Disassembly and Troubleshooting

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
	12/99	OJuntune	Original

CONTENTS

	Page No
Vocabulary	6
Introduction	7
Disassembly	7
Tools and Parts	7
Remove Antenna	8
Open Top Cover Printed	8
How to use the Opening Tool	9
Using Screwdriver as disassembly tool	10
Open Bottom Cover subassembly	11
Remove PCB from Extension Box subassembly	12
Reassembly	13
Install the PCB to Extension Box subassembly	13
Assemble Bottom Cover subassembly	14
Close Top Cover Printed	14
Push Antenna into the Extension Box subassembly	15
Baseband Troubleshooting	16
Current Consumption in Fault Diagnostics	16
Card Phone does not Communicate with the Host Computer	17
MCU Problems	18
Flasah Programming Initialization sequence	19
WinTesla Self Tests	19
ADC Readings With WinTesla	20
SIM Card Failure	21
SIM interface diagram	22
SIM Card Reader pins	22
Audio Fails	23
RF Troubleshooting	24
RF trouble shooting principles	24
Quick check RX with WinTesla	26
Gather test equipment	26
Connect test equipment	26
Settings and diagnostic	26
Quick check TX with WinTesla	27
Test equipment list	27
Connect test equipment	27
Settings & diagnostic	27
GSM	28
PCN	28
RX trouble shooting	29

Test equipment 29
GSM Receiver 30
Settings 30
Test diplexer 30
Test RX duplex filter 30
Test LNA (CRFU3 asic) 30
Test RX SAW filter 31
Test UHF mixer 31
Test 73MHz filter 31
Test SUMMA asic 31
PCN Receiver 33
Settings 33
Test diplexer 33
Test rx/tx switch 33
Test pre_LNA rx filter 33
Test LNA 33
Test RX RF SAW filter 34
Test UHF mixer 34
Test VHF mixer 34
Test 73MHz filter 34
Test Summa asic 35
TX trouble shooting 37
Test equipment 37
GSM TX 38
Settings 38
Test SUMMA TX part 38
Test CRFU3 TX part 41
Test TX RF SAW filter 42
Test power control circuit 42
Test power amplifier 43
Test duplexer TX side 44
Test diplexer GSM side 44
GSM1800 TX 45
Settings 45
Test SUMMA TX part 45
Test CRFU3 TX part 46
Test 1st TX RF SAW filter 46
Test buffer amplifier 46
Test 2nd TX RF SAW filter 47
Test power control circuit 47
Test power amplifier 47
Test RX / TX switch 49
Test diplexer GSM1800 side 49
Synthesizer Troubleshooting 50
Test equipment 50

Settings 51
VCTCXO (G802) 51
UHF VCO (G801) 52
VHF VCO (G803) 53
PLL IC (N800) 54
13 Mhz buffer 54
Repair instructions 55
RF–BB Interface 56
Test Points of GX9 57
Test Points, Top side 59
Test Points, Bottom side 60

Vocabulary

ASIC	Application Specific Integrated Citcuit
BB	Baseband part of RPM–1
CCONT	Power supply ASIC of RPM–1
CIS	Card Information Structure specified by PC Card standard. Stored in EEPROM in RPM–1
COBBA_GJP	Audio codec and RF interface ASIC of RPM–1
DSP	Digital Signal Processor
EEPROM	Elecrically Erasable Programmable Read Only Memory
Flash	Reprogrammable non–volatile memory
GX9	Tranceiver module of RPM–1
HSCSD	High Speed Circuit Switched Data (multislot GSM transmission)
HW	Hard Ware
MAD	MCU + ASIC + DSP
MAD2WD1	Version of MAD2 ASIC used in RPM–1
MCU	MicroController Unit
PCB	Printed Circuit Board
PURX	Power Up Reset, active low. Reset signal to MAD2WD1
RPM–1	Type designation of Nokia Cellular Card Phone V.2
Sulo	PC Card interface ASIC of RPM–1

Introduction

The purpose of this document is to help in hardware troubleshooting of the RPM–1, Nokia Cellular Card Phone V.2. RPM–1 is a GSM900/1800 HSCSD PC Card.

Disassembly

Tools and Parts

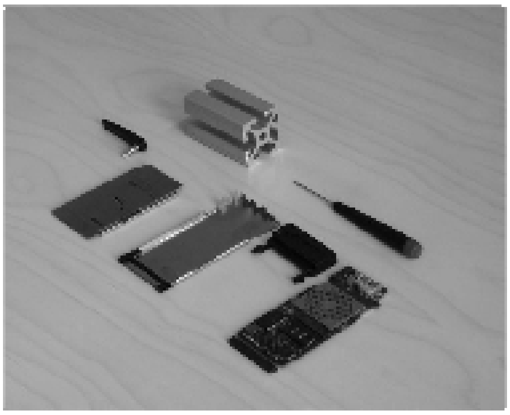


Fig. 1 Disassembled parts, left to right:

0660200   Antenna

9507011   Top Cover Printed

9507010   Bottom Cover subassembly

9477002   Extension Box subassembly

GX9 module (PCB with components)

Tools:

Opening tool for the RPM-1 Phone

Screwdriver

Remove Antenna

Pull Antenna smoothly from the Extension Box subassembly.

Refer to the picture below.

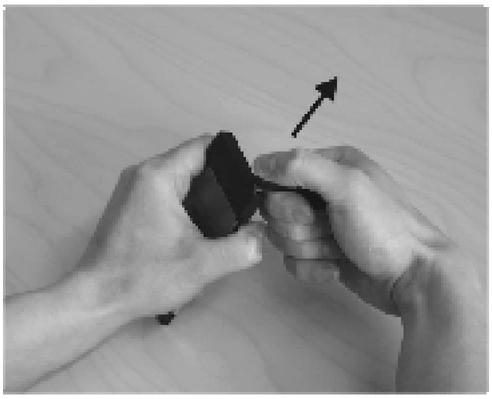


Fig 2. Note:

Do not bend the antenna.

Open Top Cover Printed

Use preferably the opening tool as you open the Top Cover Printed.
Please note that It is easy to damage covers with a screwdriver.

Note: (general)

Do not open Top Cover Printed from left side (top view). Flash component may damage on the PCB.

Open Top Cover Printed only from right side (top view). See picture 3.

Fig 3. Top view

How to use the Opening Tool

STEP 1:

Put the sharp edge of the opening tool to the Top Cover Printed’s edge and turn the opening tool smoothly. See picture 4.

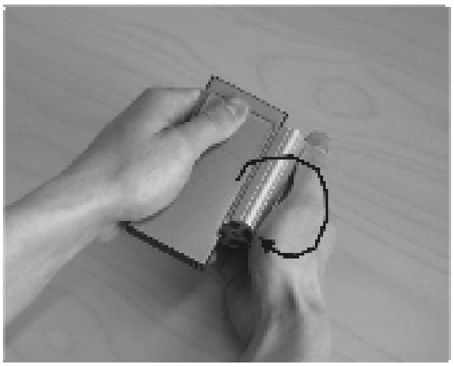


Fig.4. Position of the opening tool

STEP 2:

Release the right side of the RPM-1 .

Push Top Cover Printed a little bit to left side after you have opened the right side of the RPM-1 .

Open carefully the Top Cover Printed simultaneously pushing the Top Cover Printed to left side .

See picture 5.

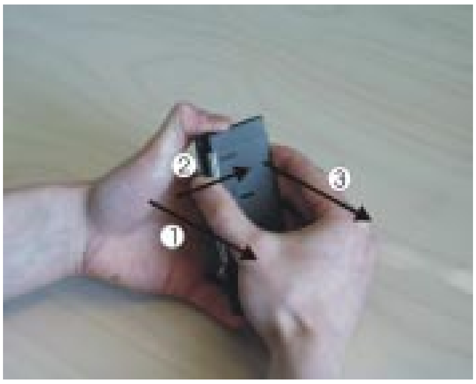


Fig. 5. Open Top Cover Printed

STEP 3:

Lift Top Cover Printed. Top Cover Printed must be about 90 degree open. See picture 6 below.

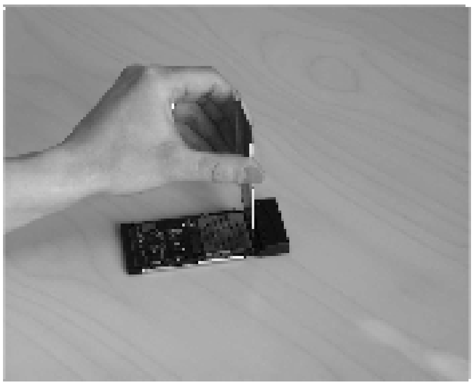


Fig.6. Lift Top Cover Printed

Using Screwdriver as disassembly tool

Use preferably the opening tool as you open the Top Cover Printed. Please note that It is easy to damage the covers and the electronics, too, using a screwdriver.

STEP 1:

Put the screwdriver to the edge of the Top Cover Printed.

Push the Top Cover Printed's edge over the edge of the Bottom Cover subassembly.

See picture 7.

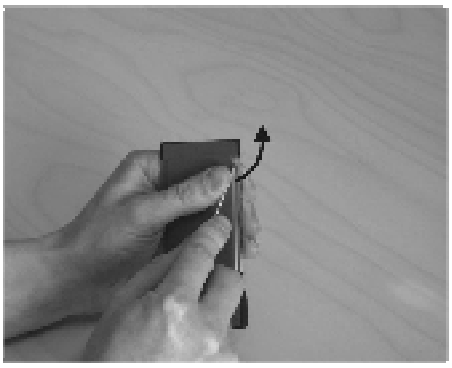


Fig. 7. Position of the screwdriver

STEP 2:

Release left side of the RPM-1 .

Push Top Cover Printed a little bit to left side after you have opened right side of the RPM-1 .

Open carefully Top Cover Printed same time as you push Top Cover Printed to left side .

See picture 5.

STEP 3:

Lift Top Cover Printed. Top Cover Printed must be 90 degree open. See picture 6.

Note when using a screwdriver:

Avoid scratching covers

Do not push screwdriver too much inside the RPM-1. Only a few mm is allowed.

Open Bottom Cover subassembly

Use screwdriver as you open the Bottom Cover subassembly.

Note: (general)

Do not push screwdriver too much inside to Extension Box subassembly. Only a few mm is allowed.

STEP 1:

Push screwdriver (use standard screwdriver ~∅ 1,50 mm) to gap between Extension Box subassembly and Bottom Cover subassembly (left or right side).

Open Bottom Cover subassembly step by step as illustrated in pictures 8 to 9.

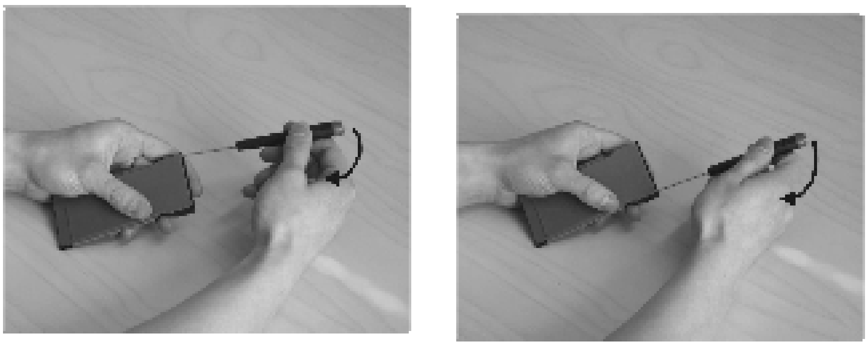


Fig. 8 : Open Bottom Cover subassembly

Fig 9. Open Bottom Cover subassembly

STEP 2:

–Lift Bottom Cover subassembly. See picture 10.

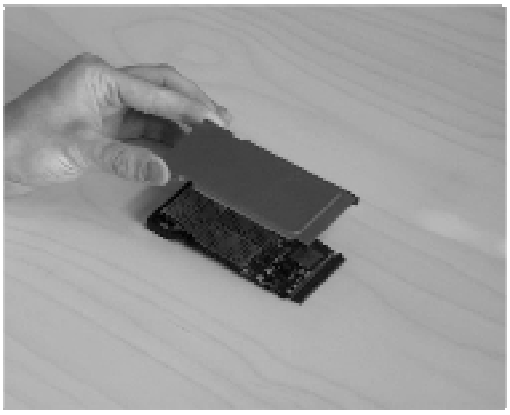


Fig. 10. Lift

Remove PCB from Extension Box subassembly

STEP 1:

–Lift and turn the GX9 to audio connector's side and snap fit between Extension Box subassembly and GX9 will disengage.

Small pins near the audio connector will damage the GX9 if the module is lifted in vertical direction.

The angle for turn is about 30 degree. Pull the GX9 smoothly from under small pins. See picture 11.

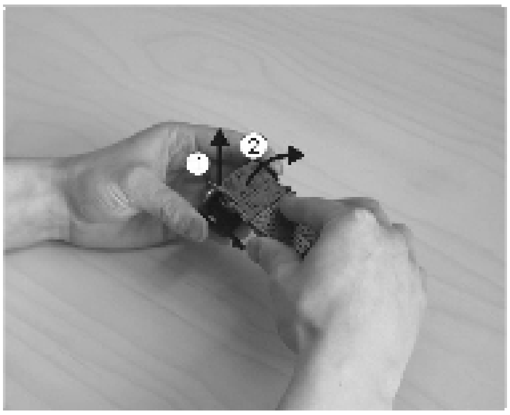


Fig. 11. Lift and turn

Note:

–Take extra care when performing this operation. Do not use too much force, the PCB may break.

Reassembly

Install the PCB to Extension Box subassembly

STEP 1:

–Slide carefully the GX9 under the Extension Box subassembly's small pins near audio connector.

–Turn and push the GX9 into the Extension Box subassembly after GX9 in assembled under small pins.

–Assembly is OK as the snap fit between these parts engages. The assembly angle for turn is about 30 degree. See picture 12.

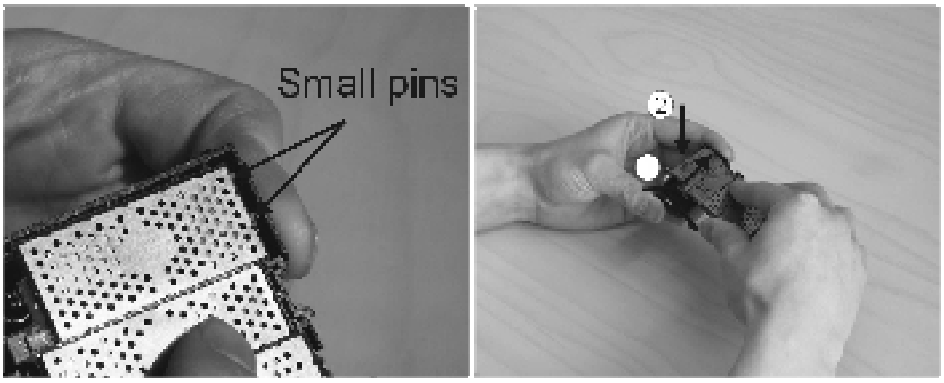


Fig. 12. Slide and turn

Note:

–Do not use old Extension Box subassembly for assembly. Antenna contact between Bottom Cover subassembly and Antenna insert may disengage.

–Use only new (unused) Extension Box subassembly.

–Do not bend audio connector springs as you assembled GX9. Be very careful with the audio connector springs. Change audio connector if needed.

Assemble Bottom Cover subassembly to the Extension Box subassembly

STEP 1:

–Put Extension Box subassembly on the Bottom Cover subassembly and push it against table, etc. Push only from the Extension Box subassembly. See picture 13.

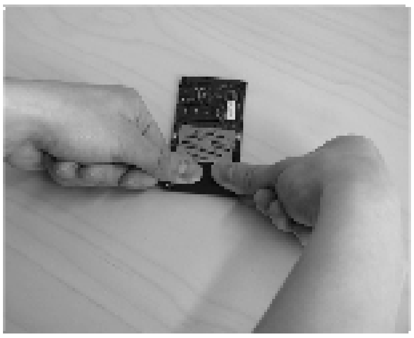


Fig. 13. Push from the Extension Box subassembly

Note:

–Check the dimensions of the Bottom Cover subassembly grounding clips before assembly. Dimension must be 1,80 +0,2 mm. Change the clips' dimension into tolerance range if needed.

Clip is situated in the right side of the Bottom Cover subassembly (top view).

Close Top Cover Printed

STEP 1:

Assemble Top Cover Printed to the holes of the Extension Box subassembly. See picture 14.

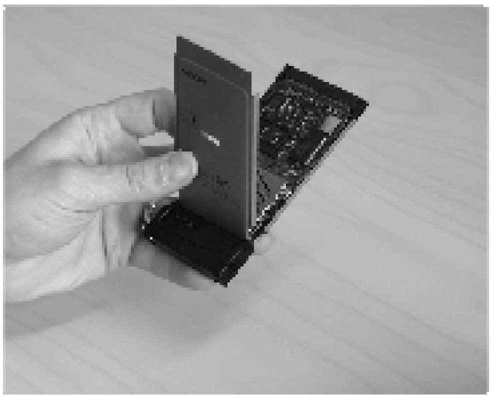


Fig. 14. Assembly angle

STEP 2:

First assemble the left side of the RPM-1. It’s important to start assembly near Extension Box subassembly. Do not push near flash component. See picture 15.

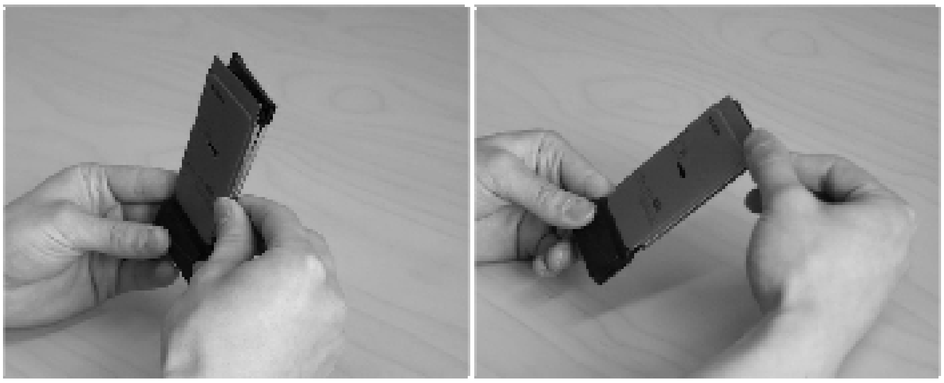


Fig. 15. Close left side

STEP 3:

Assemble the right side as the left side was assembled. Start assembly near Extension Box subassembly. See picture 16.

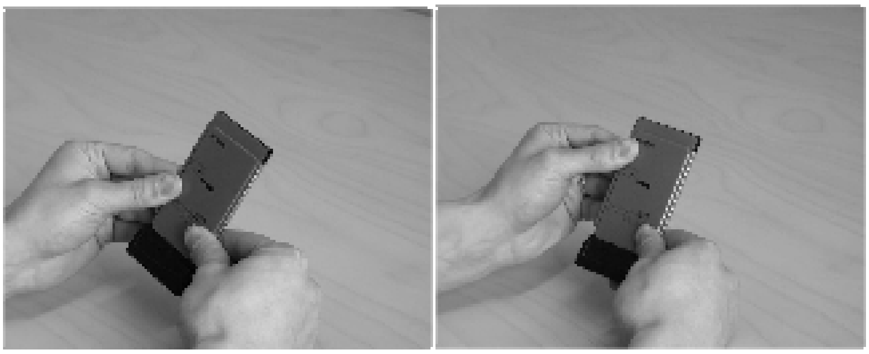


Fig. 16. Close right side

Push Antenna into the Extension Box subassembly

STEP 1:

–Push the Antenna smoothly to Extension Box subassembly

Baseband Troubleshooting

When a faulty RPM-1 is taken under investigation a first a thorough visual inspection should be done. Special attention should be paid to

- Solderings and condition of PCMCIA connector X400,
- Solderings of Sulo ASIC D400,
- Alignment of μBGA packaged ICs MAD2WD1, CCONT, COBBA and Flash (D500, N700, N600 and D501 respectively)

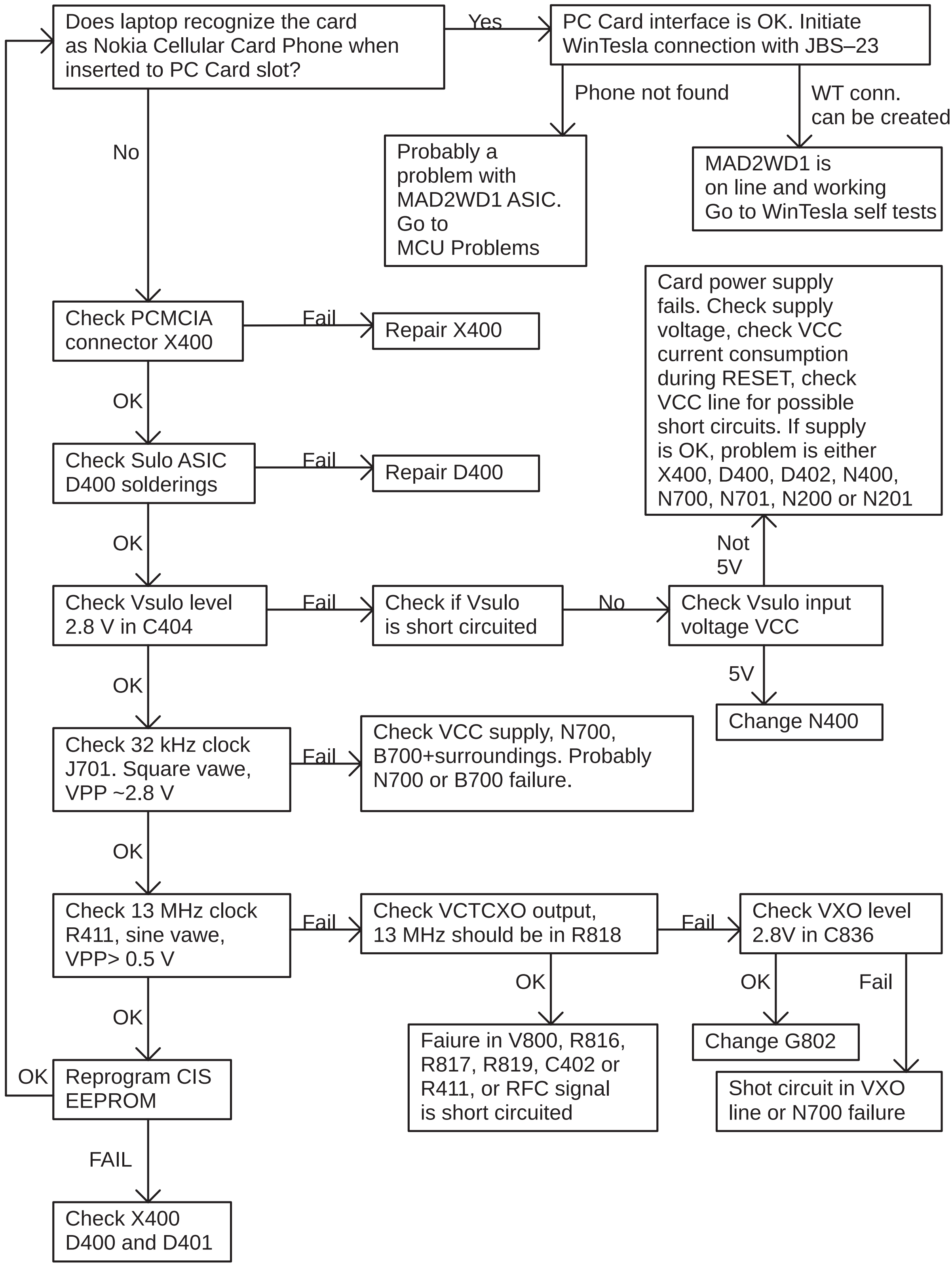
Current Consumption in Fault Diagnostics

When the RPM-1 is placed in service adapter JBS–23 and RESET button is being pressed , the current consumption should be around 30 mA..

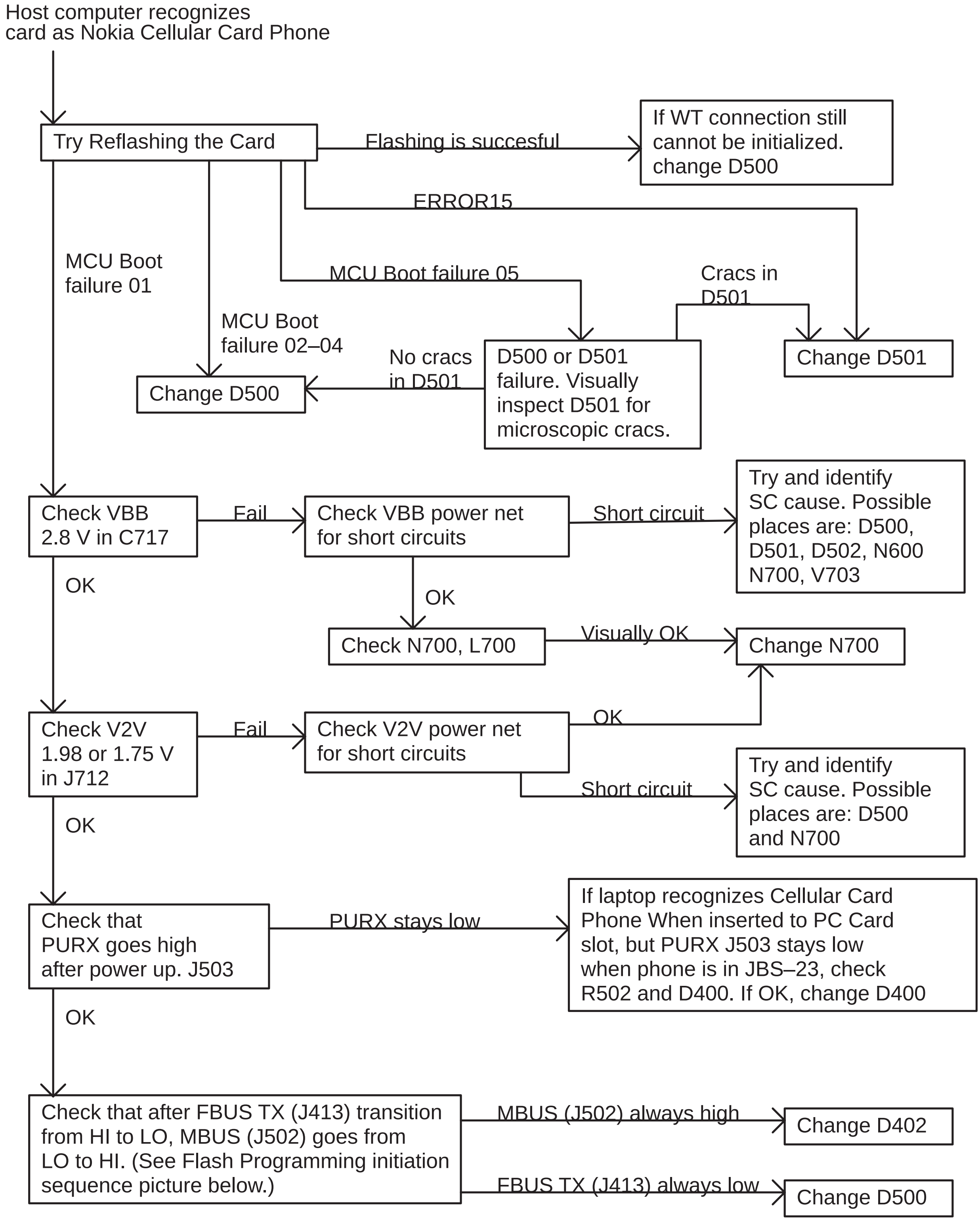
If the current consumption of the RPM-1 is several hundred mAs even when RESET button of service adapter is pressed, there is obviously a short circuit in the main power supply rail or massive failure in one of the following circuits: CCONT (N700), PA power switch (N701), Sulo (D400), Sulo core voltage regulator (N400) or MBUS switch (D402). Check PCMCIA supply voltage (VCC) resistance to ground to determine this.

If the current consumption of the RPM-1 is constantly significantly higher than expected, for example 100–300 mA even when RESET button of service adapter is pressed, but VCC to GND resistance is OK, either one of CCONT’s (N700) regulator outputs is short circuited to GND or Sulo core voltage regulator (N400) output is short circuited to GND. Check resistances to GND from CCONT regulator output voltages. (J702, J703, J704, J705, J706, J708, J724 to be 2.8 V, J712 to be either 1.975 or 1.75 V and J709 to be 5 V.) Also check Sulo core voltage regulator output voltage to be 2.8 V. (This can be measured from capacitor C404’s positive terminal.)

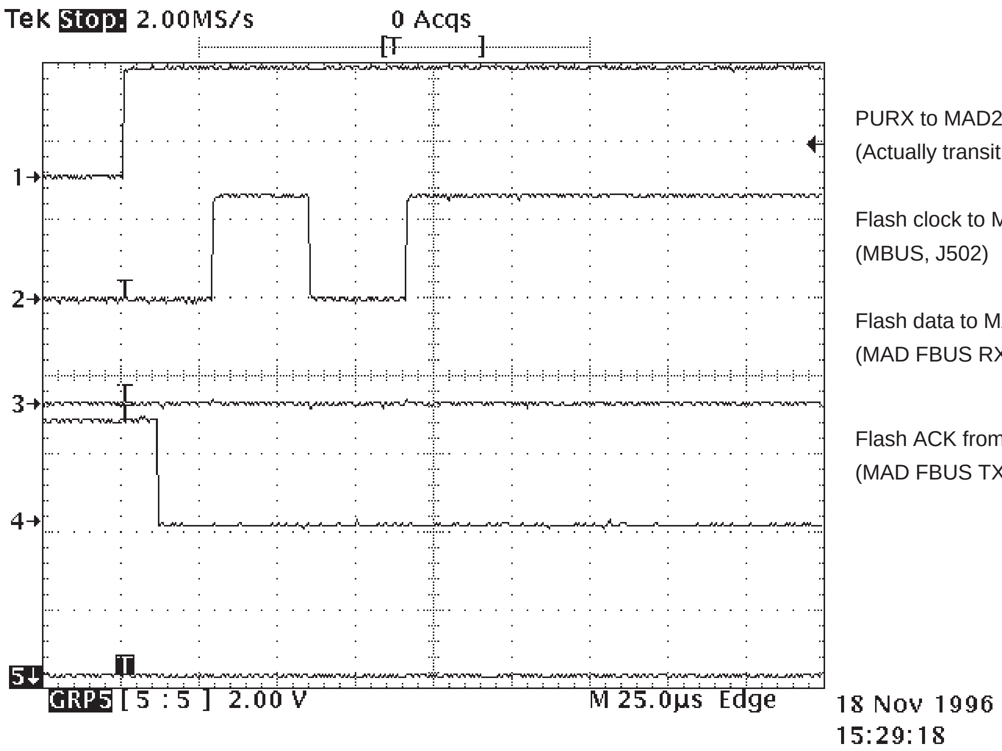
Card Phone does not Communicate with the Host Computer



MCU Problems



Flasah Programming Initialization sequence



WinTesla Self Tests

Open product RPM–1 in WinTesla and go to Testing —> Self tests... menu .

If no tests are reported as FAIL, powering, clocking and digital parts of base band are OK.

See list below of what to do in case of different self test failures:

– **MCU ROM Checksum FAIL**:
  Reflash card phone.
  still fails: total erase flash, reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
  still fails: change flash IC (D501), reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
  still fails: change MAD2WD1 (D500).

– **MCU RAM Interface FAIL**:
  Reflash card phone,
  still fails: change MAD2WD1 (D500),
  still fails: change flash IC (D501), reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks

– **MCU EEPROM Interface FAIL**:
  Reflash card phone, run factory setup.
  still fails: total erase flash, reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.

- **CCONT Interface FAIL**:
  MAD2WD1 (D500) or CCONT (N700) or traces connecting them are faulty.
- **Security Data Fail**:
  Reflash card phone
  still fails: total erase flash, reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
  still fails: change flash IC (D501), reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
- **EEPROM Tune Checksum FAIL**:
  Reflash card phone,
  still fails: Run factory setups, check RF tunings.
  still fails: total erase flash, reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
  still fails: change flash IC (D501), reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
- **MCU Download DSP FAIL**:
  Reflash card phone,
  still fails: change MAD2WD1 (D500)
- **DSP Alive FAIL**:
  Reflash card phone,
  still fails: change MAD2WD1 (D500)
- **COBBA Serial/Parallel FAIL**:
  MAD2WD1 (D500) or COBBA (N600) or traces connecting them are faulty.
- **EEPROM Sec Checksum FAIL**:
  Reflash card phone
  still fails: total erase flash, reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.
  still fails: change flash IC (D501), reflash phone, run all factory setups, retune RF, rebuild IMEI and open SIM locks.

ADC Readings With WinTesla

Select Testing —> ADC Readings

Battery voltage should be about 5.0 V, if not, there is probably a problem with either power supply, CCONT (N700) or MAD2WD1 – CCONT interface. First try running factory setup. (Check RF tunings after running factory setup!)

Battery Temperature should be about 5 degrees above room temperature. If temperature reading is over 5 degrees below or over 15 degrees above room temperature run factory setup. (Check RF tunings after running factory setup!)

- Measure R709 resistance. Should be at 25 °C temperature (47 ± 3) kΩ

– Check R703 and C725
– Check VREF level, should be (1.5 ± 0.033) V
– If both are OK, but temperature reading is not OK, there is a problem with CCONT (N700) or CCONT – MAD2WD1 (D500) interface bus. If supply voltage reading is OK, change N700 if both readings fail, problem can also be in D500.

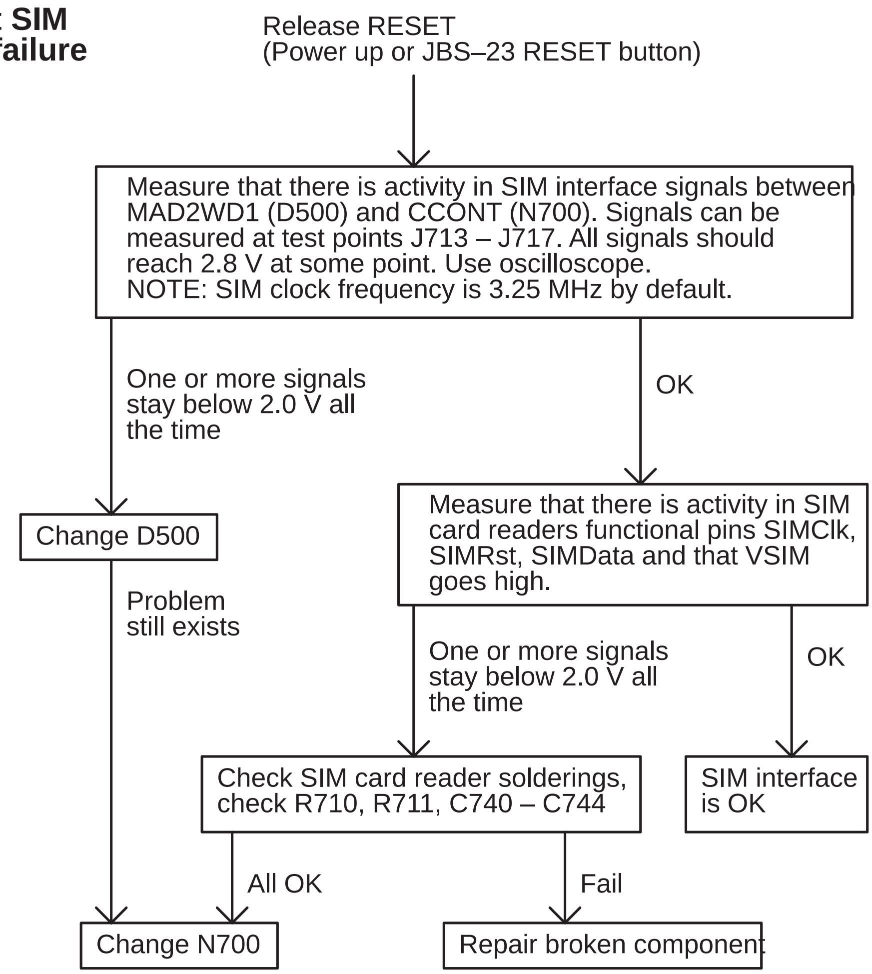
See section Audio Fails for accessory detection test.

SIM Card Failure

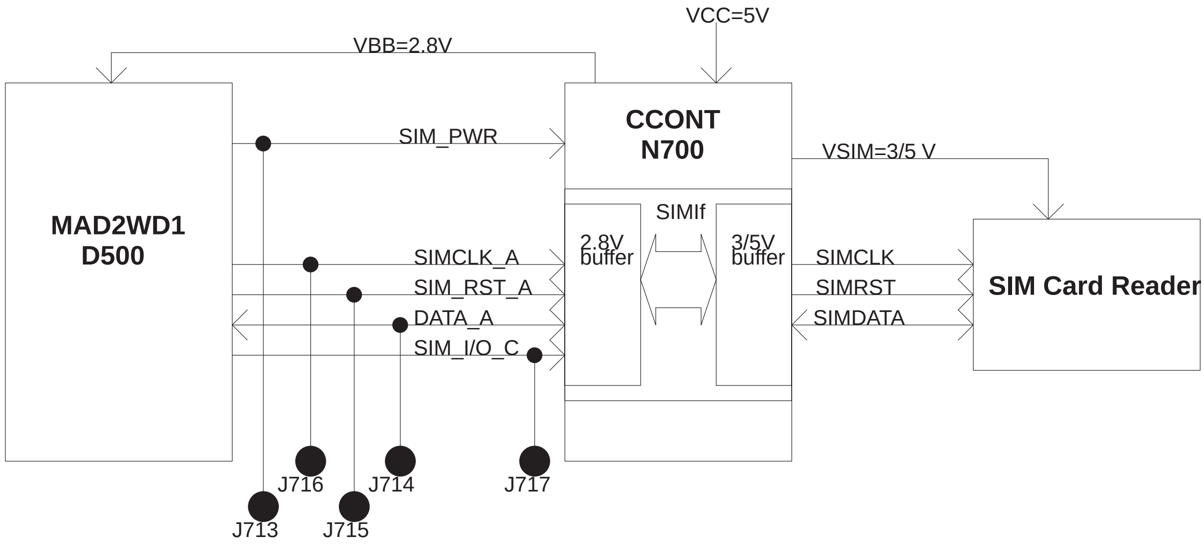
If the RPM–1 User Interface asks user to insert SIM card even when a known good SIM card is installed there is probably a problem in SIM interface signals. The SIM is controlled by MAD2WD1 (D500) and CCONT (N700) is used as signal level sifter between MAD2WD1 and SIM card.

SIM interface signals can be tested without SIM card. After power up or releasing reset (JBS–23 reset button) activity can be measured in all of the SIM interface signals. See NO TAG and NO TAG for logical connections and SIM card reader pinout.

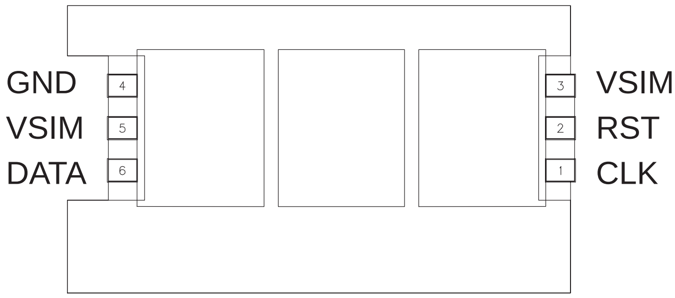
Insert SIM card failure



SIM interface diagram



SIM Card Reader pins



Audio Fails

Audio testing means only analog audio related things (headset connection), because the RPM-1 does not support PC–audio. Consequently the headset is necessary in these tests. WinTesla can be used for checking some basics of properly working audio.

The whole audio functioning can be tested by following steps. However, when looping audio, it is often quite difficult to specify exactly the failing section. Two following sections give some useful hints to tests mic and ear paths separately. But first of all, be sure to have working headset (HDC–6D).

When the loop is set on, it should be heard from the earpiece what is said to the microphone (without delay).

- WinTesla: Testing => Audio => Internal...
  - Loop (on/off)

One of the first things which could cause audio loop fail is that Dragon hasn't noticed the existing headset. That could be tested by following way (checking ADC–values).

- WinTesla: Testing => ADC Readings...
  - Accessory Detection:

    <650 (headset in), >650 (headset out)

    if Micbias not on, then <100 (headset in), >800 (headset out)
  - Hook Information: 1 (button pushed), else 0

Micbias will be switched on when the loop is activated. After deactivating the loop, micbias remain on. But if it (Accessory Detection) is checked before activating the audio loop, micbias is off.

If there appear some problems, next components should be checked:

- Headset connector and EMI–components (E600...E603, Z600...Z602, C601, C603, C619, C620, C630...C632, V600 and R609...R611)
- Loop on => Micbias (2.1V) on testpoint J614
- Audio–signal on testpoint J604 (if missing, check components: C636, C618, C635 and R630)

Audio–signal should be seen clearly with oscilloscope (1ms/div, 100mV/div) while e.g. blowing to the microphone.

- Output on testpoint J620

Output could be checked with oscilloscope (1ms/div, 100mV/div). There should be seen also dc–level of about 1 to 1.5 V in the output.

If the signal on the testpoint seems to be OK, but anything could be heard from the earpiece, check components: C616, R603.

RF Troubleshooting

RF trouble shooting principles

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

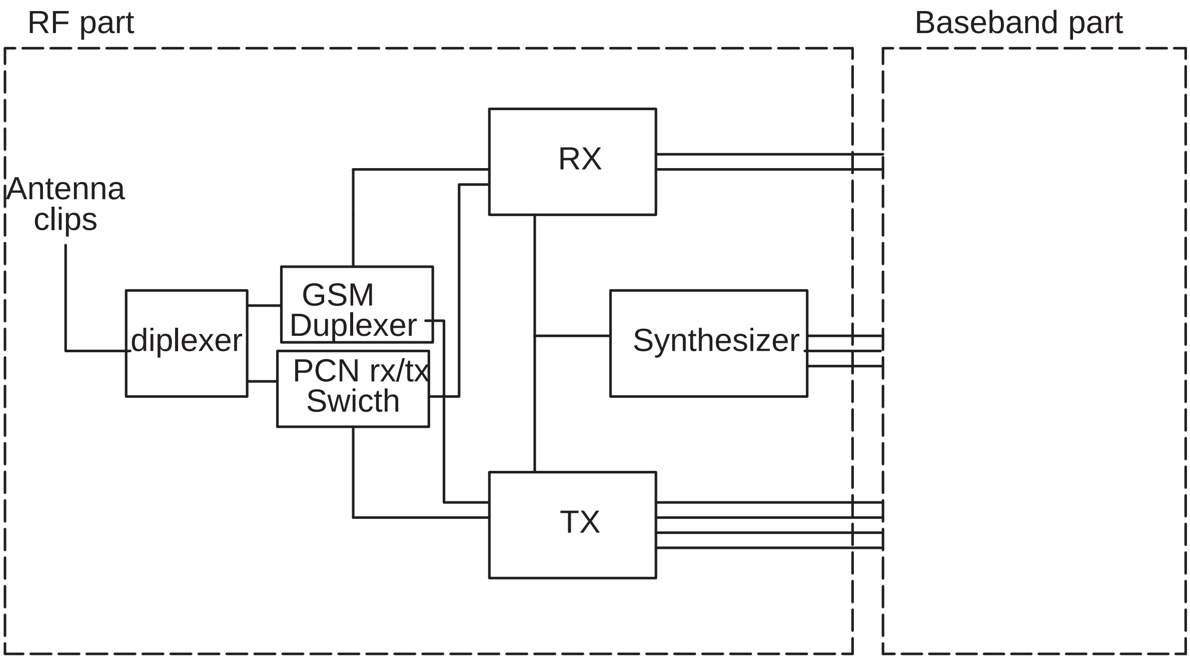
– RX?

– TX?

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

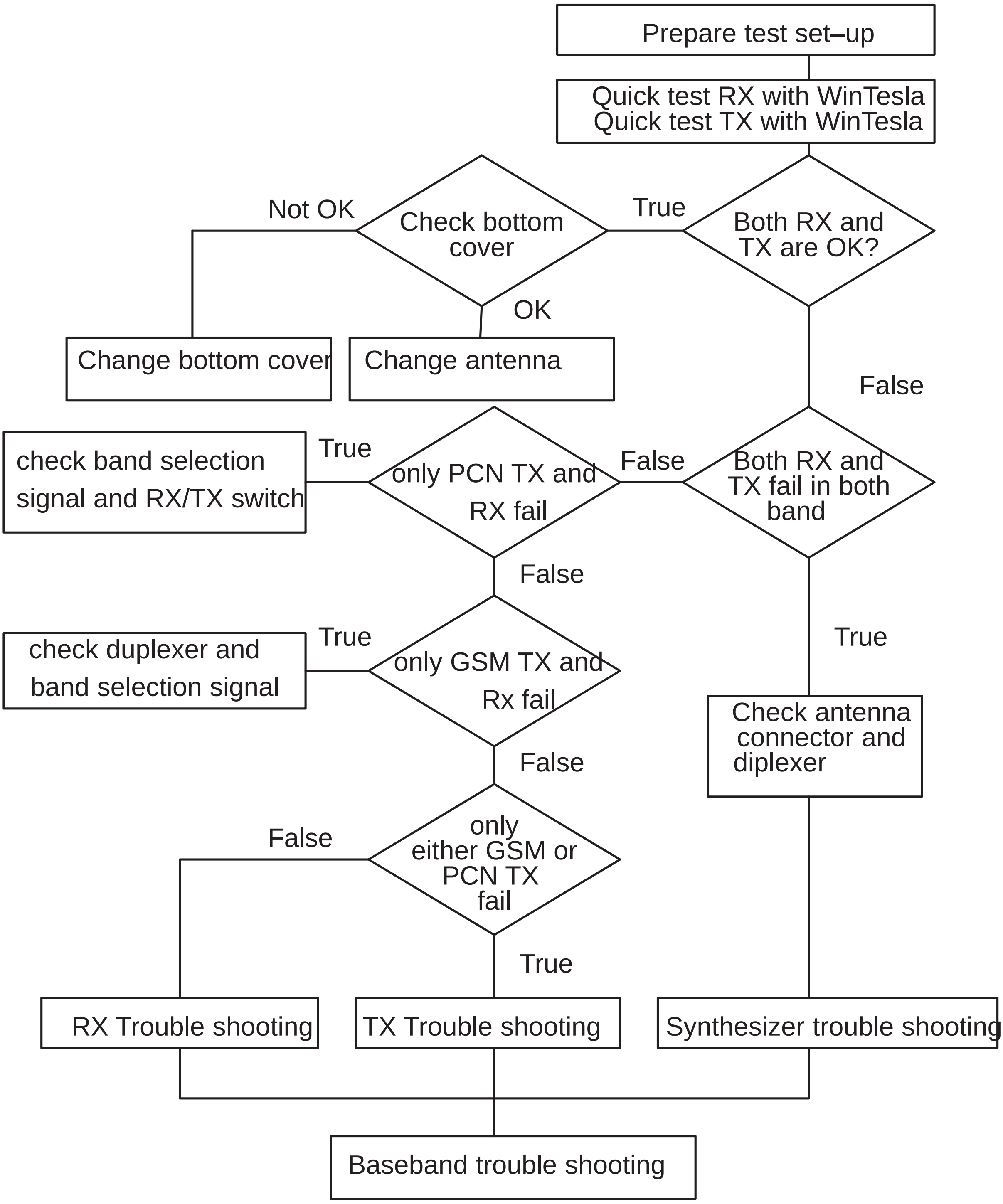
This is quickly found out using the WinTesla, a signal generator, and a spectrum analyzer. After the problem has been located in one of the above said 'main blocks' the particlular 'main block' must be examined in more detail. Refer to the figures below.

RF Main Blocks below



Typical signal levels and signal shapes are listed in the tables and there is also some oscilloscope views in the pictures. If there is not correct signal in DUT and it is input signal, check the signal route where it should be coming (schematic) and check that block (CCONT, COBBA, MAD2WD1 synthesizer ...). If the defective signal is output signal the error can be in the block under the examination..

Figure below: Rough troubleshooting



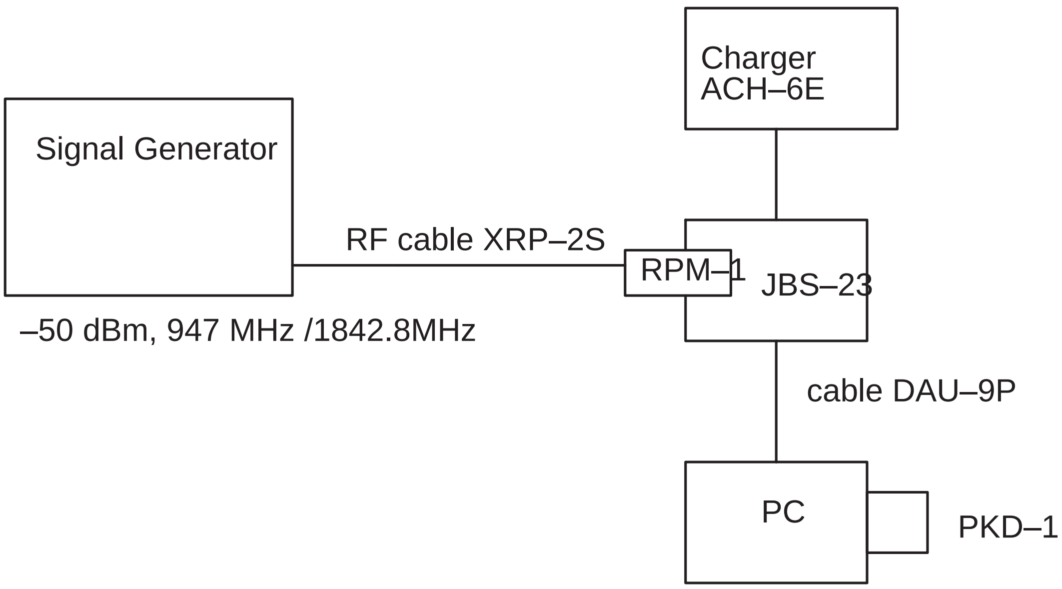
Quick check RX with WinTesla

Rx quick test must be done covers on.

Gather test equipment

– Service adapter JPS–23
– Charger ACH–6 (check your area variant from chapter Service tools)
– PC with WinTesla SW
– Cable DAU–9P
– Security key PKD–1A
– RF cable type XRP–2S
– Signal generator (Up to 2 GHz)

Connect test equipment



Settings and diagnostic

in GSM band:

– Signal generator: RF power –50 dBm, frequency 947 MHz
– WinTesla: Testing > RF controls > Cont mode ch: 60, Operation Mode: Continous > Apply > Close > Testing > RSSI Reading

If RSSI reading is –54...–48 dBm, Rx is approximately OK.

in PCN band:

- Signal generator: RF power –50 dBm, frequency 1842.8 MHz
- WinTesla: Testing > RF controls > Cont mode ch:700, Operation Mode: Continous > Apply > Close > Testing > RSSI Reading

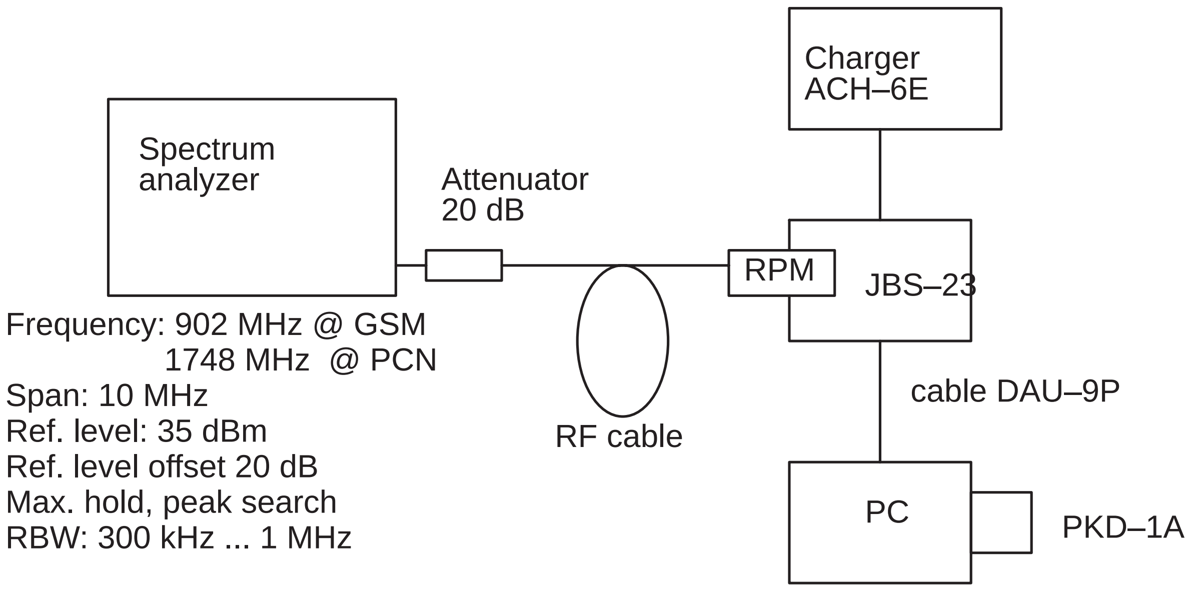
If RSSI reading is –54...–48 dBm, Rx is approximately OK.

Quick check TX with WinTesla

Test equipment list

- Service adapter JBS–23
- Cable DAU–9P
- Charger ACH–6
- PC with WinTesla SW
- Security key PKD–1
- Spectrum analyzer
- RF cable XRP–2S
- Attenuator 20 dB (e.g. HP8491A)

Connect test equipment



Settings & diagnostic

Do not remove the covers before quick tests (when bottom cover is off, there can be 1 ... 2 dB extra attenuation in antenna connector). The attenuation of XRP–2S RF cable is about 0.7dB in GSM and 1dB in PCN band.

GSM

- Spectrum analyzer: Center frequency: 902 MHz, Span: 10 MHz, Ref. level: 35 dBm, Ref. level offset 20 dB, Trace > MAX HOLD, (Marker) PEAK SEARCH, RBW: 300 kHz ... 1 MHz
- Service adapter: ’vertical mode’
- WinTesla: Testing > RF controls > Active unit TX, Operation mode Burst, Channel: 60, TX power level: 5 > Apply

If output power reading is 32.5 dBm (+/– 3 dB) then TX is approximately OK. (notice cable attenuations !)

PCN

- Spectrum analyzer: Center frequency: 1748 MHz, Span: 10 MHz, Ref. level: 35 dBm, Ref. level offset 20 dB, Trace > MAX HOLD, (Marker) PEAK SEARCH, RBW: 300 kHz ... 1 MHz
- Service adapter: ’vertical mode’
- WinTesla: Testing > RF controls > Active unit TX, Operation mode Burst, Channel: 701, TX power level: 0 > Apply

If output power reading is 29.5 dBm (+/– 3 dB) then TX is approximately OK. (notice cable attenuations !)

RX trouble shooting

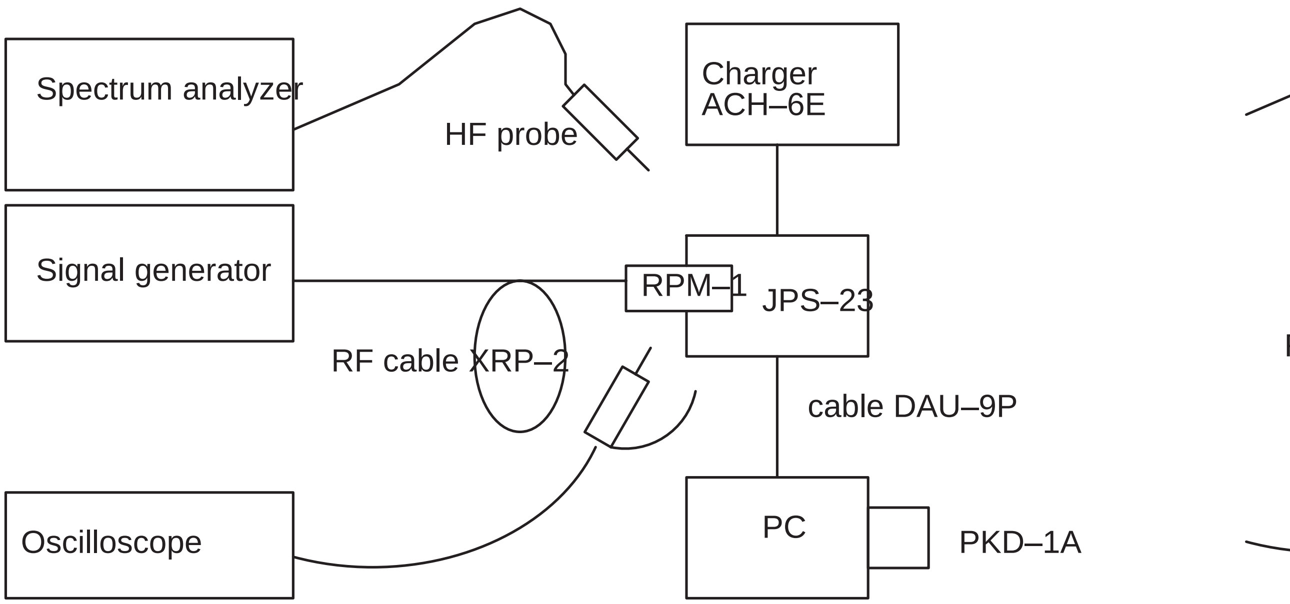
Test equipment

- Service adapter JPS–23
- Cable DAU–9P
- Charger ACH–6(check your area variant from chapter Service tools)
- PC with WinTesla SW
- Security key PKD–1
- Spectrum analyzer up to 2 GHz
- Signal generator up to 2GHz
- HF probe i.e HF–probe 85024A
- RF cable type XRP–2S
- Digital multimeter, oscilloscope

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

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

Figure below: use of HF probe for power measurements and oscilloscope for voltage measurements



Note that when bottom cover is off, there can be 2db extra attenuation in antenna connector in PCN band. The attenuation of XRP–2 rf cable is 0.7db in GSM band and 1db in PCN band.

Test points are defined as component pin numbers wherever possible. In case the components have no pin or terminal numbering (e.g. resistors), the test point is marked as the component number, then the component pad is the measuring point. If needed, it is also mentioned which pad is to be measured. Input and output pads are defined according to the direction of the signal in the rx chain.

You need to refer to the component assembly drawing.

GSM Receiver

Settings

– Spectrum analyzer: Center frequency depends on test, span 2 MHz, Ampilude REF LVL +0 dBm, REF level offset 20db
– HF probe: use 10:1 adapter
– WinTesla
  Product > Band > GSM
  Testing > RF Controls > Active unit: RX, Operation mode Continous, Continous Mode Ch: 60, Monitoring channel 60, n Front End On, AGC 512.> apply
– Signal Generator Frequency 947 MHz, LEVEL –45 dBm (notice cable attenuation)
– Service adapter: ’vertical mode’

Test diplexer

	test point	nominal	tolerance	notes
RF in	Z202 pin 3	–46 dBm	± 1 dB	947 MHz
RF out1	Z202 pin 2	–46 dBm	± 1 dB	947 MHz

Test RX duplex filter

	test point	nominal	tolerance	notes
RF in	Z200 pin (ANT)	–46 dBm	± 1 dB	947 MHz
RF rx	Z200 pin (RX)	–49 dBm	± 2 dB	947 MHz

Test LNA (CRFU3 asic)

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

	test point	nominal	tolerance	notes
RF in	C108	–49 dBm	± 3 dB	947 MHz
RF out	Z106 pin (in)	–33 dBm	± 5 dB	947 MHz
band_sel	N100 pin 24	2.7 V	± 0.2 V	DC
Pdata0	N100 pin 28	2.7 V	± 0.2 V	DC
Supply Volt. Vrx	N100 pin 33	2.7 V	± 0.2 V	DC
voltage drop due to operating current	R101	510 mV	± 50mV	DC (7.5 mA). Measure voltage difference over R101.

Test RX SAW filter

	test point	nominal	tolerance	notes
RF in	Z106 pin (in)	– 33 dBm	± 5 dB	947 MHz
RF out (bal)	Z106 pin (out)	– 39 dBm	± 5 dB	947 MHz

Test UHF mixer

	test point	nominal	tolerance	notes
RF in (bal)	Z106 pin (out)	–38 dBm	± 5 dB	947 MHz
LO in	N100 pin 3	–11 dBm	± 5 dB	2040 MHz
IF out (bal)	C117	–18 dBm	± 5 dB	73 MHz
Vsyn_1	N100 pin 47 and 8	2.7 V	± 0.2V	DC

If LO_in –signal level and/or frequency aren’t correct, refer tosynthesizer trouble shooting part.

Test 73MHz filter

	test point	nominal	tolerance	notes
IF in (bal.)	Z303 (pin 1 and 3)	–19 dBm	± 8 dB	73 MHz
IF out (bal.)	C337 / C335 output	–25 dBm	± 8 dB	73 MHz

Test SUMMA asic

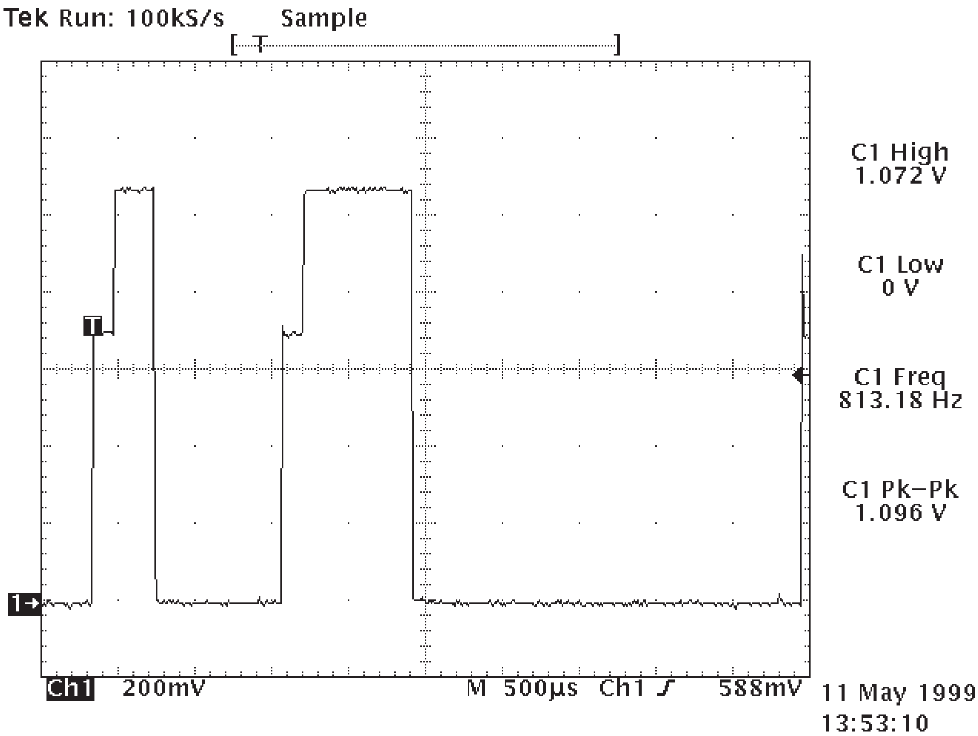
	test point	nominal	tolerance	notes
1st IF in (negative)	N300 pin 38	–26 dBm	± 8 dB	73 MHz
1st IF in (positive)	N300 pin 37	–26 dBm	± 8 dB	73 MHz
2nd IF out	N300 pin 30	3 dBm	± 8 dB	13 MHz

	test point	nominal	tolerance	notes
2nd IF in (positive)	N300 pin 25	–8 dBm	± 8 dB	13 MHz
2nd IF in (negative)	N300 pin 26	–8 dBm	± 8 dB	13 MHz
LO in	N300 pin 8	–3 dBm	± 5 dB	480 MHz
gain control (AGC)	N300 pin 36	1.2 V (see figure 5)	± 0.2 V	Pulsed. Measure in **Burst** mode!
voltage Vrx	N300 pin 35	2.7 V	± 0.2V	DC. Measure in **Continous** Mode.
voltage Syn2	N300 pins 9,16,19	2.7 V	± 0.2V	DC. Measure in **Continous** Mode.
voltage Vref	N300 pin 41	1.5 V	± 50mV	DC. Measure in **Continous** Mode.
RXI positive	N300 pin 24	DC 1.2 V AC 140 mV	± 0.2 V	DC. Note: Front end off. AGC 512
RXI negative	N300 pin 23	DC 1.2 V AC 140 mV	± 0.2 V	DC. Note: **Front end off**. AGC 512

Notice: If 2st IF in (positive or negative) signal level isn't correct (and 2st IF out is correct), change 13MHz filter Z301.

There are feedback connections between SUMMA and COBBA for AGC, so if the AGC voltage isn't correct, the reason can be either SUMMA or baseband.

GSM AGC control signal, in burst mode: figure below



PCN Receiver

Settings

- Spectrum analyzer: Center frequency depends on test, span 2 MHz, Ampilude REF LVL 0 dBm, REF level offset 20db
- HF probe: use 10:1 adapter
- WinTesla
  Product > Band > PCN
  Testing > RF Controls > Active unit: RX, Operation mode Continous, Continous Mode Ch: 700, Monitor. channel 700, n Front End On.> apply
- Signal Generator Frequency 1842.8 MHz, LEVEL –45 dBm (Notice cable attenuation) Note: if bottom cover is off, there can be even 2dB extra attenuation in antenna connector.
- Service adapter: ’vertical mode’

Test diplexer

	test point	nominal	tolerance	notes
RF in	Z202 pin 3	–46 dBm	± 1 dB	1842.8 MHz
RF out1	Z202 pin 1	–46 dBm	± 1 dB	1842.8 MHz

Test rx/tx switch

	test point	nominal	tolerance	notes
PCN ANT	Z206 pin (ANT)	–46 dBm	± 2 dB	1842.8 MHz
PCN Rx	Z206 pin (RX)	–46 dBm	± 2 dB	1842.8 MHz
Vcontrol	Z206 pin (VC)	0 V	± 0.3 V	DC

Test pre_LNA rx filter

	test point	nominal	tolerance	notes
RF in	Z207 pin 1	– 46 dBm	± 3 dB	1842.8 MHz
RF out	Z207 pin 3	– 49 dBm	± 3 dB	1842.8 MHz

Test LNA

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

	test point	nominal	tolerance	notes
RF in	C115	– 51 dBm	± 3 dB	1842.8 MHz
RF out	after C126	– 35 dBm	± 5 dB	1842.8 MHz
AGC control	N100 pin 28	2,7 V	± 0.2 V	DC

	test point	nominal	tolerance	notes
Supply volt. Vrx	N100 pin 33	2.7 V	± 0.2 V	DC
Band selection	N100 pin 24	0 V	± 0.3 V	DC
voltage drop due to operating current	R100	490 mV	± 50mV	DC (4 mA). Measure voltage difference over R100.

Test RX RF SAW filter

	test point	nominal	tolerance	notes
RF in	after C126	– 35 dBm	± 5 dB	1842.8 MHz
RF out (bal.)	N100 pin 42 and 43	– 43 dBm	± 5 dB	1842.8 MHz

Test UHF mixer

	test point	nominal	tolerance	notes
RF in (bal.)	N100 pin 42 and 43	– 43 dBm	± 5 dB	1842.8 MHz
LO in	N100 pin 3	– 11 dBm	± 5 dB	2035.8 MHz
IF out (bal.)	R105	– 20 dBm	± 5 dB	193 MHz
V_syn1 (V_uhf)	N100 pin 8	2.7V	± 0.2 V	DC

If LO in –signal level and/or frequency aren't correct, refer to the synthesizer trouble shooting section.

Test VHF mixer

	test point	nominal	tolerance	notes
RF in (bal.)	C144	– 24 dBm	± 5 dB	193 MHz
LO in	N100 pin 9	– 3 dBm	± 5 dB	120 MHz
IF out (bal.)	C117	– 17 dBm	± 5 dB	73 MHz
VHF LO	N300 pin 8	– 3 dBm	± 5 dB	480 MHz
V_rx (V_vhf)	N100 pin 13 and 33	2.7 V	± 0.2 V	DC

If LO in –signal isn't correct, measure VHF_LO frequency from SUMMA (N300) pin 8. If it isn't correct read synthesizer trouble shooting section otherwise change SUMMA asic (N300).

Test 73MHz filter

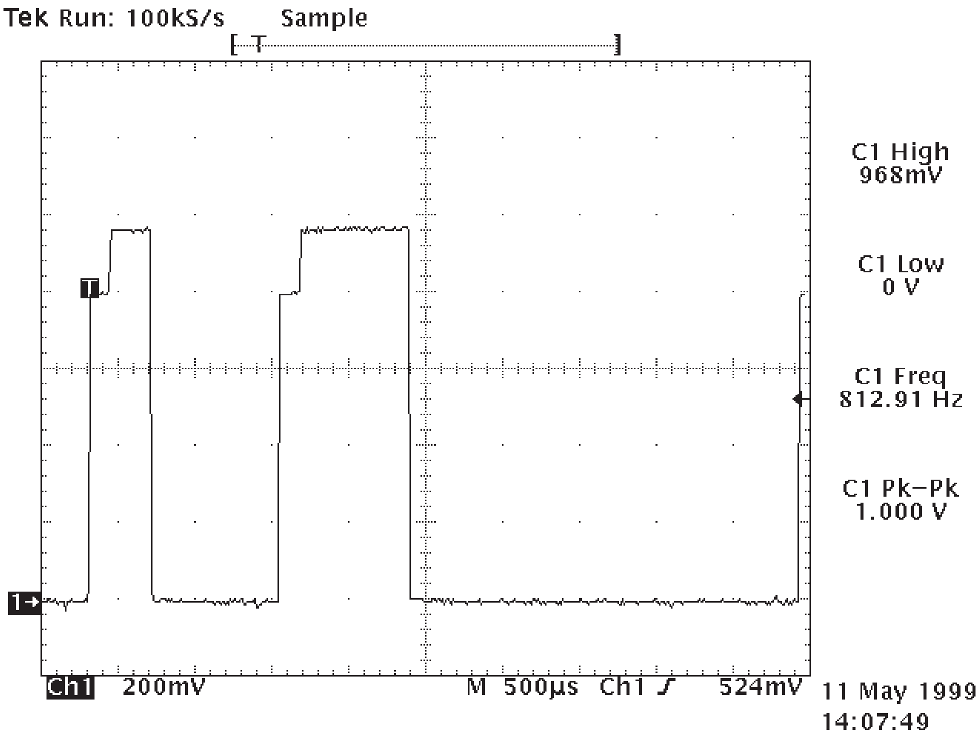
	test point	nominal	tolerance	notes
IF in (bal.)	Z303 pins 1 / 3	– 20 dBm	± 8 dB	73 MHz
IF out (bal.)	C337 / C335 ouput	– 28 dBm	± 8 dB	73 MHz

Test Summa asic

	test point	nominal	tolerance	notes
1st IF in (negative)	N300 pin 38	–30 dBm	± 8 dB	73 MHz
1st IF in (positive)	N300 pin 37	–30 dBm	± 8 dB	73 MHz
2nd IF out	N300 pin 30	5 dBm	± 8 dB	13 MHz
2nd IF in (positive)	N300 pin 25	–10 dBm	± 8 dB	13 MHz
2nd IF in (negative)	N300 pin 26	–10 dBm	± 8 dB	13 MHz
VHF_LO in	N300 pin 8	–3 dBm	± 5 dB	480 MHz
VHF_LO out (to CRFU3)	N300 pin 48	–12 dBm	± 8 dB	120 MHz
gain control (AGC)	N300 pin 36	1.2 V (see figure 6)	± 0.2 V	Pulsed. Measure in **Burst** mode! Signal level –70dBm in antenna connector
voltage Vsyn2	N300 pin 9,16,19	2.7 V	± 0.2 V	DC. Measure in **Continous** Mode.
voltage Vrx	N300 pin 35	2.7 V	± 0.2V	DC. Measure in **Continous** Mode.
voltage Vref	N300 pin 41	1.5 V	± 50mV	DC. Measure in **Continous** Mode.
RXI positive	N300 pin 24	DC 1.2 V AC 100mV	± 0.2V ± 50mV	DC. Measure front end off
RXI negative	N300 pin 23	DC 1.2 V AC 100 mV	± 0.2V ± 50mV	DC. Measure front end off

Note: If 2st IF in (positive or negative) signal level isn’t correct (and 2st IF out is correct), change 13MHz filter Z301.

There are feedback connections between SUMMA and COBBA for AGC, so if AGC voltage isn’t correct, the reason can be either SUMMA or baseband.



PCN AGC control voltage,in signal level –70dBm, burst mode

TX trouble shooting

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

Connect a 20 dB attenuator to the antenna–connector using the XRP–2S antenna cable.

Test equipment

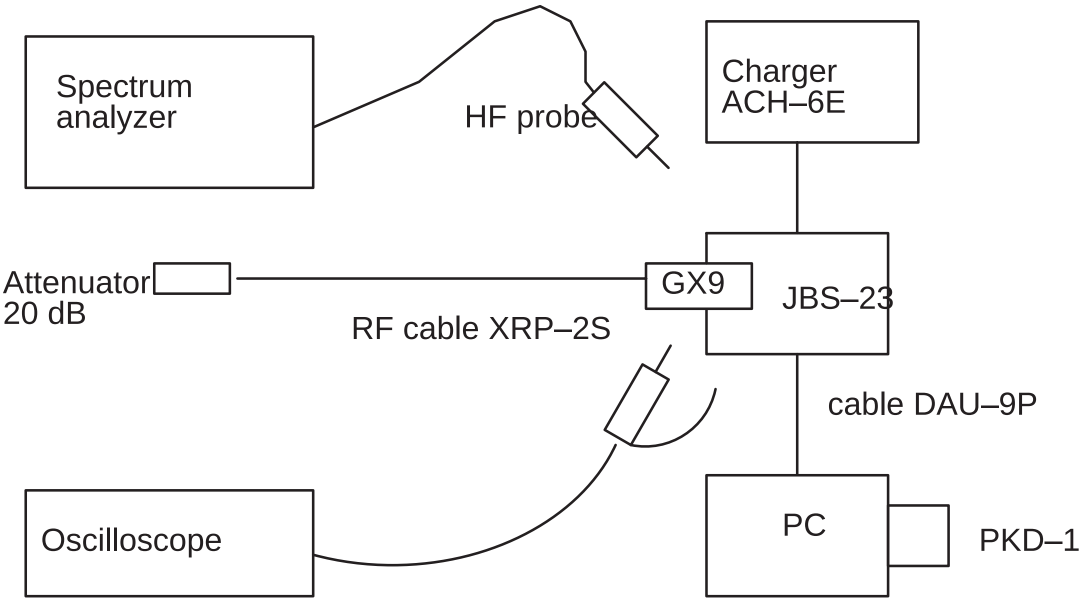
– Service adapter JBS–23
– Cable DAU–9P
– Charger ACH–6
– PC with WinTesla SW
– Security key PKD–1A
– Spectrum analyzer
– HF–probe (Note the voltage handling capability of the probe)
– RF cable XRP–2S
– Attenuator 20 dB (e.g. HP8491A)

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

Take off the metal covers of RPM–1 in order to be able to probe. Connect test equipment as in figure. Make sure that the PCMCIA connector connects properly, since the covers are not forcing proper match between the card and socket!

Typical signal levels and signal shapes are listed in the tables and there is also some oscilloscope views in the pictures. If there is not right signals in GX9 and it is input signal, check the signal route where it should be coming (schematic) and check that block (CCONT, COBBA, MAD2WD1 synthesizer ...). If the defective signal is output signal the error can be in the block under the examination.

TX troubleshooting equipment setup diagram next page



GSM TX

Settings

– WinTesla Testing > RF Controls > Active unit; TX, Operation mode Burst, Channel: 60, TX data type: Rand, TX power level: 5. (Apply)

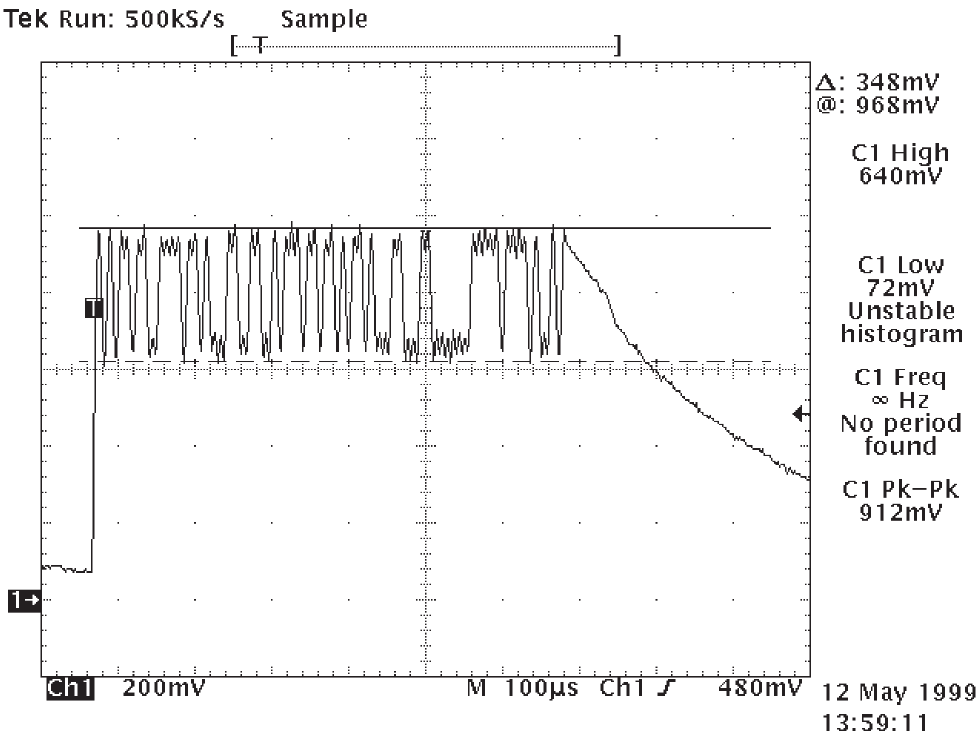
– Service adapter: ’vertical mode’

Test SUMMA TX part

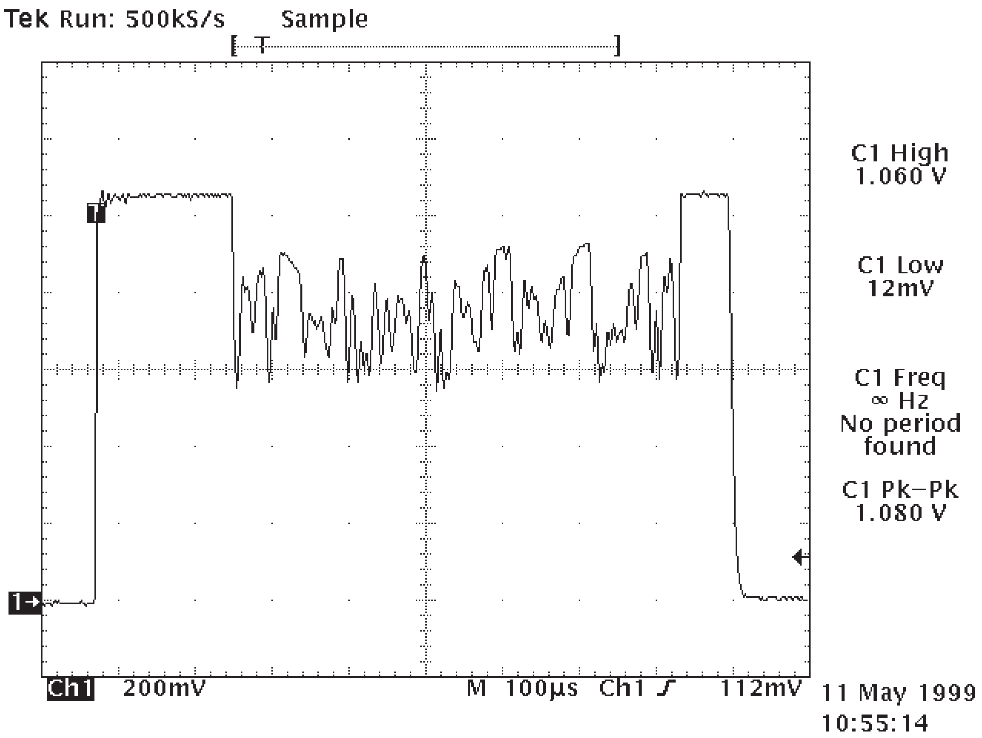
Signal	test point	nominal	tolerance	notes
TX I & Q (inmq, inpq, inpi, inmi) in	N300 pins 1, 2, 3, 4	see NO TAG	–	use oscilloscope
IF (outm_tx & outpg_tx) out	N300 pins 44, 45	– 11 dBm using probe. See also oscilloscope view NO TAG.	± 4 dB	Spectrum analyzer settings Frequency 120 MHz, Span 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3s
VHF_LO (LO)	N300 pin 8	– 3 dBm	± 4 dB	480 MHz If there is no signal check the synthesizer trouble shooting.
VTX in (operating voltage)	N300 pin 47, 27	2.75 V (peak)	± 0.15 V	pulsed

Signal	test point	nominal	tolerance	notes
TXC in (Analog power control input voltage from COBBA to SUMMA)	N300 pin 34	1.7 V (see NO TAG)	± 0.5 V	pulsed
CTL_GSM (POG power control signal to PA)	N300 pin 31	1.9 V	± 0.5 V	pulsed
VREF_1 (Accurate reference voltage VB_ext) in	N300 pin 41	1.5 V	± 50 mV	DC
SENA1	N300 pin 7	2.8 V	± 0.2 V	
VSYN_2 (VP1, VP2 & VDD)	N300 pins 9, 16, 19	2.75 V (peak)	± 0.15 V	pulsed

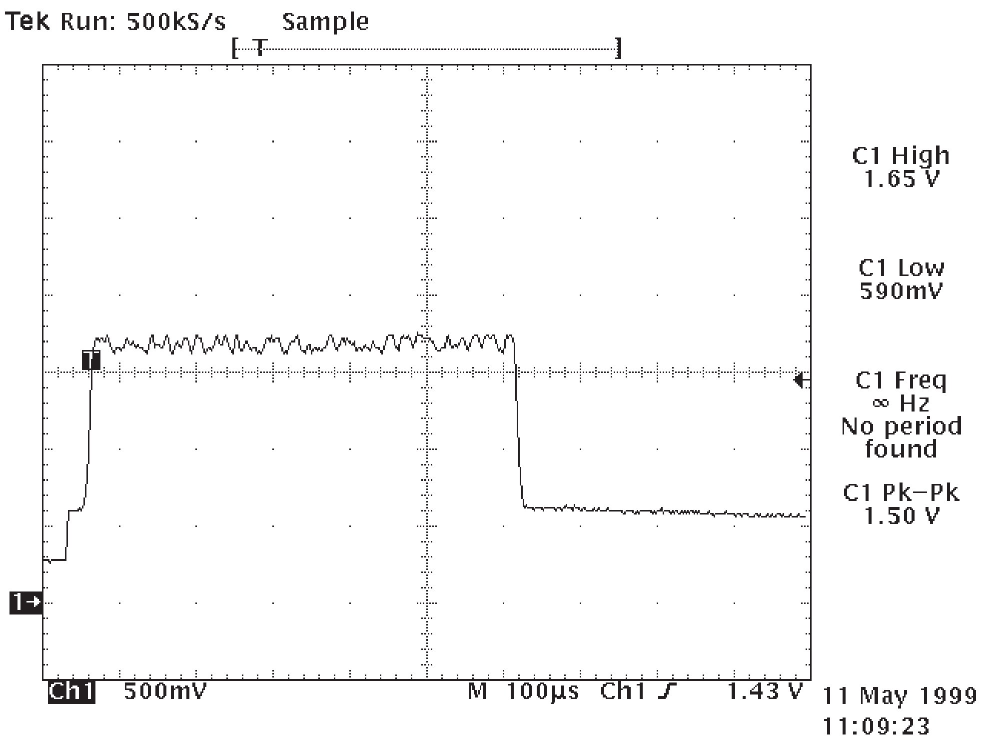
Typical shape of TX positive and negative I and Q signals in the diagram below:



Typical shape of IF signal (pin 44, 45)



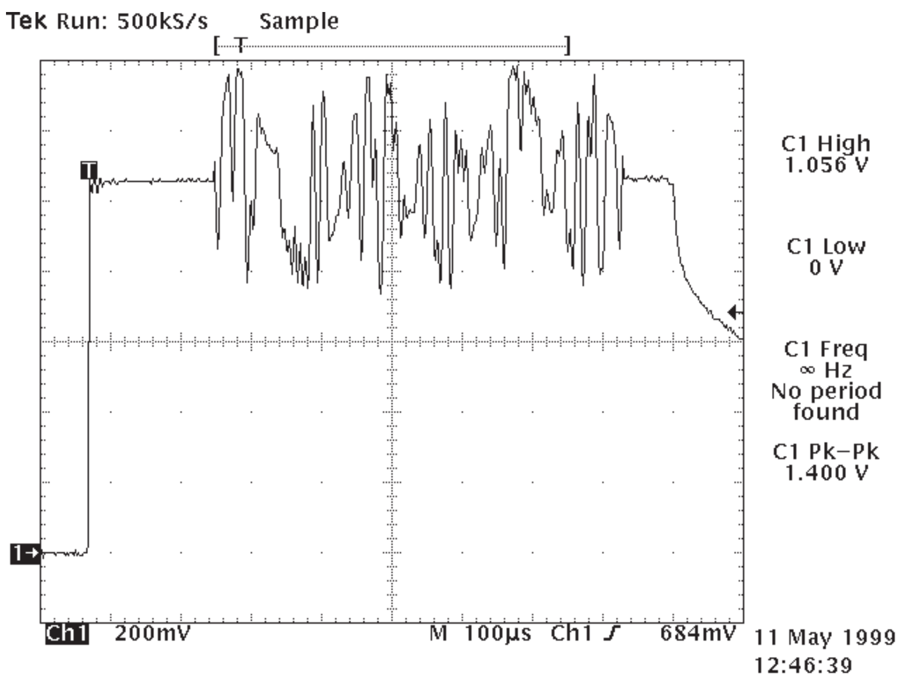
Typical shape of TXC signal (pin 34)



Test CRFU3 TX part

	test point	nominal	tolerance	notes
TX_GSM_P (TXIF_IN_1P) in	CRFU3 pin 25	–6 dBm See the next figure	± 5 dB	Spectrum analyzer settings: C.FREQ 120 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s
TX_GSM_M (TXIF_IN_1M) in	CRFU3 pin 26	–6 dBm See the next figure	± 5 dB	Spectrum analyzer settings: C.FREQ 120 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s
UHFLO (UH-FLO_IN_2_P) in	CRFU3 pin 3	–8 dBm	± 4 dB	Spectrum analyzer settings: C.FREQ 1018 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s If there is no signal check the synthesizer trouble shooting.
RF out (TX_OUT_1)	CRFU3 pin 22	13 dBm	± 6 dB	Spectrum analyzer settings: C.FREQ 902 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s
VSYN_1 (V_DIV_2 V_UHF) in	CRFU3 pins 47, 8	2.75 V	± 0.15 V	
VTX (V_TX) in	CRFU3 pin 39	2.75 V	± 0.15 V	
VTX in	CRFU3 pin 22	2.75 V	± 0.15 V	
BAND_SEL (SELECT) in	CRFU3 pin 24	2.8 V	± 0.2 V	

GSM TX IF signal, pins 25, 26



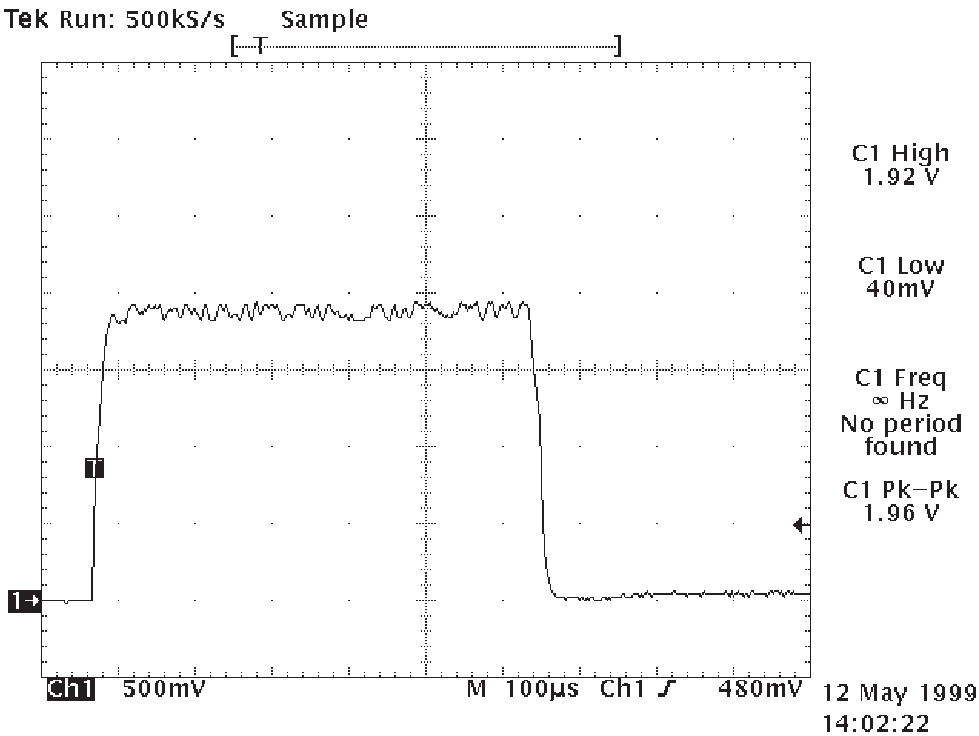
Test TX RF SAW filter

	test point	nominal	tolerance	notes
RF in	Z100 pin 2	13 dBm	± 5 dB	902 MHz
RF out	Z100 pin 5	15 dBm	± 5 dB	902 MHz

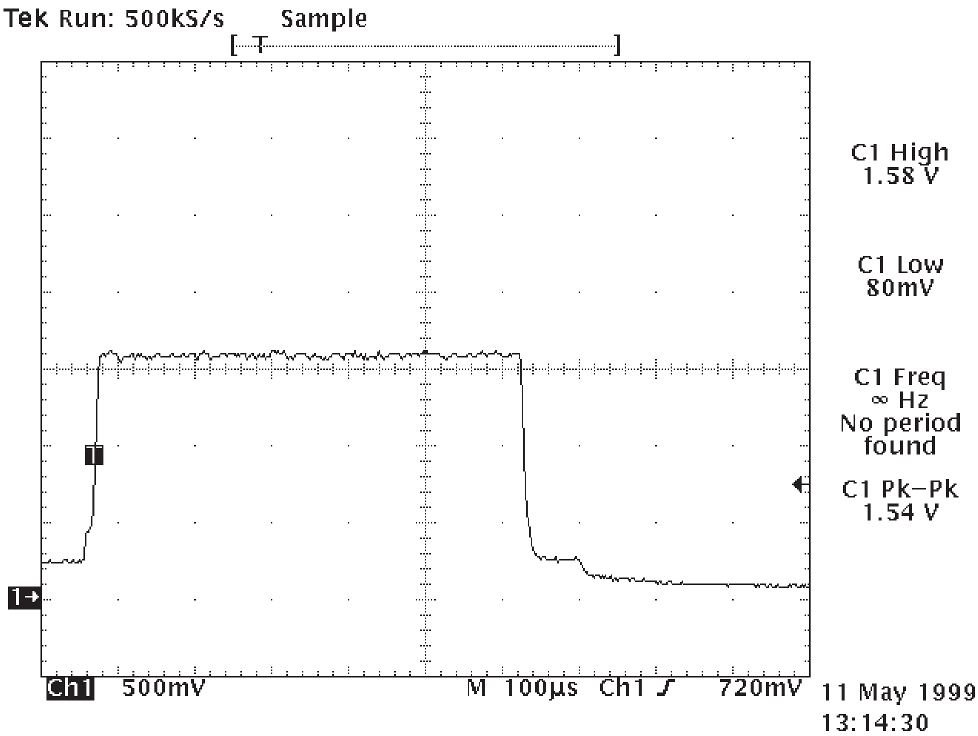
Test power control circuit

	test point	nominal	tolerance	notes
CTL_GSM (POG) out	SUMMA pin 31	1.9 V (see NO TAG)	± 0.5 V	’smooth pulse’, duration 576 us repetition 4.6 ms Tested already in Test SUMMA TX part
TXC in	SUMMA pin 34	1.7 V See Typical shape of TXC signal	± 0.5 V	’smooth pulse’, duration 576 us repetition 4.6 ms Tested already in Test SUMMA TX part
DET (detected voltage from pow-er detector)	R302	1.6 V see Typ.detected volt from the DET	± 0.8 V	

Typical APC voltage waveform to the PA (N200 pin2) at pwr ctrl level 5



Typical detected voltage from the Power Detector (DET)



Test power amplifier

	test point	nominal	tolerance	notes
RF in (Pin)	N200 pin 1	8 dBm	± 8 dB	Spectrum analyzer settings: C.FREQ 902 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s (The signal is coupled to the probe from the PA and PA output)
RF out (Pout)	N200 pin 4	29 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 902 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s Ref. level 35 dBm
Vdd	N200 pin 3	4.85 V	± 0.2 V	DC (almost)
Vapc	N200 pin 2	1.9 V See Fig. Typical APC voltage wave form..	± 0.5 V	pulse

Test duplexer TX side

	test point	nominal	tolerance	notes
RF in (TX)	Z200 pin 3	29.5 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 902 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s Ref. level 35 dBm
RF out (ANT)	Z200 pin 1	28 dBm	± 5 dB	Same as above

Test diplexer GSM side

	test point	nominal	tolerance	notes
GSM in (/ RXout) (P2)	Z202 pin 1	27 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 902 MHz, SPAN 10 MHz, RBW = 300 kHz ... 1 MHz Sweep time 2 ... 3 s Ref. level 35 dBm
Antenna side (P3)	Z202 pin 5	28.5 dBm	± 5 dB	Same as above

GSM1800 TX

Settings

- WinTesla Testing > RF Controls > Active unit; TX, Operation mode Burst, Channel: 701, TX data type: Rand, TX power level: 0.
- Service adapter: ’vertical mode’

Test SUMMA TX part

	test point	nominal	tolerance	notes
IF (outpp_tx) out	(SUMMA pin 46) R330	– 10 dBm using probe.	± 5 dB	Spectrum analyzer settings Frequency 240 MHz, Span 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s
VHF_LO (LO)	SUMMA pin 8	– 3 dBm	± 4 dB	480 MHz If there is no signal check the synthesizer trouble shooting.
VTX in (operating voltage)	SUMMA pin 47, 27	2.75 V (peak)	± 0.15 V	pulsed
TXC in (Analogue power control input voltage from COBBA to SUMMA)	SUMMA pin 34	1.5 V (see NO TAG)	± 0.7 V	pulsed
CTL_PCN (POP pover control signal to PA)	SUMMA pin 28	1.5 V	± 0.9 V	pulsed
VREF_1 (Accurate reference voltage VB_ext) in	SUMMA pin 41	1.5 V	± 25 mV	DC
SENA1	SUMMA pin 7	2.8 V	± 0.2 V	
VSYN_2 (VP1, VP2 & VDD)	SUMMA pins 9, 16, 19	2.75 V (peak)	± 0.15 V	pulsed

Test CRFU3 TX part

	test point	nominal	tolerance	notes
TX_PCN_M (TXIF_IN_2_M) in	N100 pin 35	–8 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 240 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s
TX_PCN_P (TXIF_IN_2_P) in	N100 pin 37	–8 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 240 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s
UHFLO (UH-FLO_IN_2_P) in	N100 pin 3	–7 dBm	± 5 dB	Spectrum analyzer settings: FREQ MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s If there is no signal check the synthesizer trouble shooting.
RF out (TX_OUT_2)	N100 pin 40	3 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 1748 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s
VSYN_1 (V_DIV_2 V_UHF) in	N100 pins 47, 8	2.75 V	± 0.15 V	
VTX (V_TX) in	N100 pin 39	2.75 V	± 0.15 V	
VTX in (TX_OUT_2)	N100 pin 40	2.75 V	± 0.15 V	DC level (there is also TX signal in the pin)
BAND_SEL (SELECT) in	N100 pin 24	0 V	± 0.3 V	

Test 1st TX RF SAW filter

	test point	nominal	tolerance	notes
RF in	Z112 pin 2	1 dBm	± 5 dB	1748 MHz
RF out	Z112 pin 6	–3 dBm	± 5 dB	1748 MHz

Test buffer amplifier

	test point	nominal	tolerance	notes
RF in	V100 pin	–6 dBm	± 5 dB	1748 MHz
RF out	Z111 pin 2	7 dBm	± 5 dB	1748 MHz
VTX	C150	2.7 V	± 0.2 V	pulsed DC
(V100 collector DC–level)	R110 / C141	1.9 V	± 0.5 V	pulsed DC

Test 2nd TX RF SAW filter

	test point	nominal	tolerance	notes
RF in	Z111 pin 2	7 dBm	± 5 dB	1748 MHz
RF out	Z111 pin 5	4 dBm	± 5 dB	1748 MHz

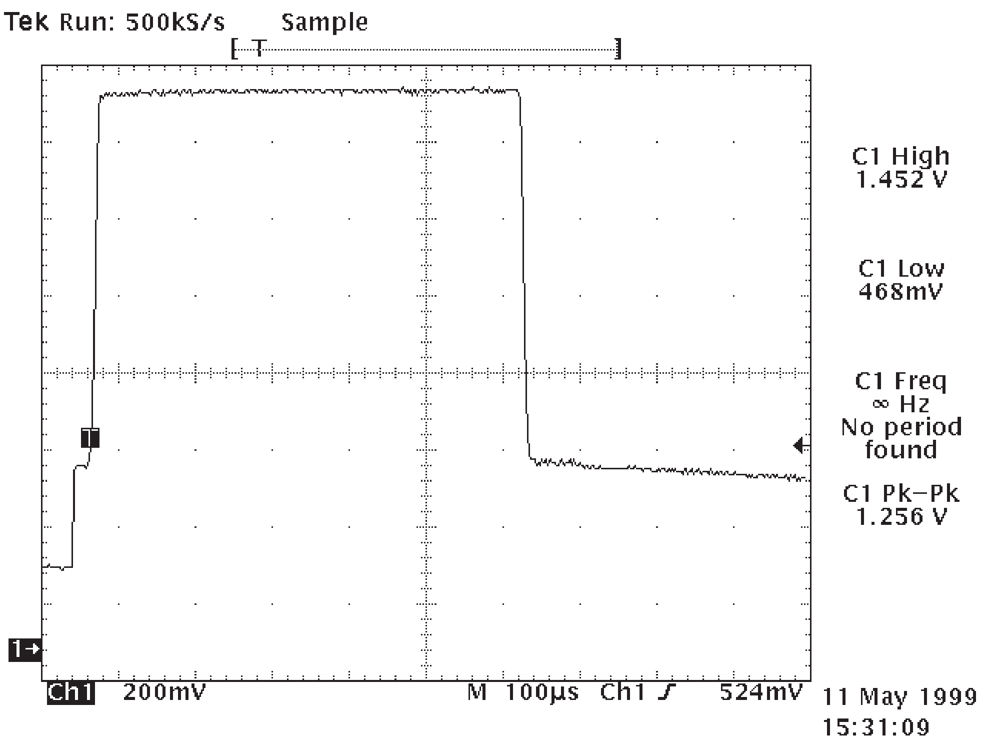
Test power control circuit

	test point	nominal	tolerance	notes
CTL_PCN (POP) out	SUMMA pin 28	1.5 V	± 0.7 V	’smooth pulse’, duration 576 us repetition 4.6 ms Tested already in table SUMMA TX part
TXC in	SUMMA pin 34	1.5 V (refer to fig. Typ. shape of theTXC signal)	± 0.7 V	’smooth pulse’, duration 576 us repetition 4.6 ms Tested already in table SUMMA TX part
DET (detected voltage from power detector)	R302	1.4 V	± 0.7 V	’smooth pulse’,

Test power amplifier

	test point	nominal	tolerance	notes
RF in (Pin)	N201 pin 1	6 dBm	± 7 dB	Spectrum analyzer settings: C.FREQ 1748 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s (The signal is coupled to the probe also from PA output)
RF out (Pout)	N201 pin 4	27.5 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 1748 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s Ref. level 35 dBm
Vdd	N200 pin 3	4.9 V	± 0.2 V	DC (almost)
Vapc	N200 pin 2	1.4 V See the Fig. below	± 0.8 V	

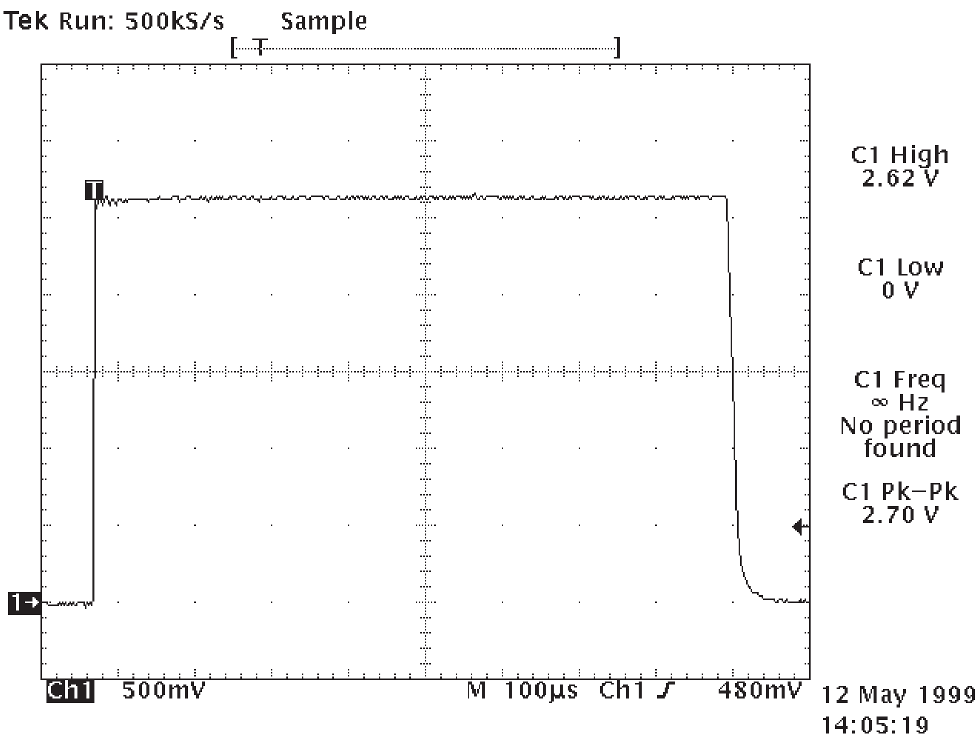
Typical Vapc waveform in the figure below:


Tek Run: 500kS/s Sample
C1 High
1.452 V
C1 Low
468mV
C1 Freq
∞ Hz
No period
found
C1 Pk–Pk
1.256 V
Ch1 200mV M 100µs Ch1 ƒ 524mV
11 May 1999
15:31:09

Test RX / TX switch

	test point	nominal	tolerance	notes
RF in (TX)	Z206 pin 3	26.5 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 1748 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s Ref. level 35 dBm
RF out (ANT)	Z206 pin 6	27 dBm	± 5 dB	–"–
VC (VC)	Z206 pin 5	2.6 V	– 0.1 V	

Typical VC control signal to the RX/TX switch



Test diplexer GSM1800 side

	test point	nominal	tolerance	notes
TX in (/ RXout) (P1)	Z202 pin 3	27 dBm	± 5 dB	Spectrum analyzer settings: C.FREQ 1748 MHz, SPAN 10 MHz, RBW = 300kHz ... 1MHz Sweep time 2 ... 3 s Ref. level 35 dBm
Antenna side (P3)	Z202 pin 5	27 dBm	± 5 dB	–"–

Synthesizer Troubleshooting

Test equipment

- Service adapter JBS–23
- Cable DAU–9P
- Charger ACH–6
- PC with WinTesla SW
- Security key PKD–1
- Spectrum analyzer
- HF–activeprobe
- Oscilloscope

Test each block separately while the phone is in local mode. Measure the LO and clock outputs using the HF–probe . Use the 10:1 adaptor(20 dB attenuator). Measure the operating voltage using voltage meter and the control signals using oscilloscope.

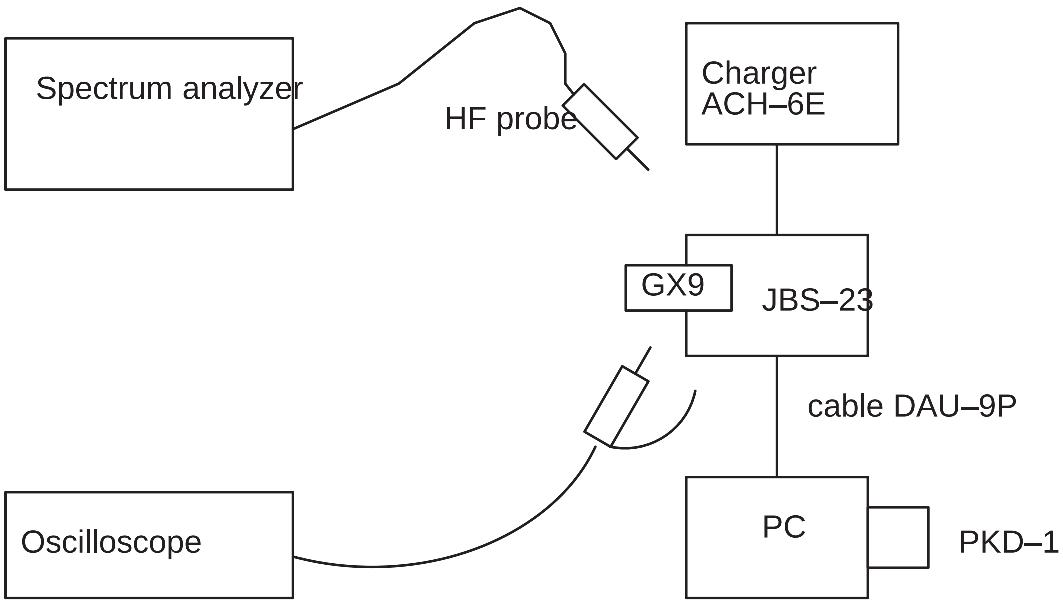


Figure 1. Synthesizer trouble shooting.

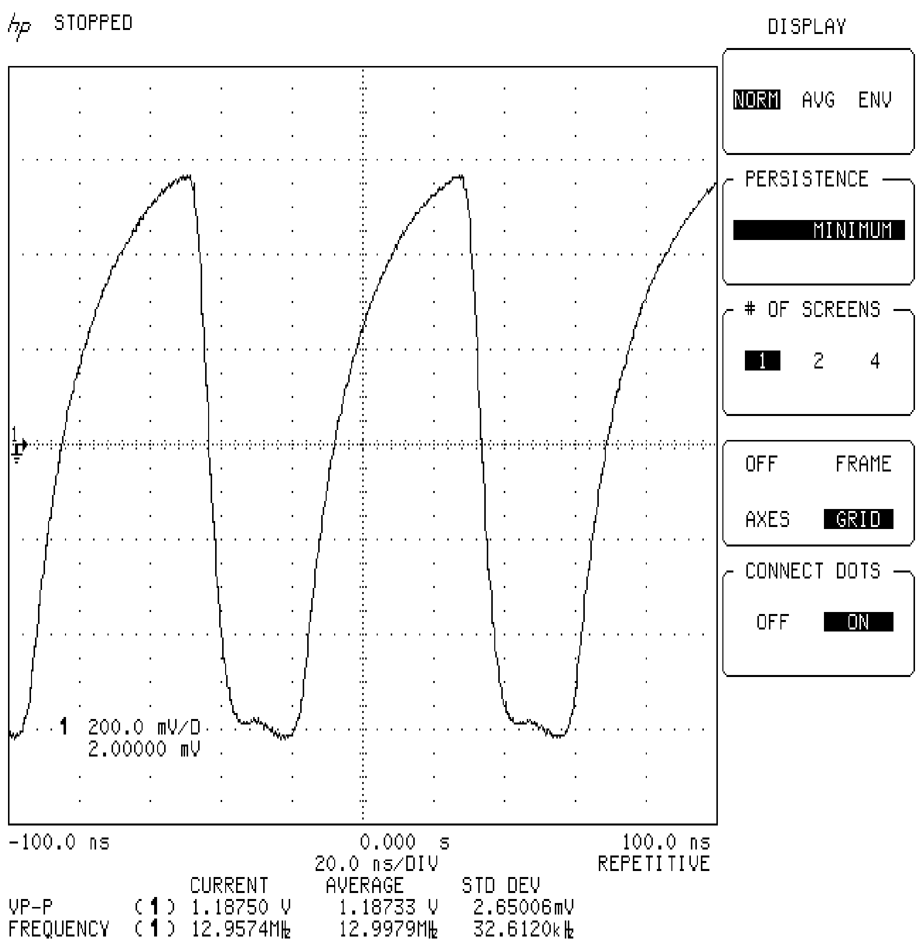
Settings

– WinTesla `Testing > RF Controls > RX , continuous mode.`
– Service adapter: ’vertical mode’

VCTCXO (G802)

	test point	nominal	tolerance	notes
control voltage	G802,pin 1	1.3 V	±0.2 V	DC
clock out	G802,pin 3	1.2 Vpp	±0.3 V	13.000 MHz NO TAG
operating voltage	G802,pin 4	2.8 V	±0.2 V	DC

Figure below: VCTCXO output at pin no.3



UHF VCO (G801)

	test point	nominal	tolerance	notes
control voltage	G801, pin 2	2.6	± 0.25 V	DC
RF Out	G801, Pin 4	2044.0 Mhz (level: – 3dBm)	± 3 dB	measured ch 70
operating voltage	G801,pin 3	2.7 V	± 0.2 V	DC

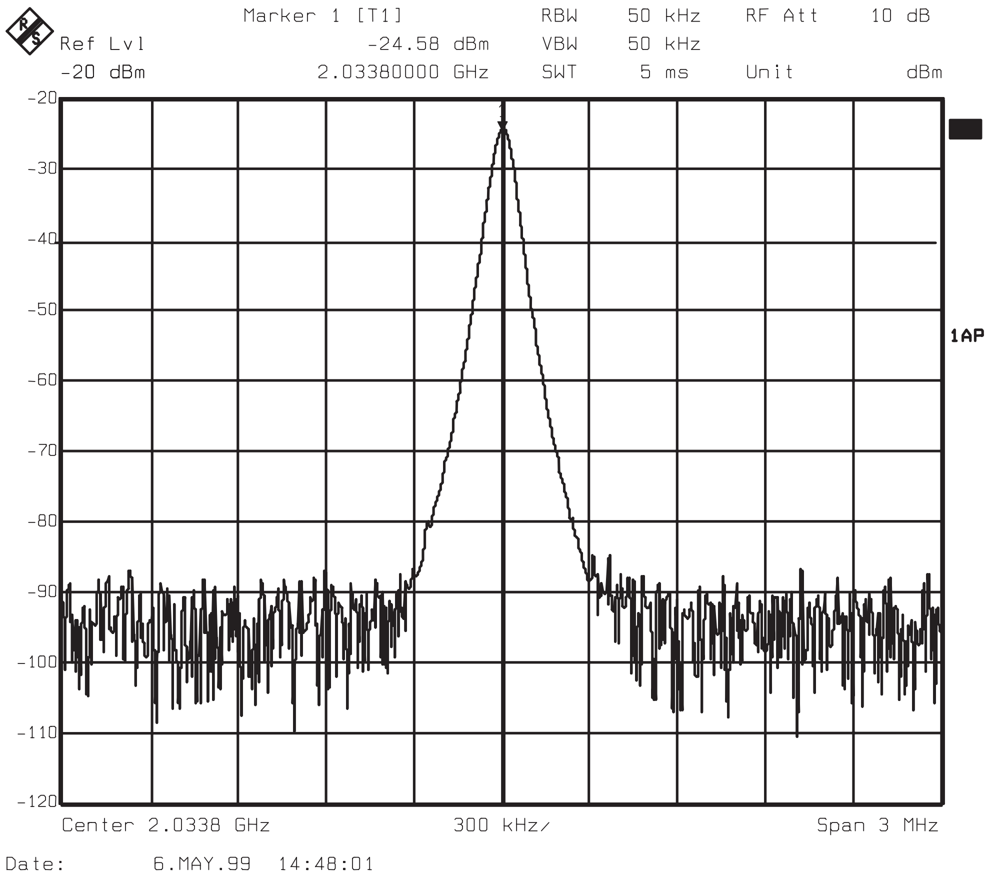
Measure settings:

– WinTesla: Product > Band > GSM

– WinTesla: Testing > RF controls > RX , continuous mode, ch 70.

– Spectrum analyzer: Span 3 MHz, RBW 50 kHz, VBW 50 kHz, REF l. –20 dBm

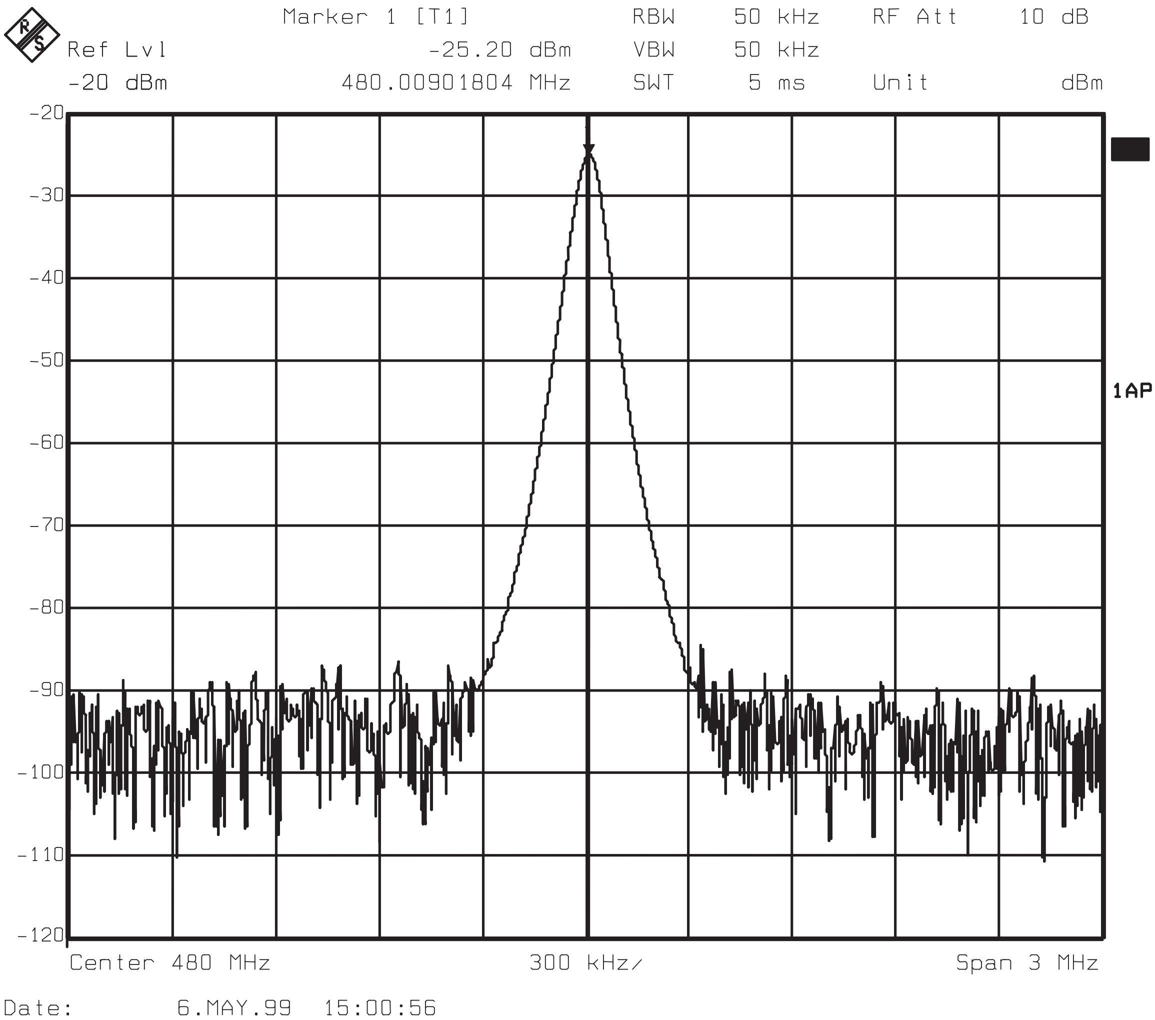
Figure below: typical UHF VCO output spectrum at VCO Output pin 4 with 20dB attenuator



VHF VCO (G803)

	test point	nominal	tolerance	notes
control voltage	G803 , pin 1	2.2 V	± 0.2 V	DC
RF out	G803 , pin 4	– 5 dBm	± 2 dB	480 MHz
operating voltage	G803 , pin 3	2.7 V	± 0.2 V	DC

Figure below: typical UHF VCO output spectrum measured from VCO Output pin



PLL IC (N800)

Table 1.

	test point	nominal	tolerance	notes
operating voltage1	pin 1 of n800	2.8 V	± 0.2 V	DC
operating voltage2	pin 20 of n800	2.8 V	± 0.2 V	DC
operating voltage of charge pumps	pin 2 of n800	4.9 V	± 0.2 V	DC

Check also data pins 11, 12 and 13 if synthesizer is not working.If data missing , check Baseband.

13 Mhz buffer

	test point	nominal	tolerance	notes
Output level	V800,collector	0.95V	± 0.15 V	Vpp, 8 pF probe

Repair instructions

If control or operating voltages from BB are not correct check them without load. If they are still uncorrect => Read baseband trouble shooting. Otherwise change component.

If signal levels are not correct in component outputs and operating and control voltages are correct (and there is correct input signals) => Change broken component.

After component changes the tunings has to be made. Also the call check should be made (against tester or some operator).

RF–BB Interface

In case of some malfunctions in the phone the reason might be also in the RF–BB interface. If the baseband seems to be OK (usually it is if the WinTesla conection works correctly) but, however, there appears something strange while e.g. trying to establish a call. The following table summarizes all the signals related to the RF–BB interface.

Signal	Description	Ref.	Brief spec.	Test method
AFC	Freq. control	J603	Output of COBBA DAC, 0.015–2.315V	WinTesla=>RF Controls, voltage meas.
BAND-SEL	900/1800 selection	N100, pin24	Output of MAD, digital	WinTesla=>Product=>Band, oscilloscope
PDATA0	LNA enable	N100, pin28	Output of MAD, digital	WinTesla=>RF Controls=>Front End On, voltage meas.
RFC	13 MHz clock	R819	0.7–1.0 Vpp	Oscilloscope
RXC	RX gain control	J605	Output of COBBA DAC, 0.15–2.3V	WinTesla=>RF Controls, voltage meas.
RXIN	neg. RX–signal	J601	50mVpp, 13MHz	RX cont. mode, oscilloscope
RXIP	pos. RX–signal	J600	50mVpp, 13MHz	RX cont. mode, oscilloscope
SCLK	clock for synth.	N800, pin11	3.25MHz	Oscilloscope
SDATA	data for synth.	N800, pin12	3.25MHz	Oscilloscope
SENA1	PLL enable	N300, pin7	Output of MAD, digital	Oscilloscope
SENA2	F–N PLL enable	N800, pin13	Output of MAD, digital	Oscilloscope
TXC	TX pwr control	J608	Output of COBBA DAC, 0.15–2.3V	WinTesla=>RF Controls, voltage meas.
TXIN	neg. I–signal (TX)	J610	0.8Vdc, 1.1Vpp	TX cont. mode, oscilloscope
TXIP	pos. I–signal (TX)	J611	0.8Vdc, 1.1Vpp	TX cont. mode, oscilloscope
TXP	Pwr control enable	R304	Output of MAD, digital	Oscilloscope
TXQN	neg. Q–signal (TX)	J612	0.8Vdc, 1.1Vpp	TX cont. mode, oscilloscope
TXQP	pos. Q–signal (TX)	J613	0.8Vdc, 1.1Vpp	TX cont. mode, oscilloscope
VCOBBA	supply voltage	C724*	2.8V for Cobba–ASIC	Voltage measurement
VCP	supply voltage	J709	5V for synth. (N800)	Voltage measurement
VPA	supply voltage	C704*	5V for PA–modules	Voltage measurement
VREF_1	supply voltage	J707	Ref. voltage 1.5V for Summa–ASIC etc.	Voltage measurement
VRX_1	supply voltage	J706	2.8V for CRFU3–ASIC	Voltage measurement
VRX_2	supply voltage	J703	2.8V for Summa–ASIC	Voltage measurement

Signal	Description	Ref.	Brief spec.	Test method
VSYN_1	supply voltage	J705	2.8V for synth. and CRFU3	Voltage measurement
VSYN_2	supply voltage	J704	2.8V for synth. and Summa	Voltage measurement
VTX	supply voltage	J708	2.8V for TX–parts	Voltage measurement
VXO	supply voltage	C729*	2.8V for 13 MHz VCTCXO	Voltage measurement

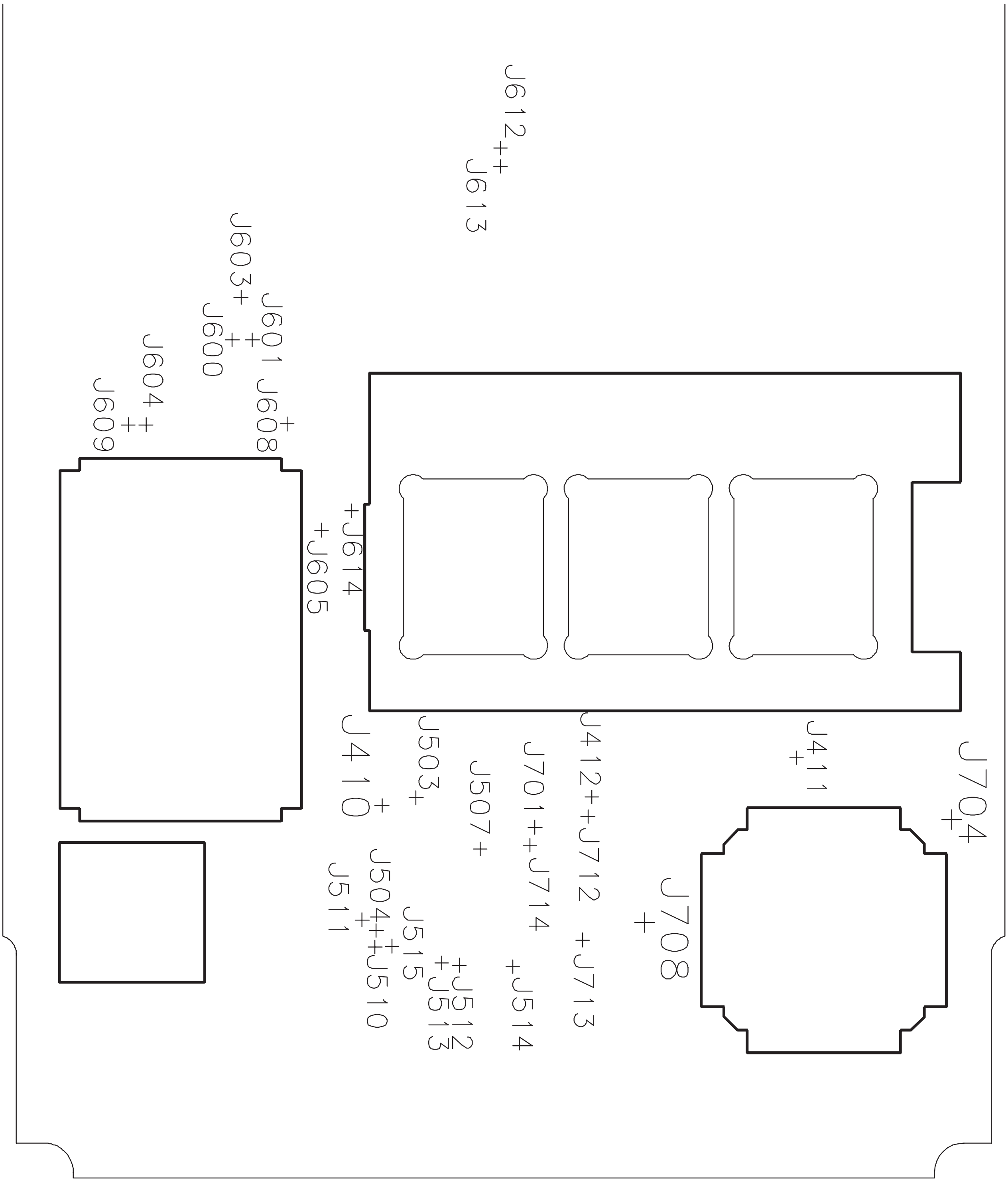
(*) means that the voltage has to measured on one of the two terminal. The other terminal is grounded.

Test Points of GX9

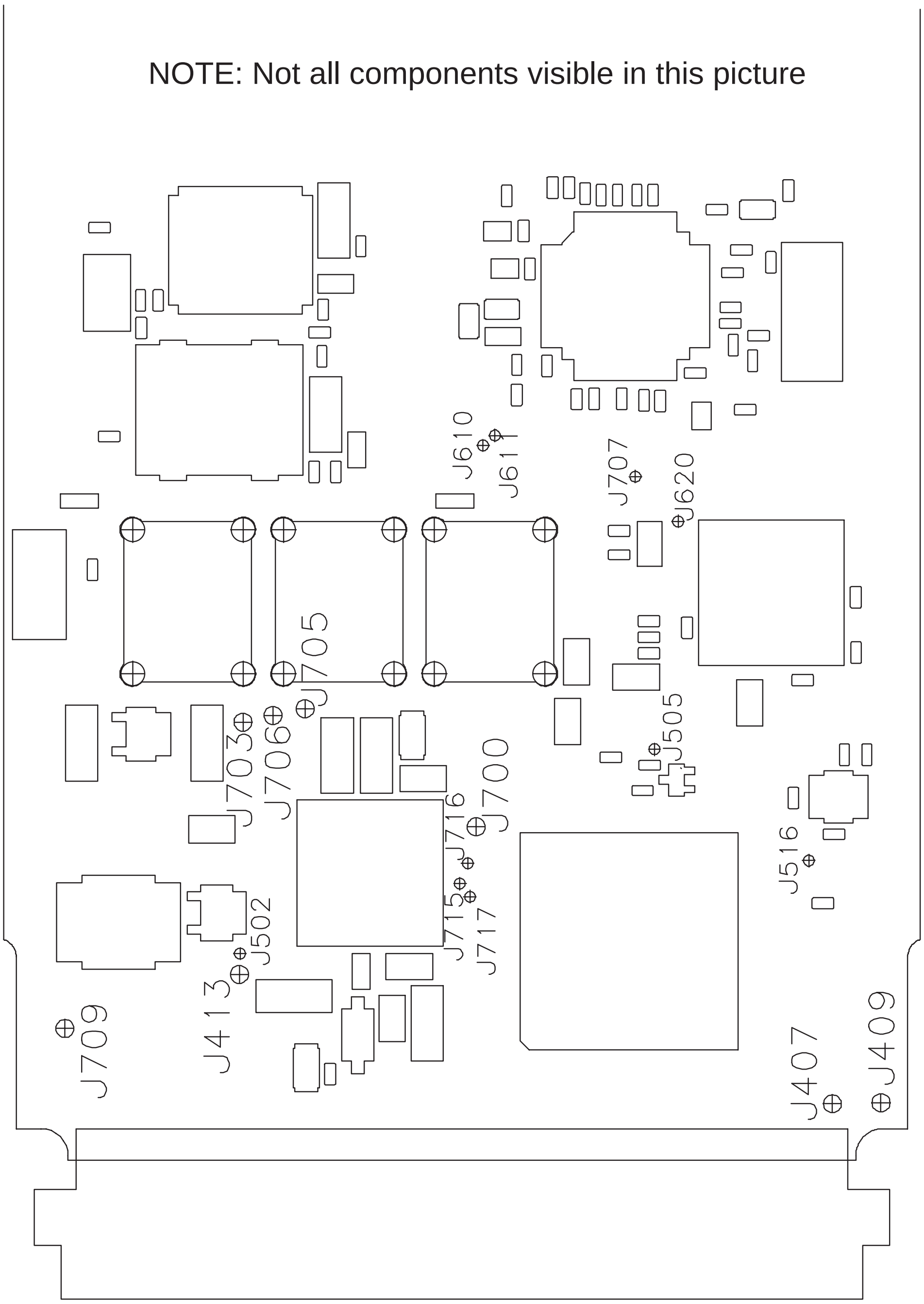
Ref	Description	Connects to / notes
J407	Card supply voltage VCC	VCC power net
J409	GND	Ground potential power net
J410	FBUSRxD (in MAD)	FBUS from Sulo to MAD
J411	PURX	Power Up Reset from Sulo to MAD and PA power switch N701
J412	CCONT_PURX	Power Up Reset from CCONT to Sulo
J413	FBUSTxD (in MAD)	FBUS from MAD to Sulo
J502	MBUS/Flash clock	MAD MBUS, Sulo's flash clock output and MBUS switch (D402)
J503	PURX	Delayed PURX to MAD. This is delayed from J411 PURX
J504	DSP	DSP external flag from MAD
J505	SIMCardDetX	This is inverted J411 PURX from Sulo
J507	DEEPSLEEPX	VCO power control from MAD to CCONT and Sulo
J510	COBBAIdata	TX data I sample from MAD to COBBA
J511	COBBAQdata	TX data Q sample from MAD to COBBA
J512	COBBARSTX	COBBA reset from MAD
J513	COBBACSX	COBBA Chip Select from MAD
J514	COBBASD	Serial data between MAD and COBBA
J515	COBBACLK	13 MHz clock from MAD to COBBA, clocks COBBASD and I&Qdatas
J516	ROM1SelX	Chip select signal from MAD to Flash memory (D501)
J600	RxIP	Positive data sample receive from SUMMA to COBBA
J601	RxIN	Negative data sample receive from SUMMA to COBBA
J603	AFC	Automatic frequency control from COBBA to 13 MHz system clock.
J604	MIC3N	Headset microphone negative input to COBBA
J605	RXC	Rx signal Gain Control from COBBA to SUMMA
J608	TXC	Tx power control from COBBA to SUMMA
J609	MIC3P	Headset microphone positive input to COBBA
J610	TxIN	Tx data negative I sample to SUMMA
J611	TxIP	Tx data positive I sample to SUMMA

Ref	Description	Connects to / notes
J612	TxQN	TX data negative Q sample to SUMMA
J613	TxQP	Tx data positive Q sample to SUMMA
J614	AUXOUT	Headset microphone bias voltage, nominal 2.1 V. From COB-BA.
J620	HF	Headset earpiece output from COBBA
J700	CCONTINT	CCONT interrupt to MAD
J701	SLEEPCLK	32 kHz sleep clock from CCONT to MAD
J703	VRX_2	RX part power supply to SUMMA (2.8 V)
J704	VSYN_2	PLL power supply to PLLIC (N800) and SUMMA (N300). (2.8 V)
J705	VSYN_1	VCO power, to 480 MHz VCO (G803) and CRFU3 (N100). (2.8 V)
J706	VRX_1	RX part power supply to CRFU3 (N100). (2.8 V)
J707	VREF_1	Reference voltage to COBBA (N600) and SUMMA (N300) (1.5 V)
J708	VTX	TX power control to SUMMA (N300) and CRFU3 (N100). (2.8 V)
J709	VCP	Synthesizer charge pump supply to PLLIC (N800). (5.0 V)
J712	V2V	MAD core voltage, initially 1.975 V, after PURX release 2.425 V
J713	SIMCardPwr	SIM supply voltage control, from MAD to CCONT
J714	SIMCardData	SIM data between MAD and CCONT
J715	SIMCardRstX	SIM Reset control from MAD to CCONT
J716	SIMCardClk	SIM clock control from MAD to CCONT
J717	SIMCardIOC	SIMCardData direction control, from MAD to CCONT

Test Points, Top side



Test Points, Bottom side



[] 1