007	886.6	3546.4	931.6	3726.4
1008	886.8	3547.2	931.8	3727.2

Table 7. GSM frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
1009	887.0	3548.0	932.0	3728.0
1010	887.2	3548.8	932.2	3728.8
1011	887.4	3549.6	932.4	3729.6
1012	887.6	3550.4	932.6	3730.4
1013	887.8	3551.2	932.8	3731.2
1014	888.0	3552.0	933.0	3732.0
1015	888.2	3552.8	933.2	3732.8
1016	888.4	3553.6	933.4	3733.6
1017	888.6	3554.4	933.6	3734.4
1018	888.8	3555.2	933.8	3735.2
1019	889.0	3556.0	934.0	3736.0
1020	889.2	3556.8	934.2	3736.8
1021	889.4	3557.6	934.4	3737.6
1022	889.6	3558.4	934.6	3738.4
1023	889.8	3559.2	934.8	3739.2
0	890.0	3560.0	935.0	3740.0
1	890.2	3560.8	935.2	3740.8
2	890.4	3561.6	935.4	3741.6
3	890.6	3562.4	935.6	3742.4
4	890.8	3563.2	935.8	3743.2
5	891.0	3564.0	936.0	3744.0
6	891.2	3564.8	936.2	3744.8
7	891.4	3565.6	936.4	3745.6
8	891.6	3566.4	936.6	3746.4
9	891.8	3567.2	936.8	3747.2
10	892.0	3568.0	937.0	3748.0
11	892.2	3568.8	937.2	3748.8
12	892.4	3569.6	937.4	3749.6
13	892.6	3570.4	937.6	3750.4
14	892.8	3571.2	937.8	3751.2
15	893.0	3572.0	938.0	3752.0
16	893.2	3572.8	938.2	3752.8
17	893.4	3573.6	938.4	3753.6
18	893.6	3574.4	938.6	3754.4
19	893.8	3575.2	938.8	3755.2
20	894.0	3576.0	939.0	3756.0
21	894.2	3576.8	939.2	3756.8
22	894.4	3577.6	939.4	3757.6



Table 7. GSM frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
23	894.6	3578.4	939.6	3758.4
24	894.8	3579.2	939.8	3759.2
25	895.0	3580.0	940.0	3760.0
26	895.2	3580.8	940.2	3760.8
27	895.4	3581.6	940.4	3761.6
28	895.6	3582.4	940.6	3762.4
29	895.8	3583.2	940.8	3763.2
30	896.0	3584.0	941.0	3764.0
31	896.2	3584.8	941.2	3764.8
32	896.4	3585.6	941.4	3765.6
33	896.6	3586.4	941.6	3766.4
34	896.8	3587.2	941.8	3767.2
35	897.0	3588.0	942.0	3768.0
36	897.2	3588.8	942.2	3768.8
37	897.4	3589.6	942.4	3769.6
38	897.6	3590.4	942.6	3770.4
39	897.8	3591.2	942.8	3771.2
40	898.0	3592.0	943.0	3772.0
41	898.2	3592.8	943.2	3772.8
42	898.4	3593.6	943.4	3773.6
43	898.6	3594.4	943.6	3774.4
44	898.8	3595.2	943.8	3775.2
45	899.0	3596.0	944.0	3776.0
46	899.2	3596.8	944.2	3776.8
47	899.4	3597.6	944.4	3777.6
48	899.6	3598.4	944.6	3778.4
49	899.8	3599.2	944.8	3779.2
50	900.0	3600.0	945.0	3780.0
51	900.2	3600.8	945.2	3780.8
52	900.4	3601.6	945.4	3781.6
53	900.6	3602.4	945.6	3782.4
54	900.8	3603.2	945.8	3783.2
55	901.0	3604.0	946.0	3784.0
56	901.2	3604.8	946.2	3784.8
57	901.4	3605.6	946.4	3785.6
58	901.6	3606.4	946.6	3786.4
59	901.8	3607.2	946.8	3787.2
60	902.0	3608.0	947.0	3788.0

Table 7. GSM frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
61	902.2	3608.8	947.2	3788.8
62	902.4	3609.6	947.4	3789.6
63	902.6	3610.4	947.6	3790.4
64	902.8	3611.2	947.8	3791.2
65	903.0	3612.0	948.0	3792.0
66	903.2	3612.8	948.2	3792.8
67	903.4	3613.6	948.4	3793.6
68	903.6	3614.4	948.6	3794.4
69	903.8	3615.2	948.8	3795.2
70	904.0	3616.0	949.0	3796.0
71	904.2	3616.8	949.2	3796.8
72	904.4	3617.6	949.4	3797.6
73	904.6	3618.4	949.6	3798.4
74	904.8	3619.2	949.8	3799.2
75	905.0	3620.0	950.0	3800.0
76	905.2	3620.8	950.2	3800.8
77	905.4	3621.6	950.4	3801.6
78	905.6	3622.4	950.6	3802.4
79	905.8	3623.2	950.8	3803.2
80	906.0	3624.0	951.0	3804.0
81	906.2	3624.8	951.2	3804.8
82	906.4	3625.6	951.4	3805.6
83	906.6	3626.4	951.6	3806.4
84	906.8	3627.2	951.8	3807.2
85	907.0	3628.0	952.0	3808.0
86	907.2	3628.8	952.2	3808.8
87	907.4	3629.6	952.4	3809.6
88	907.6	3630.4	952.6	3810.4
89	907.8	3631.2	952.8	3811.2
90	908.0	3632.0	953.0	3812.0
91	908.2	3632.8	953.2	3812.8
92	908.4	3633.6	953.4	3813.6
93	908.6	3634.4	953.6	3814.4
94	908.8	3635.2	953.8	3815.2
95	909.0	3636.0	954.0	3816.0
96	909.2	3636.8	954.2	3816.8
97	909.4	3637.6	954.4	3817.6
98	909.6	3638.4	954.6	3818.4

Table 7. GSM frequencies and corresponding VCO frequencies

CH	TX	vco	RX (TX+95)	VCO
99	909.8	3639.2	954.8	3819.2
100	910.0	3640.0	955.0	3820.0
101	910.2	3640.8	955.2	3820.8
102	910.4	3641.6	955.4	3821.6
103	910.6	3642.4	955.6	3822.4
104	910.8	3643.2	955.8	3823.2
105	911.0	3644.0	956.0	3824.0
106	911.2	3644.8	956.2	3824.8
107	911.4	3645.6	956.4	3825.6
108	911.6	3646.4	956.6	3826.4
109	911.8	3647.2	956.8	3827.2
110	912.0	3648.0	957.0	3828.0
111	912.2	3648.8	957.2	3828.8
112	912.4	3649.6	957.4	3829.6
113	912.6	3650.4	957.6	3830.4
114	912.8	3651.2	957.8	3831.2
115	913.0	3652.0	958.0	3832.0
116	913.2	3652.8	958.2	3832.8
117	913.4	3653.6	958.4	3833.6
118	913.6	3654.4	958.6	3834.4
119	913.8	3655.2	958.8	3835.2
120	914.0	3656.0	959.0	3836.0
121	914.2	3656.8	959.2	3836.8
122	914.4	3657.6	959.4	3837.6
123	914.6	3658.4	959.6	3838.4
124	914.8	3659.2	959.8	3839.2

## **6 Diagrams of Test Points**

Diagrams of test points, refer to Section 11, Service Instructions.

[] 1