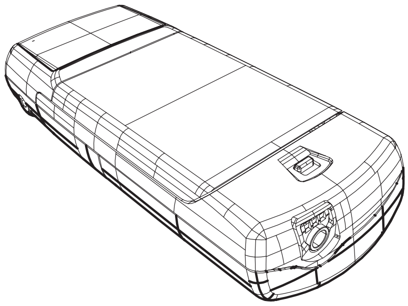
Disassembly & Troubleshooting

AMENDMENT RECORD SHEET

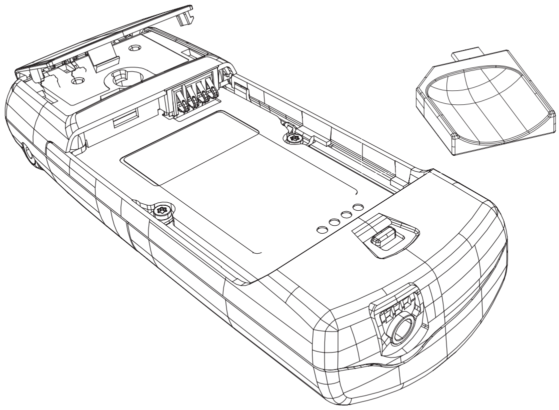
Amendment Number	Date	Inserted By	Comments
	12/99	OJuntune	New disassembly

CONTENTS

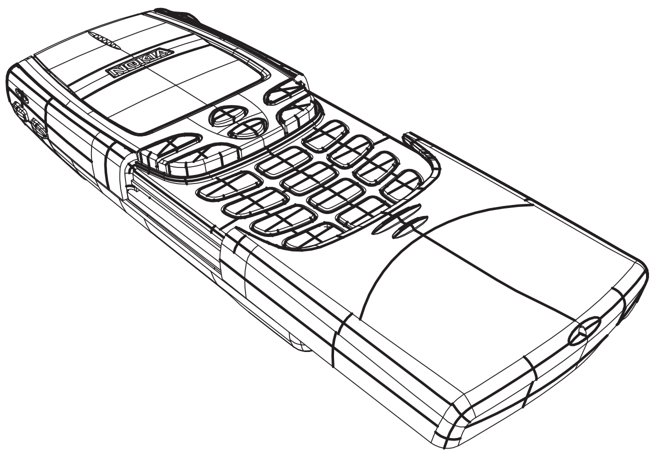
Disassembly



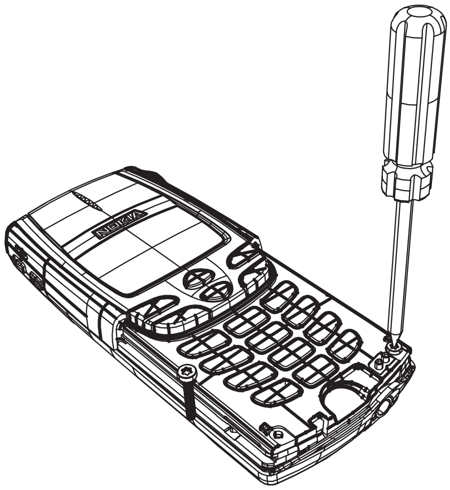
1. Remove battery



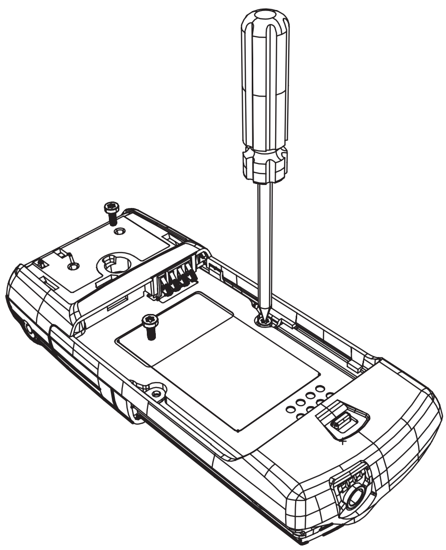
2. Remove the antenna cover by using the ART–5 antenna removal tool. Place the ART–5 flat side down in the battery recess of the phone in the top left hand corner. The extruding ”finger” slides in the hole next to the battery springs and when pushing the tool the antenna is released for removal



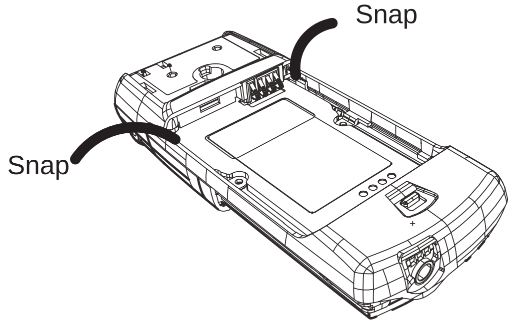
3.Remove slide: open it halfway down, and with the left side first, remove it by flipping it over its axle.



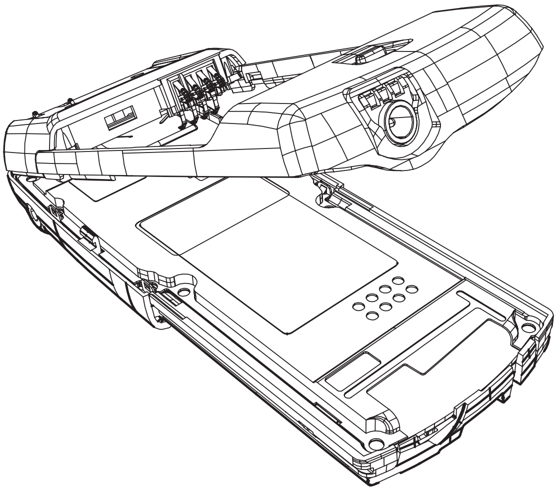
4.Remove A–cover screws (2 pcs)



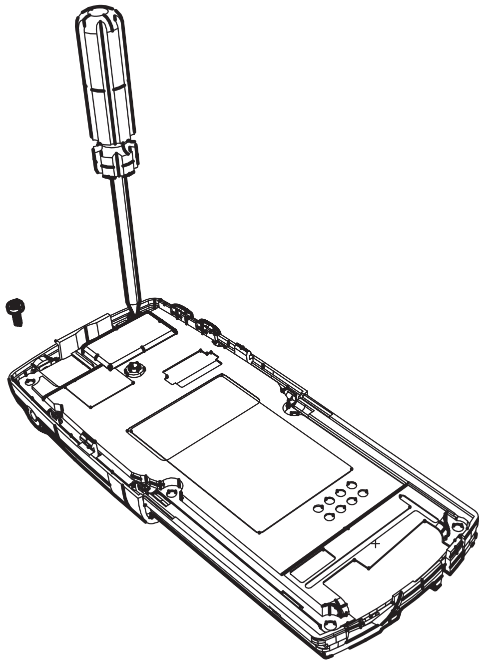
5. Turn the phone over and remove C–cover screws (3 pcs)



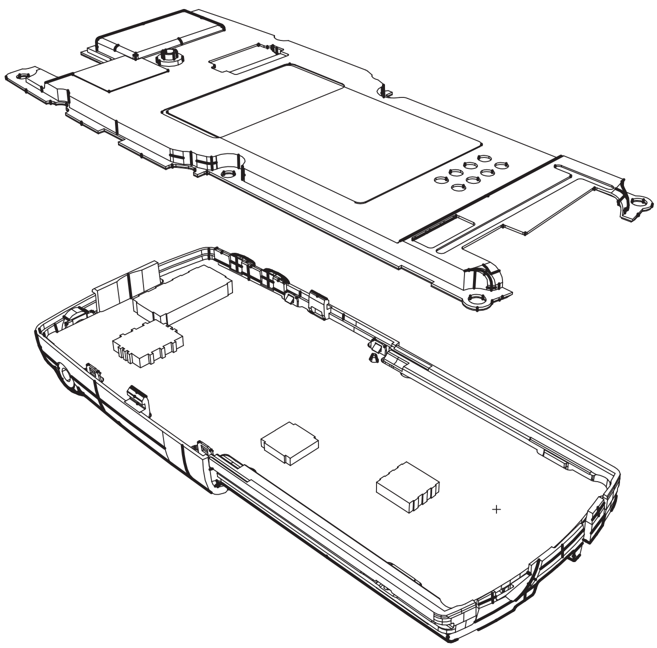
6.Release C–cover snaps



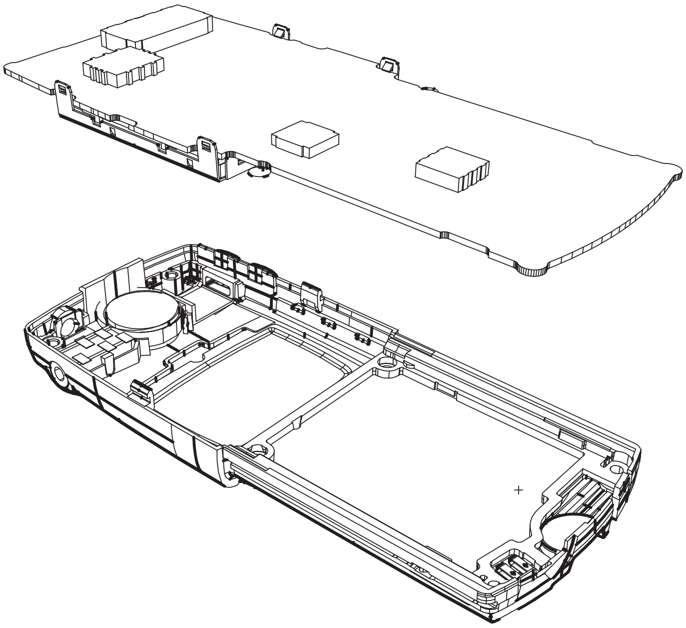
7. Open covers



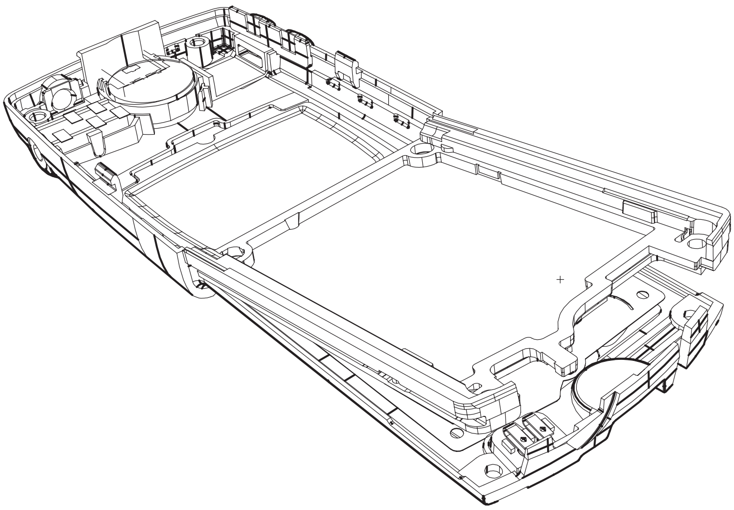
8. Remove shield screws (2 pcs)



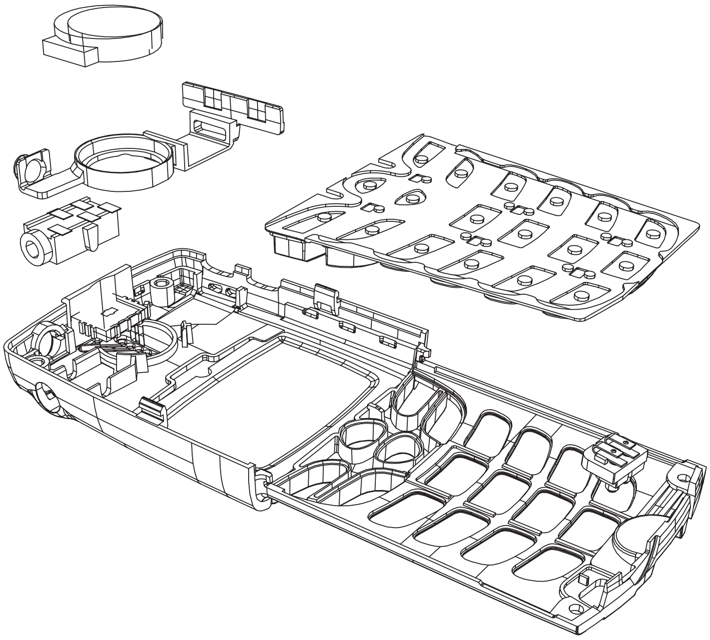
9. Remove shield



10. Remove main PCB



11. Remove slide frame, UI PCB follows



12. Now parts can be separated from the cover.

Baseband Testing

The MCU software enters a local mode at start-up if suitable resistors are connected to the BTEMP and BSI lines.

NOTE! Baseband doesn't wake up automatically when the battery voltage is connected. Power must be switched on via:

1. Pwr key or
2. BTEMP line or
3. Charger
4. Connecting J150 to ground

Alignments

Within alignment those parameters are adjusted, that cannot be set accurate enough by design, because of component tolerances.

Due to use of 5% resistor values, the channels of the CCONT A/D converters need to be aligned in the production phase.

Within battery voltage tuning VBAT the MCU software reads the A/D reading from CCONT at 4.1 V and stores this reading to EEPROM (emulated by Flash) memory as a reference point. Then second reading is done at 3.1 V. Now the slope is known and A/D readings can be calibrated. Calibration is included in VBAT A/D reading task.

Battery charging voltage VCHAR and current ICHAR are calibrated using one test setting. Test jig in production line must have a connection to battery terminals. ICHAR is adjusted to 500 mA and VCHAR to 8.4 V with appropriate load connected to the battery terminals.

Trouble Shooting

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

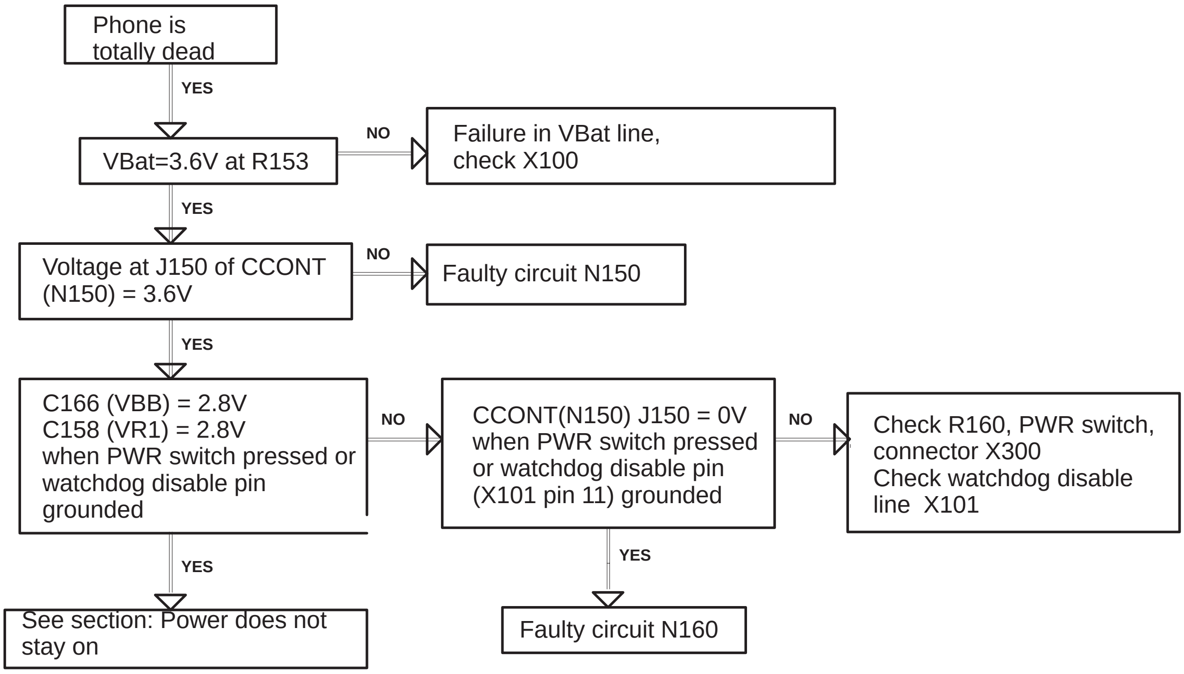
1. Phone is totally dead
2. Flash programming does not work
3. Power does not stay on or the phone is jammed
4. Display information: Contact Service
5. Phone does not register to the network or phone does not make a call.
6. Audio fault.
7. Charging fault

The first thing to do is carry out a through visual check of the module. Ensure in particular that:

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

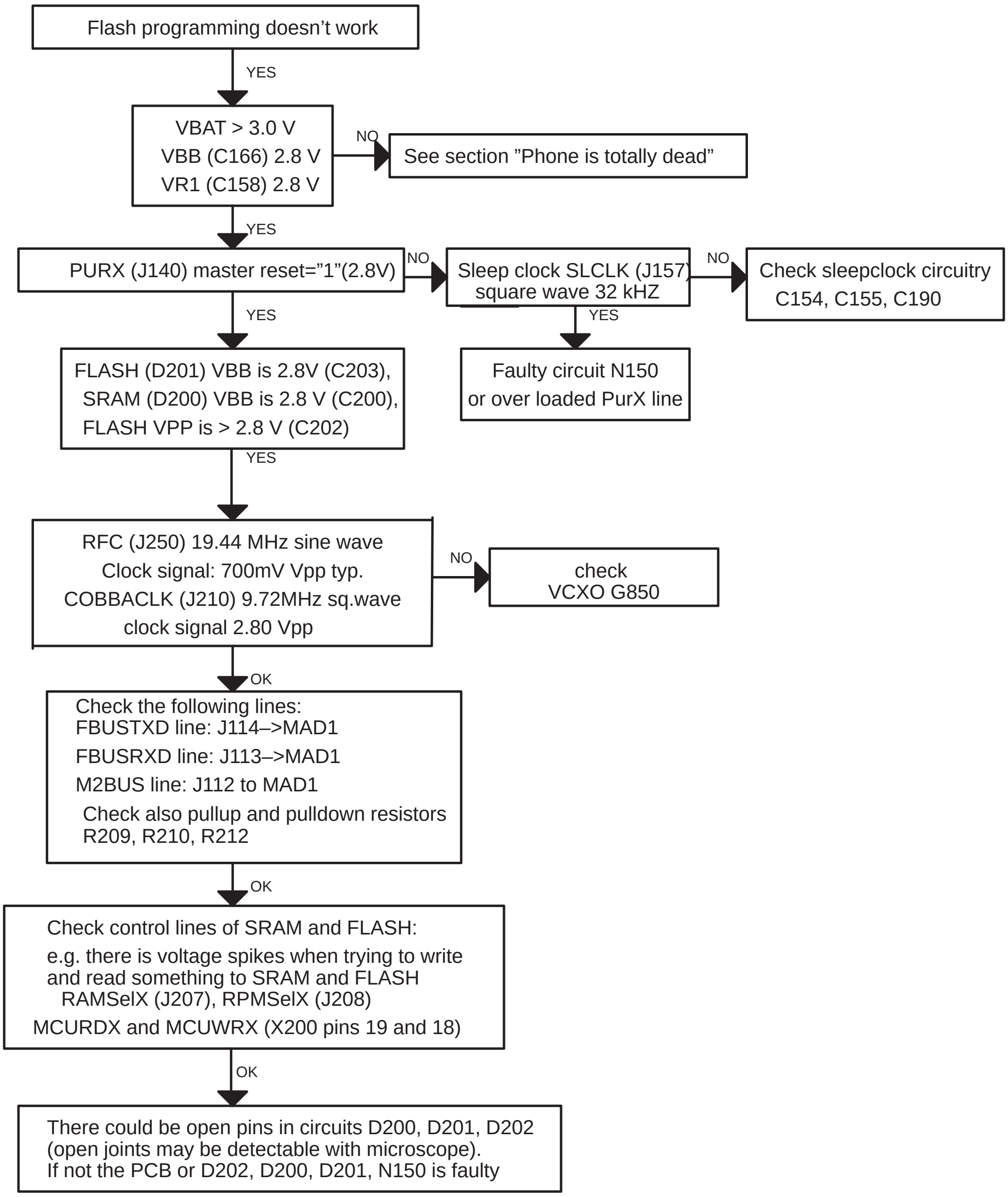
Phone is totally dead

This means that phone doesn't take current at all when the power switch is pressed or when the watchdog disable pin (X101 pin 11 or J150) is grounded. Used battery voltage must be higher than 3.0 V. Otherwise the hardware of CCONT (N150) prevents totally switching power on. Here the VBat is set to 3.6V



Flash programming doesn't work

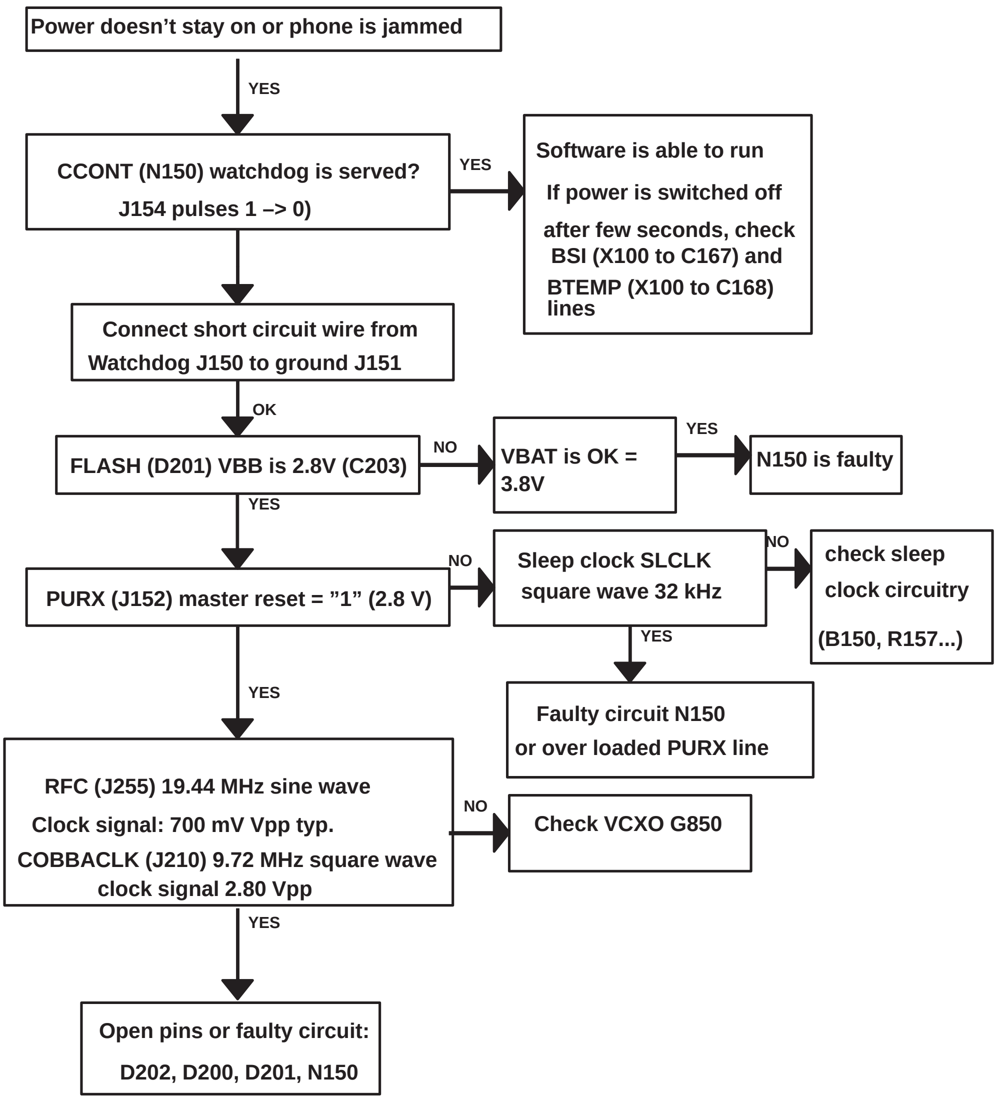
The flash programming is carried out via the pads accessible from the back of the phone (using service accessories).



Power doesn’t stay on or the Phone is jammed

If this kind of fault has come after flash programming, there are most probably open pins in ICs. The solder joints of ICs: MAD1 (D202), Flash (D201) and SRAM (D200) are to be checked at the extent possible (by microscope from the side of PCB and lightly pressing components while switching power on).

Normally the power will be switched off by CCONT (N150) after 32 seconds, if the watch-dog of the CCONT can not be served by software. The watch-dog updating can be seen by oscilloscope at J154 (DataselX) of CCONT. In normal case there is a short pulse from ”1” –> 0 every 8 seconds. The power off function of CCONT can be prevented by connecting a short circuit wire from WDDISX (CCONT E4 (J150)) to ground (J151).

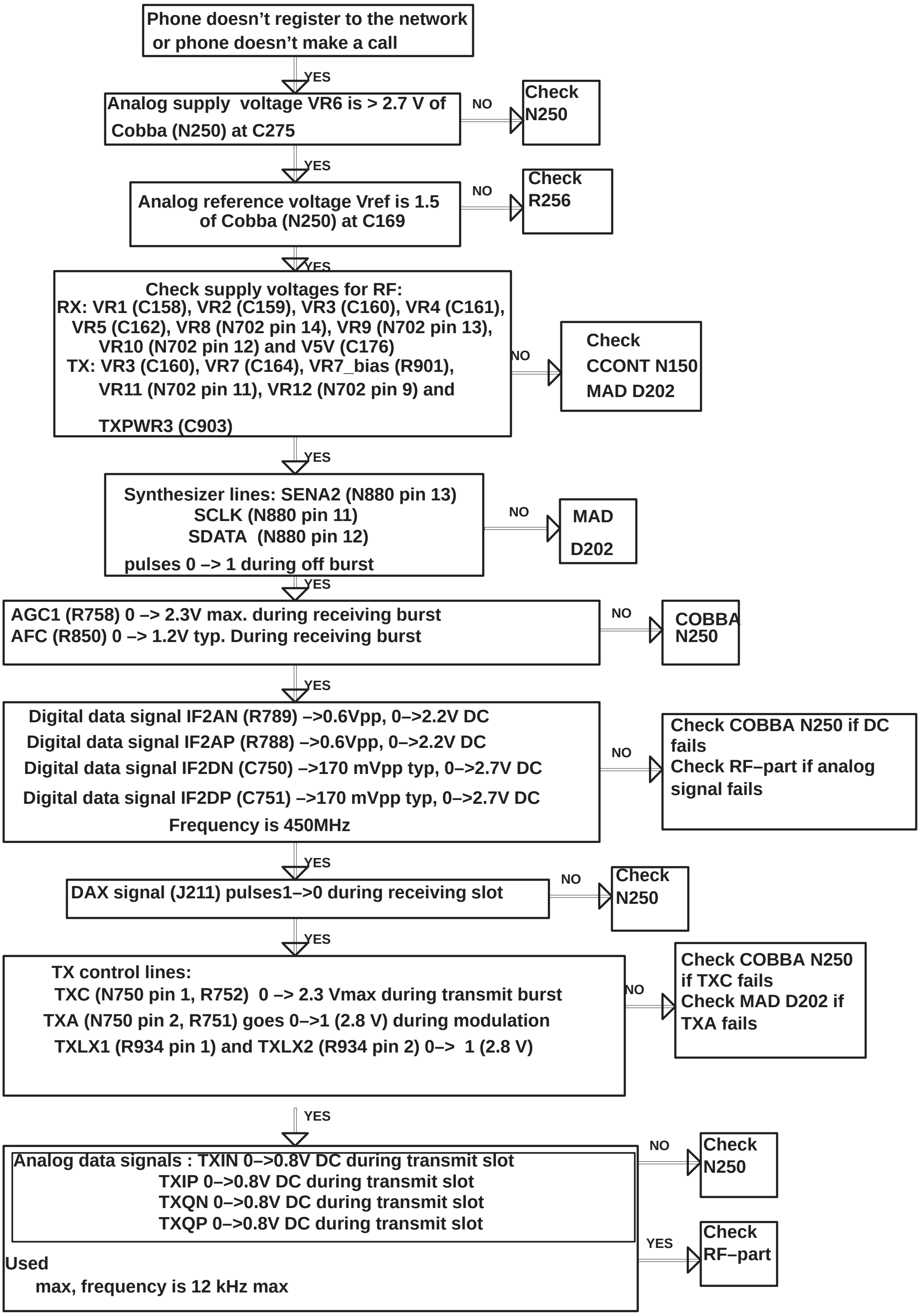


The phone doesn’t register to the network or phone doesn’t make a call

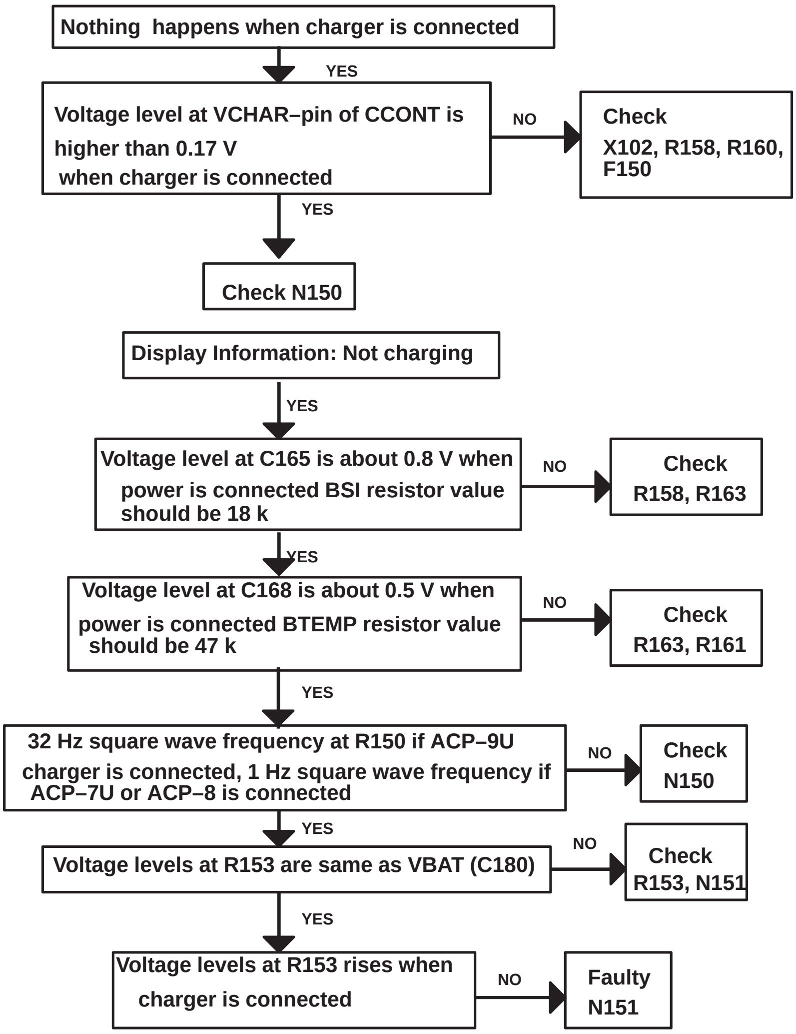
If the phone doesn’t register to the network or the phone doesn’t make a call, the reason could be either the baseband or the RF part. The phone can be set to wanted mode by WinTesla service software and determinate if the fault is in RF or in baseband part (RF interface measurements).

The control lines for RF part are supplied both the System Asic (MAD D202) and the RFI (Cobba N250). MAD handles digital control lines and Cobba handles analog control lines.

Diagram is on the next page.


Phone doesn't register to the network or phone doesn't make a call
YES
Analog supply voltage VR6 is > 2.7 V of Cobba (N250) at C275
NO
Check N250
YES
Analog reference voltage Vref is 1.5 of Cobba (N250) at C169
NO
Check R256
YES
Check supply voltages for RF:
RX: VR1 (C158), VR2 (C159), VR3 (C160), VR4 (C161), VR5 (C162), VR8 (N702 pin 14), VR9 (N702 pin 13), VR10 (N702 pin 12) and V5V (C176)
TX: VR3 (C160), VR7 (C164), VR7_bias (R901), VR11 (N702 pin 11), VR12 (N702 pin 9) and TXPWR3 (C903)
NO
Check CCONT N150 MAD D202
YES
Synthesizer lines: SENA2 (N880 pin 13) SCLK (N880 pin 11) SDATA (N880 pin 12) pulses 0 –> 1 during off burst
NO
MAD D202
YES
AGC1 (R758) 0 –> 2.3V max. during receiving burst
AFC (R850) 0 –> 1.2V typ. During receiving burst
NO
COBBA N250
YES
Digital data signal IF2AN (R789) –>0.6Vpp, 0–>2.2V DC
Digital data signal IF2AP (R788) –>0.6Vpp, 0–>2.2V DC
Digital data signal IF2DN (C750) –>170 mVpp typ, 0–>2.7V DC
Digital data signal IF2DP (C751) –>170 mVpp typ, 0–>2.7V DC
Frequency is 450MHz
NO
Check COBBA N250 if DC fails
Check RF–part if analog signal fails
YES
DAX signal (J211) pulses1–>0 during receiving slot
NO
Check N250
YES
TX control lines:
TXC (N750 pin 1, R752) 0 –> 2.3 Vmax during transmit burst
TXA (N750 pin 2, R751) goes 0–>1 (2.8 V) during modulation
TXLX1 (R934 pin 1) and TXLX2 (R934 pin 2) 0–> 1 (2.8 V)
NO
Check COBBA N250 if TXC fails
Check MAD D202 if TXA fails
YES
Analog data signals : TXIN 0–>0.8V DC during transmit slot
TXIP 0–>0.8V DC during transmit slot
TXQN 0–>0.8V DC during transmit slot
TXQP 0–>0.8V DC during transmit slot
Used
max, frequency is 12 kHz max
NO
Check N250
YES
Check RF–part

Charging failure



RF Troubleshooting

Introduction

Measurements are done using a spectrum analyzer and a high–frequency probe (Local and reference frequencies and RF–power levels in intermediate stages of TX/RX–chains). An oscilloscope is used to measure DC–voltages and low frequency signals. A multimeter is also a useful measurement instrument in fault finding.

An external RF connector is assembled only on R&D– and calibration panels for FLALI improving reliability of the measurement results, and it should be in use when it is possible. Later on soldering pads for this connector will be removed from the layout, therefore a connector to the antenna pad needs to be soldered manually.

The RF section is mainly built around EROTUS–IC (N700). The RF block has separate external filters, UHF synthesizers, Power Amplifiers, TX Driver amplifiers, LNA/Mixer and upconverter circuit for both frequency bands. In TDMA1900 mode a RF regulator IC is provided to supply voltage for RF parts.

To simplify troubleshooting, this RF troubleshooting document is divided into three bigger sections: Receiver–, Transmitter– and Synthesizer blocks. The tolerances are specified for critical signals/voltages.

Before changing single ASICS or components, please check the following things:

1. The soldering and connections of pins of ASICS

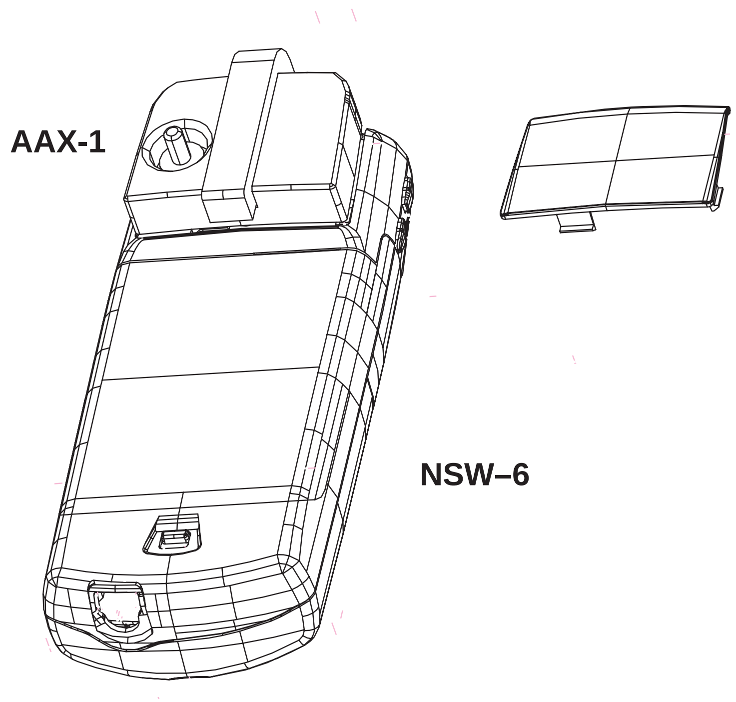
2. That supply voltages and control signals are OK

3. Signals from the synthesizers are coming to ASICS. This will prevent unnecessary changing of ASICS.

Please note that the grounding of the Power Amplifier–IC is directly underneath, so it is difficult to check. **The PA is ESD sensitive!** So ESD precaution must be used when dealing with the PA–IC (ground straps and ESD soldering irons). The PAs are also moisture sensitive components, and it is important to follow additional information about handling the components.

There are also lots of discrete components (resistors, inductors and capacitors) the troubleshooting of which is done just by checking that component is soldered or that it is not missing from the PCB.

AAX-1 tool is used to provide galvanic contact for RF measurements, kindly refer to the figure on the next page.



Abbreviations used

BB	Baseband
f	Frequency of signal (measured with spectrum analyzer)
IF	Intermediate Frequency
LO	Local Oscillator
P	Power of signal in decibels compared to a milliwatt (dBm) (measured with spectrum analyzer)
PA	Power Amplifier
PCB	Printed Circuit Board
PLL	Phase Locked Loop
RF	Radio Frequency
RX	Receiver
T	Time (between pulses)
TX	Transmitter
UHF	Ultra High Frequency
V	Voltage of signal (measured with oscilloscope)
VCO	Voltage controlled oscillator
VHF	Very High Frequency
AF	Audio Frequency

Interface signals between RF and BB/DSP

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
VBAT	Battery	RF	Voltage	3.1	3.6	5.3	V	Supply voltage for RF and regulators
VREF	CCONT	EROTUS	Voltage	1.478	1.500	1.523	V	Reference voltage for EROTUS
RFTEMP	RF	CCONT	Voltage	0 HOT	1.4 ROOM TEMP	2.7 COLD	V	RF temperature sensor 47k NTC to GND
AFC	COBBA_D	VCTCXO	Voltage	0.05	1.1	2.25	V	Automatic frequency control
AGC1	Cobba_D	EROTUS	Voltage	0.5		1.4	V	Gain control for EROTUS RX AGC
AGC2	MAD	RX LNA	Voltage	0		2.85	V	LNA Gain switch “1” min 2.0 V “0” max 0.7 V
PD1	EROTUS	VHF VCO	Voltage	0 1.0 2.8	 1.5 3.3	4.0 2.0 3.8	V V V	VCO control voltage 322.38 MHz 392.46 MHz
PD2	EROTUS	1GHz UHF VCO	Voltage	1.3		3.5	V	1 GHz
MODE	MAD	1Ghz PA bias switch	Voltage	0		2.85	V	“0” AMPS “1” TDMA
IF2AP/ IF2AN	EROTUS	COBBA_D	Voltage/Frequency		0.6 / 450		Vpp / kHz	Differential limiter output to DEMO–FM demodulator
IF2DP / IF2DN	EROTUS	COBBA_D	Voltage/Frequency		170 / 450	1400	mVpp / kHz	Differential IF2–signal to RX A/D–converter
SENA1	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	1 Ghz PLL enable
			Logic low ”0”	0		0.8	V	
SDATA	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	Synthesizer data
			Logic low ”0”	0		0.8	V	
SCLK	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	Synthesizer clock

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
			Logic low "0"	0		0.8	V	
RFC	EROTUS	COB-BA_D	Voltage/Fre-quency	0.2	0.4 / 19.44	1.0	Vpp / MHz	Clock signal for the logic circuits
RFCEN	MAD	CCONT / PENTA regulator	Voltage	0		2.85	V	"1" min 2.0 V "0" max 0.4 V
RSSI	EROTUS	CCONT/ COB-BA_D	Output level	0.1		1.5	V	Analog mode field strength in-dicator
TXIP/ TXIN	COBBA	EROTUS	Differential voltage swing (static)	1.022	1.1	1.18	Vpp	Differential in–phase TX base-band signal for the RF modula-tor
			Single ended output level	0.760	0.8	0.84	V	
TXQP/ TXQN	COBBA	EROTUS	Same as TXIP/TXIN					Differential quad-rature phase TX baseband signal for the RF modu-lator
TXP1	MAD	CCont	Logic high "1"	2.0			V	1 Ghz Transmit-ter enable
			Logic low "0"			0.5	V	VR7 ON/OFF
TXC	COBBA	EROTUS	Number of bits	10			bits	Transmitter pow-er control (ramps & power levels)
			Output volt-age swing	2.09	2.15	2.21	V	
			Minimum code output level	0.12	0.15	0.18	V	
			Maximum code output level	2.27	2.3	2.33	V	
TXF	EROTUS	MAD	Voltage	0		2.85	V	False transmis-sion indicator, function con-trolled via ERO-TUS register
TXP2	MAD	PENTA regulator	Logic high "1"	2.0			V	2 Ghz Transmit-ter enable
			Logic low "0"			0.5	V	VR11 ON/OFF
TXA	MAD	EROTUS	Logic high "1"	2.5			V	PWR control loop during TX burst (slow mode)

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
			Logic low "0"			0.2	V	PWR control loop during ramp up/down (fast mode)
TXLX1	MAD	TX 800	Logic high "1"	2.1		2.85	V	Low power level mode for power detector
			Logic low "0"	0		0.6	V	High power level mode for power detector
TXLX2	MAD	TX 1900	Logic high "1"	2.1		2.85	V	Low power level mode for power detector
			Logic low "0"	0		0.6	V	High power detector mode power detector
SENA2	MAD	2 Ghz UHF PLL	Logic high "1"	2.0		2.85	V	2 Ghz PLL enable
			Logic low "0"	0		0.8	V	
RXPWR1	MAD	CCONT	Logic high "1"	2.0			V	VR4 ON
			Logic low "0"	0		0.8	V	VR4 OFF
RXPWR2	MAD	PENTA	Logic high "1"	2.0			V	VR8 ON, 1Ghz frontend
			Logic low "0"	0		0.8	V	VR8 OFF
RXPWR3	MAD	PENTA	Logic high "1"	2.0			V	VR9 ON 2Ghz frontend
			Logic low "0"	0		0.8	V	VR9 OFF
SPWR1	COBBA_D	CCONT	Logic high "1"	2.0			V	VR2 ON , 1Ghz UHF
			Logic low "0"	0		0.5	V	VR2 OFF
SPWR2	COBBA_D	CCONT	Logic high "1"	2.0			V	VR3 ON, VHF ON/OFF
			Logic low "0"	0		0.5	V	VR3 OFF
SPWR3	COBBA_D	PENTA	Logic high "1"	2.0			V	VR10 ON , 2Ghz UHF
			Logic low "0"	0		0.5	V	VR10 OFF
TXPWR1	MAD	CCont	Logic high "1"	2.0			V	VR5 ON , TX pwr control enable
			Logic low "0"	0		0.5	V	VR5 OFF

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
TXWR2	MAD	PENTA	Logic high ”1”	2.0			V	VR12 ON , TDMA1900 TX–upconverter enable
			Logic low ”0”	0		0.5	V	VR12 OFF
TXWR3	MAD	TDMA800 TX–upconverter	Logic high ”1”	2.0			V	AMPS & TDMA800 TX–upconverter enable
			Logic low ”0”	0		0.5	V	TX–UC disable
VR1	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply for VCTCXO, Erotus VHF prescaler and bias, and 2 GHz PLL
VR2	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply voltage for 1GHZ UHF VCO and prescaler
VR3	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply voltage for VHF VCO, LO buffer, 1 Ghz TX–mixer and power detector
VR4	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply voltage for EROTUS IF–parts and IF–amplifier
VR5	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply voltage for EROTUS TX modulator and TX pwr control circuits
VR6	CCont	RF	Voltage	2.7	2.8	2.85	V	Supply voltage for EROTUS digital parts and Cobba_D analog supply
VR7	CCont	RF	Voltage	2.7	2.85	2.9	V	TX800 PA bias and driver amplifier supply voltage
VR7_bias	CCont	RF	Voltage	2.7	2.85	2.9	V	TX800 PA bias switching voltage ”0”=AMPS ”1”=TDMA
V5V	CCont	EROTUS	Voltage	4.8	5.0	5.2	V	Erotus and 2 Ghz PLL chargepump

Receiver

General instructions for RX troubleshooting

Start the WinTesla–software and use it to start the desired RX–mode of the mobile phone. The troubleshooting flowchart is divided into three steps, general checking, local checking and RX–chain checking. Please notice that before changing ASICs or filters, all solderings and missing components are checked.

IF any RX–filters and/or ASICs are changed, AGC–tunings have to be made!

Connect the desired channel frequency and level to the antenna interface.

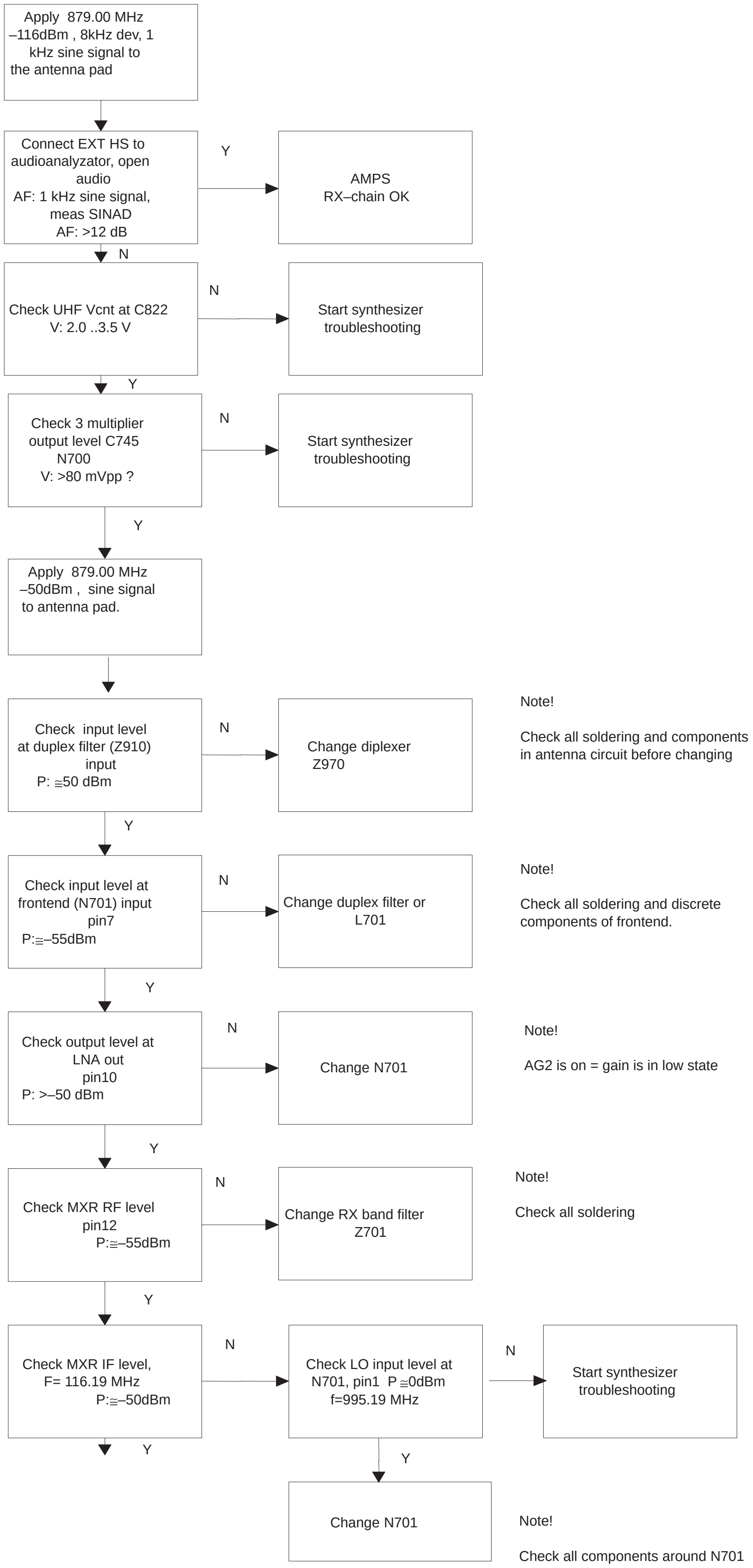
Path of the received signal

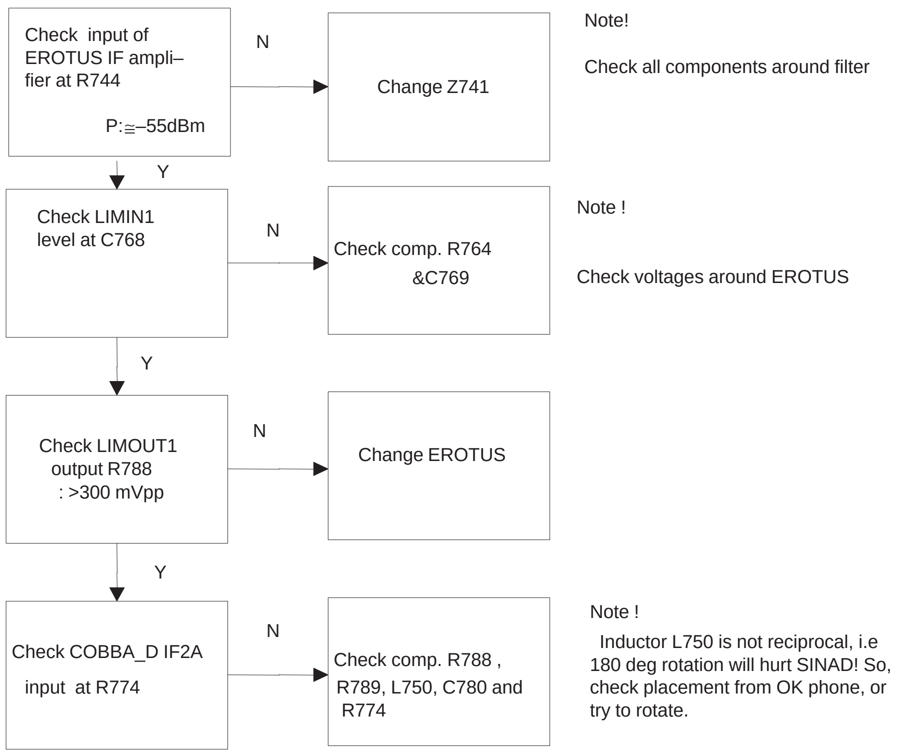
Block level description of the receiver:

Antenna
Diplexer
Duplexer
Low Noise Amplifier (LNA)
RX filter
First mixer
116.19 MHz filter
IF–amplifier
AGC/buffer
second mixer
450 kHz filters
buffer/limiter
Baseband(FM–detector).

AMPS RX

Diagram on the next page.


Apply 879.00 MHz –116dBm , 8kHz dev, 1 kHz sine signal to the antenna pad
Connect EXT HS to audioanalyzator, open audio AF: 1 kHz sine signal, meas SINAD AF: >12 dB
Y
AMPS RX–chain OK
N
Check UHF Vcnt at C822 V: 2.0 ..3.5 V
N
Start synthesizer troubleshooting
Y
Check 3 multiplier output level C745 N700 V: >80 mVpp ?
N
Start synthesizer troubleshooting
Y
Apply 879.00 MHz –50dBm , sine signal to antenna pad.
Check input level at duplex filter (Z910) input P: ≅50 dBm
N
Change diplexer Z970
Note!
Check all soldering and components in antenna circuit before changing
Y
Check input level at frontend (N701) input pin7 P:≅–55dBm
N
Change duplex filter or L701
Note!
Check all soldering and discrete components of frontend.
Y
Check output level at LNA out pin10 P: >–50 dBm
N
Change N701
Note!
AG2 is on = gain is in low state
Y
Check MXR RF level pin12 P:≅–55dBm
N
Change RX band filter Z701
Note!
Check all soldering
Y
Check MXR IF level, F= 116.19 MHz P:≅–50dBm
N
Check LO input level at N701, pin1 P ≅0dBm f=995.19 MHz
N
Start synthesizer troubleshooting
Y
Y
Change N701
Note!
Check all components around N701

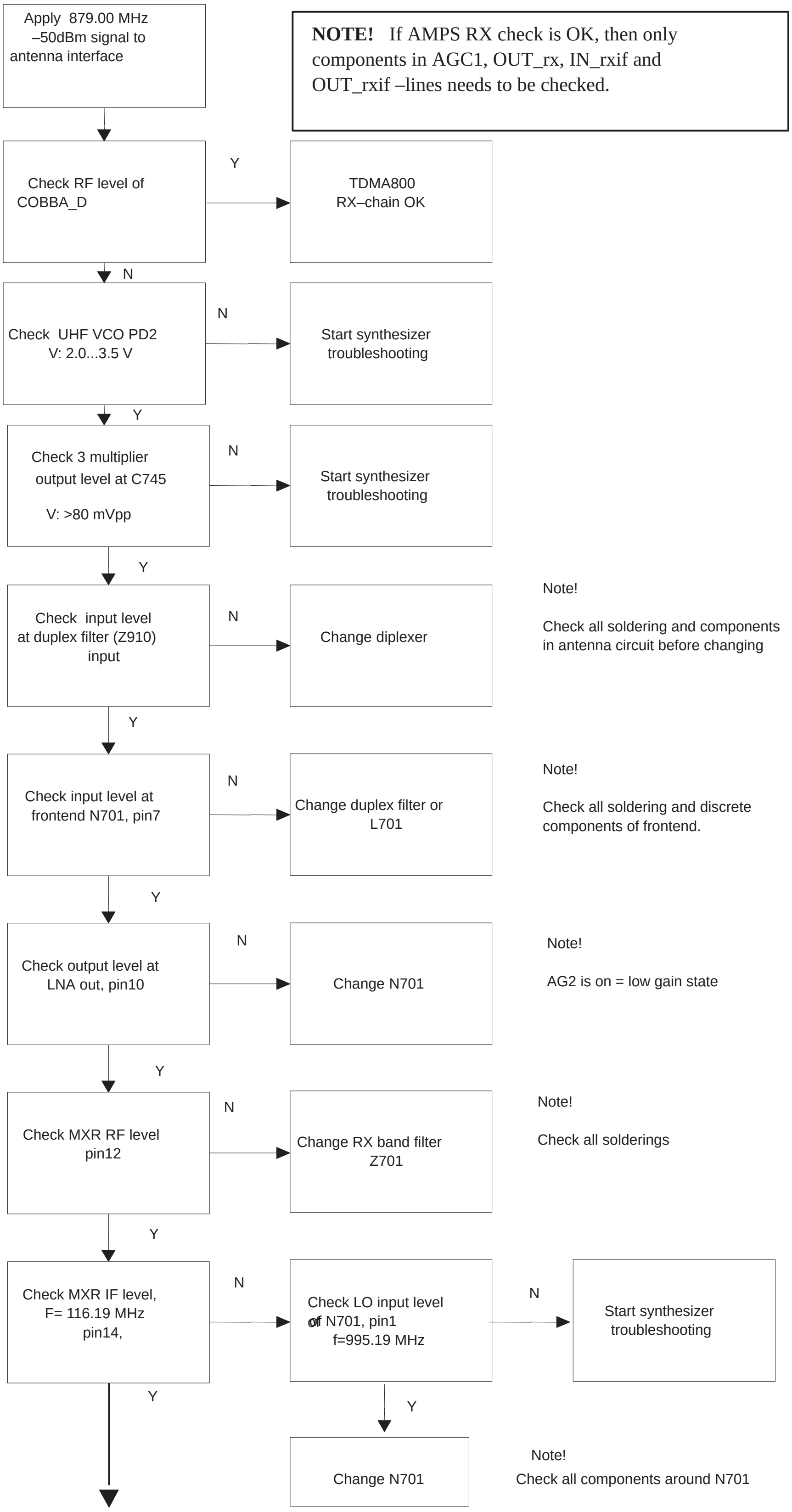


AMPS TX continued above

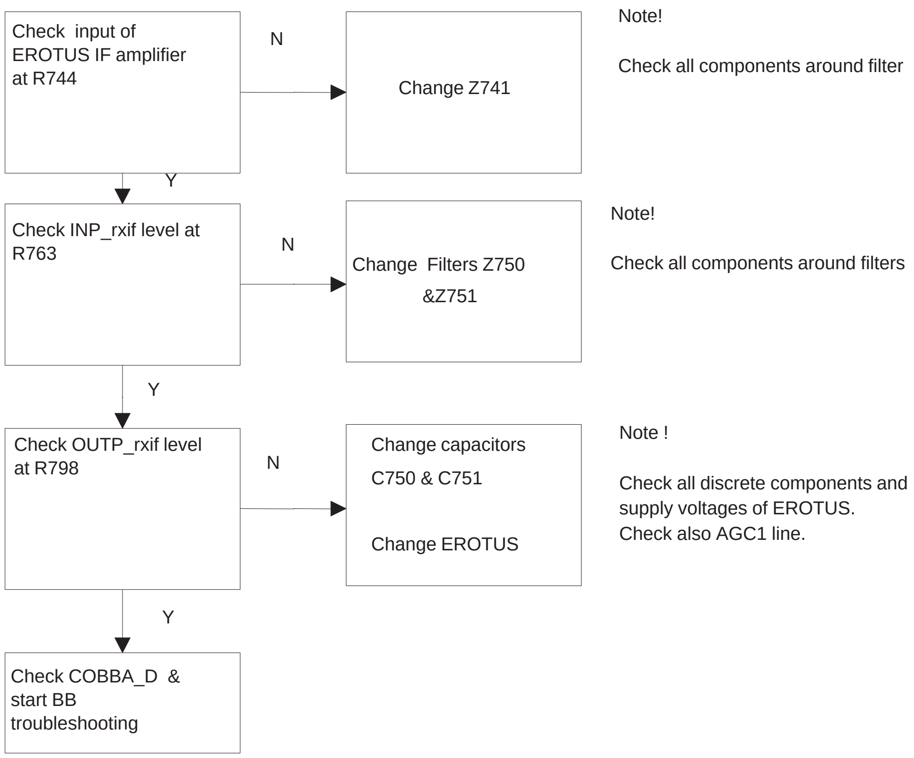
TDMA800RX

Diagram on the next page.

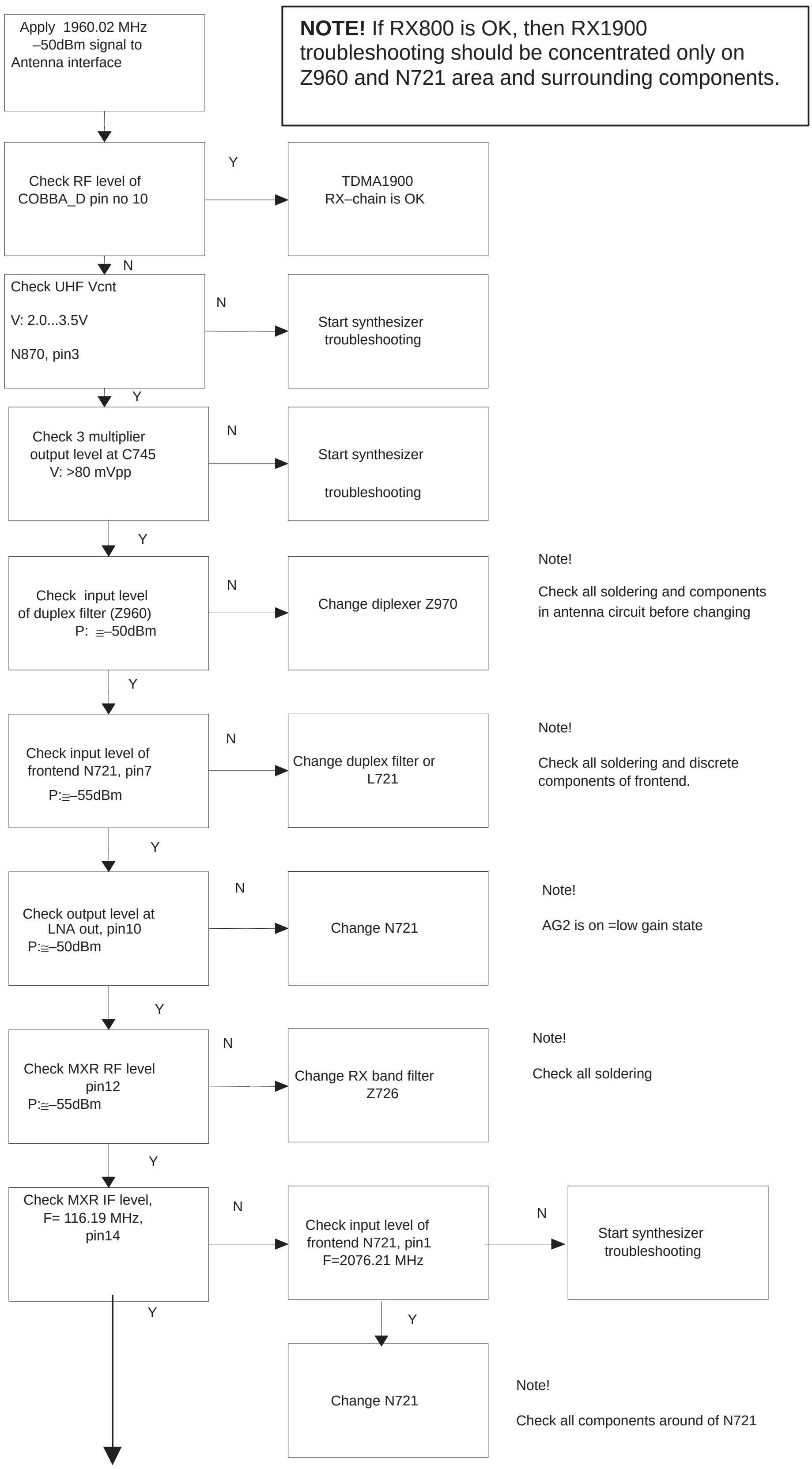
NOTE! If AMPS RX check is OK, then only components in AGC1, OUT_rx, IN_rxif and OUT_rxif –lines needs to be checked.



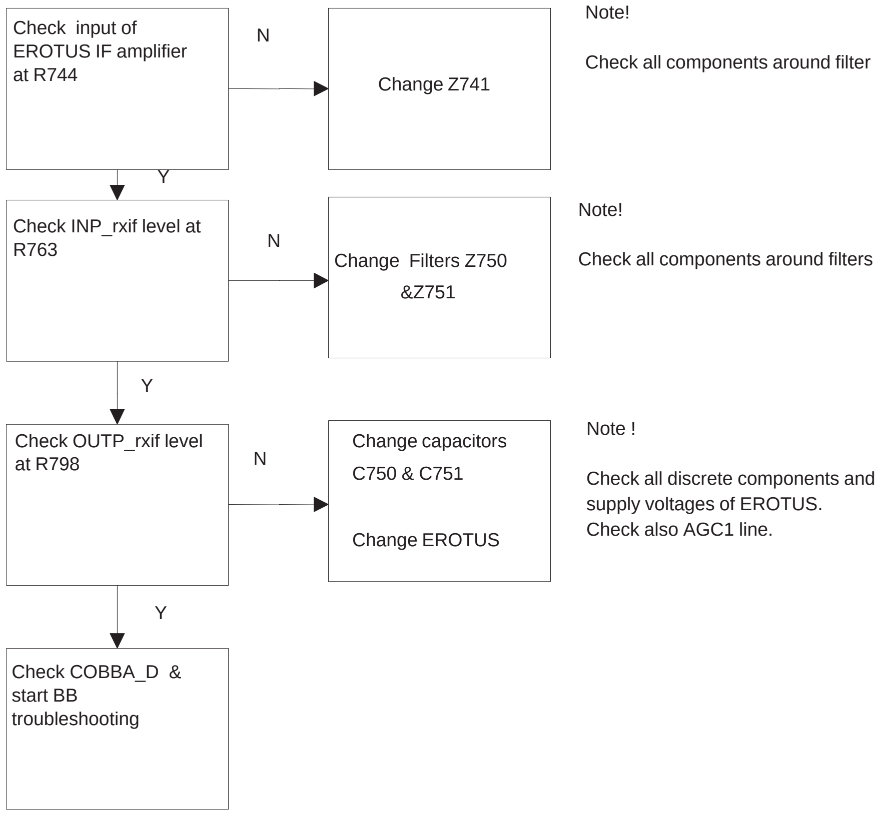
TDMA800 continued



TDMA 1900RX


Apply 1960.02 MHz –50dBm signal to Antenna interface
NOTE! If RX800 is OK, then RX1900 troubleshooting should be concentrated only on Z960 and N721 area and surrounding components.
Check RF level of COBBA_D pin no 10
Y
TDMA1900 RX–chain is OK
N
Check UHF Vcnt
V: 2.0...3.5V
N870, pin3
N
Start synthesizer troubleshooting
Y
Check 3 multiplier output level at C745 V: >80 mVpp
N
Start synthesizer troubleshooting
Y
Check input level of duplex filter (Z960) P: ≅–50dBm
N
Change diplexer Z970
Note!
Check all soldering and components in antenna circuit before changing
Y
Check input level of frontend N721, pin7 P:≅–55dBm
N
Change duplex filter or L721
Note!
Check all soldering and discrete components of frontend.
Y
Check output level at LNA out, pin10 P:≅–50dBm
N
Change N721
Note!
AG2 is on =low gain state
Y
Check MXR RF level pin12 P:≅–55dBm
N
Change RX band filter Z726
Note!
Check all soldering
Y
Check MXR IF level, F= 116.19 MHz, pin14
N
Check input level of frontend N721, pin1 F=2076.21 MHz
N
Start synthesizer troubleshooting
Y
Change N721
Note!
Check all components around of N721
Y

TDMA1900RX continued



Transmitter

General Instructions for TX Troubleshooting

Always use RF–cable connected from antenna interface to analyzer through an attenuator. This is important to protect analyzer against excessive rf–power and not to let any unwanted RF power leak to the cellular frequencies.

Start the Wintesla software and select TX mode under testing (AMPS,DAMPS or TDMA1900). It is useful to select mid channel (383 for AMPS/DAMPS or 1000 for TDMA1900) and power level 2. Select random data for digital mode of operation.

One of the basic test is to monitor current when transmitter is on. If current consumption does not change when transmitter is set on the fault is in the PA area.

Nominal current consumptions on power level 2 in mid channel:

AMPS: 650–850 mA

TDMA800: 300–350 mA

TDMA1900: 350–400 mA

Also, if pressing the PA package more tightly to PCB does have an effect on current consumption the fault is in the PA. In case of a faulty PA, the replacement should be done only under correct ESD precaution and using a hot air gun set to 10m/s and 300 degrees centigrade. The new PA must be taken from a vacuum package and the heating process should be done in less than 30 seconds. Note, that the ground slug of the package must be properly soldered and excessive solder material, if any, has to be removed.

If any components in the TX chain are replaced, the power level tunings have to be checked and retuned.

Tuning targets are presented at next page.

Set power supply voltage.

Connect pulse power meter or spectrum analyzer. Use attenuator, if needed.

Set settings for spectrum analyzer in power level tuning:

Set span 0 Hz

Set Ref LVL 30 dB

Set Ref LVL offset and —> Attenuation to Antenna Pad

Set RBW and VBW 300 kHz

Set sweep time 50 ms

Set TRIG: SWEEP CONT, VIDEO –10 dBm

Set marker at middle of slot.

Check that spectrum analyzer frequency is correct

Set settings for pulse power meter

Do calibration if needed.

Set correct frequency

Set Ref LVL offset —> Attenuation to Antenna Pad

Set correct duty cycle, 33,3 % in digital mode and 100 % at analog mode.

Select Tuning –> Using WinTesla Select Tuning –> TX power –> LowBand/HighBand –>EEPROM values

All four tuning channels have to be tuned. Repeat tuning for A, B, C and D tuning channel. Tuning channel change read old tuning values from phone's EEPROM.

Adjust power level by clicking the + and – buttons, power level change is done by keyboard keys ↑ and ↓ .

Tune power levels, which are shown by "# for calculate"

Press Calculate button to calculate other power levels.

Check tuning, Do fine tuning if needed.

Once all TX tuning channels are correct, press SAVE button.

Tuning done, if both Analog mode and 800 MHz and 1900 MHz digital mode tuned.

Difference between measured TX power from Test Pad of panel and Antenna Pad, must be taken care so that measurements from Antenna Pad give the correct results.

800MHz Analog TX output power

Power level	RF Power at ext. Antenna pad	Tuning target tolerance	Testing Limits
2	26.0 dBm	+/– 0.1 dB	**+0.5…– 1.0 dB**
			26.5 – 25.0 dBm

800MHz Digital TX output power

Power level	RF Power at ext. Antenna pad	Tuning target tolerance	Testing Limits
2	26.8 dBm	+/– 0.1 dB	**+0.5/– 1.0 dB**
			27.3 – 25.8 dBm
3	23.5 dBm	+/– 1 dB	+/– 2.0 dB
4	20.0 dBm	+/– 1 dB	+/– 2.0 dB
5	16.0 dBm	+/– 1 dB	+/– 2.0 dB
6	12.0 dBm	+/– 1 dB	+/– 2.0 dB
7	8.0 dBm	+/– 1 dB	+/– 2.0 dB

Power level	RF Power at ext. Antenna pad	Tuning target tolerance	Testing Limits
8	4.0 dBm	+/– 1 dB	+/– 2.0 dB
9	–0.0 dBm	+/– 1 dB	+/– 2.0 dB
10	–4.0 dBm	+/– 1 dB	+/– 2.0 dB

Check, that power level PL2 TXC DAC value is on allowed range +50...300.

TDMA1900 TX output power

Power level	RF Power at ext. Antenna pad	Tuning target tolerance	Testing Limits
2	25.9 dBm	+/– 0.1 dB	**+0.5…– 1.0 dB**
			26.4 – 24.9 dBm
3	23.0 dBm	+/– 1 dB	+/– 2.0 dB
4	20.0 dBm	+/– 1 dB	+/– 2.0 dB
5	16.0 dBm	+/– 1 dB	+/– 2.0 dB
6	12.0 dBm	+/– 1 dB	+/– 2.0 dB
7	8.0 dBm	+/– 1 dB	+/– 2.0 dB
8	4.0 dBm	+/– 1 dB	+/– 2.0 dB
9	0.0 dBm	+/– 1 dB	+/– 2.0 dB
10	–4.0 dBm	+/– 1 dB	+/– 2.0 dB

Check, that power level PL2 TXC DAC value is on allowed range +0...+250.

Path of the transmitted signal

AMPS/DAMPS

Cobba TX I/Q DAC – I/Q–modulator – gain step amplifier – linear gain control amplifier – IF BPF – Upconverter – TX Driver amplifier – BPF– Power Amplifier – Directional Coupler– Duplexer –Diplexer – Antenna.

TDMA1900D

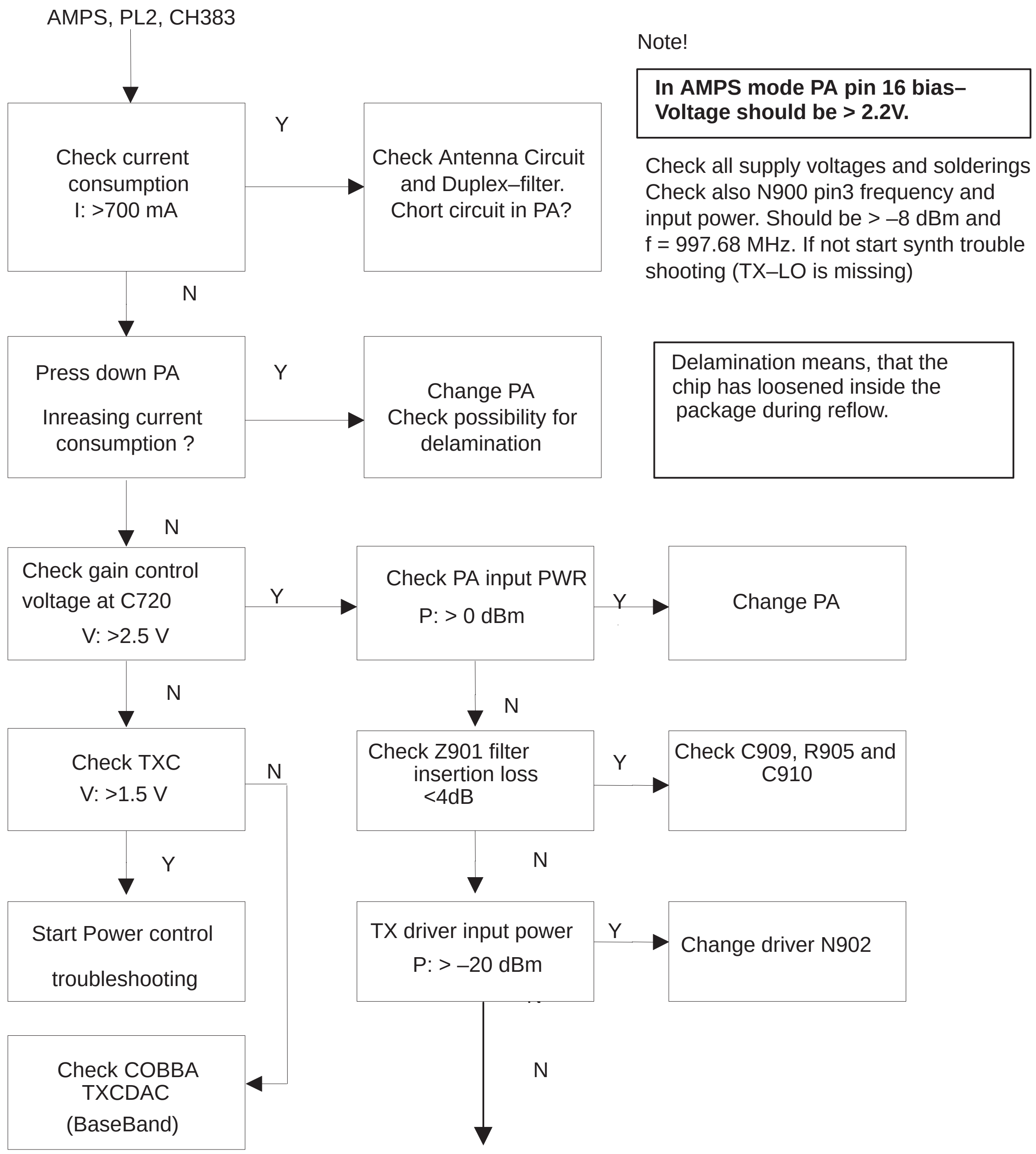
Cobba TX I/Q DAC – I/Q–modulator – gain step amplifier – linear gain control amplifier – IF BPF –Upconverter – BPF– TX Driver amplifier – BPF– Power Amplifier – Directional Coupler– Duplexer – Diplexer – Antenna.

Power detection and power control circuits are located under the power control part of this guide.

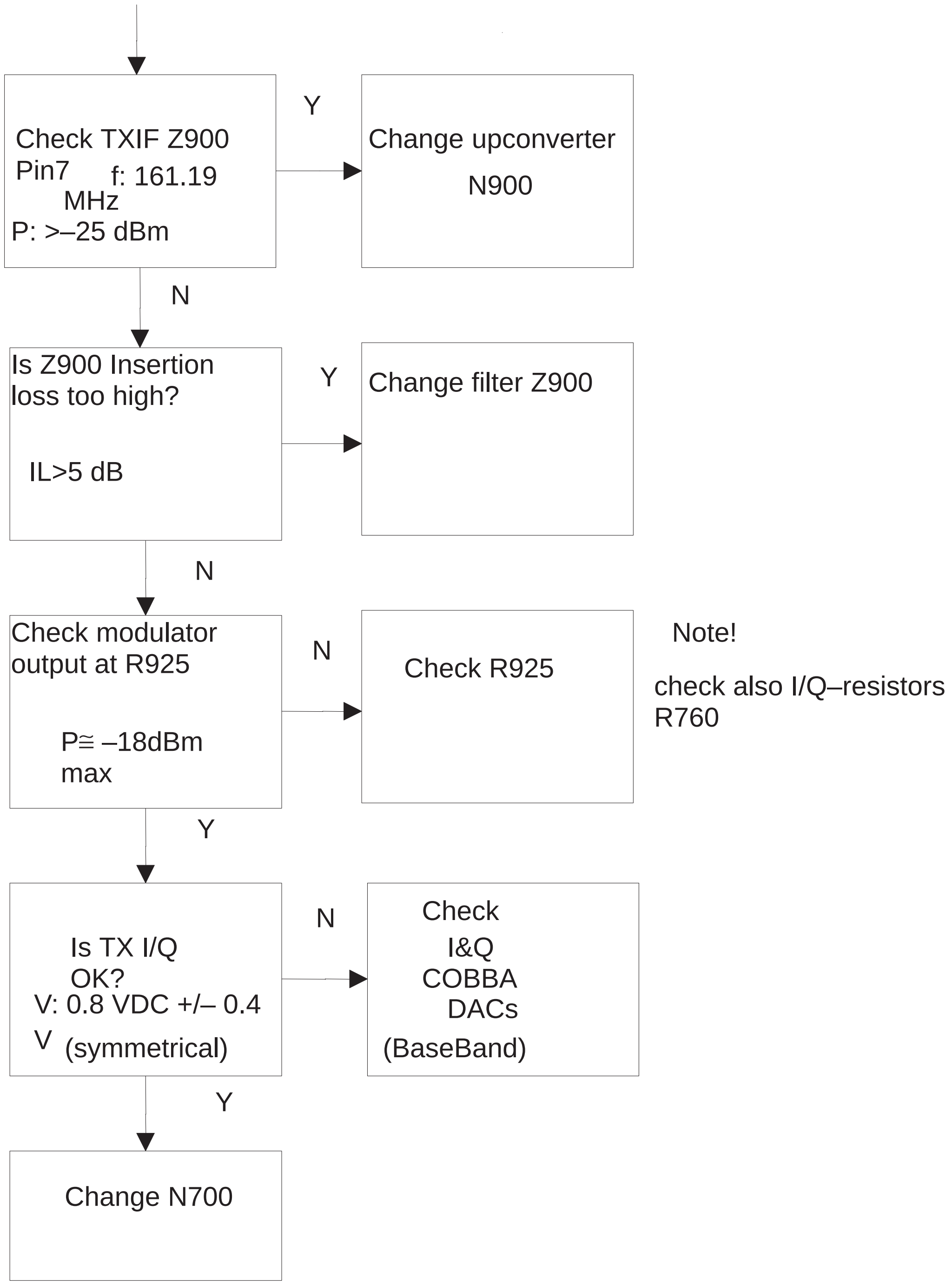
Troubleshooting diagrams for TX

AMPS TX

Connect an RF–cable to the antenna interface and connect the cable to a spectrum analyzer input. Start WinTesla–software and set the phone to Analog mode. Set channel 383 and Powerlevel 2 and measure RF ouput level. Please notice insertion loss of the cable and attenuations in the test jig or antenna adapter. It is recommended to use an external attenuator to avoid overloading the spectrum analyzer.

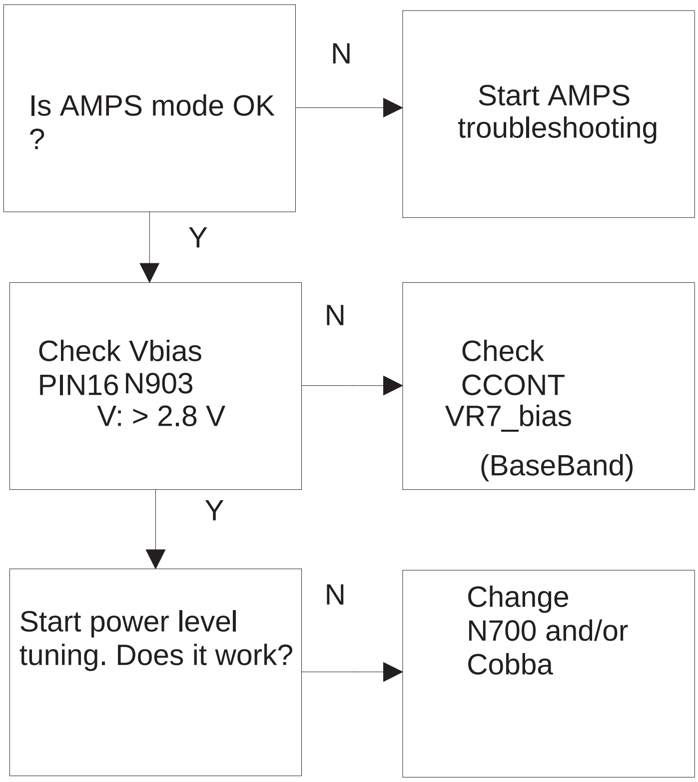


Continues from previous page



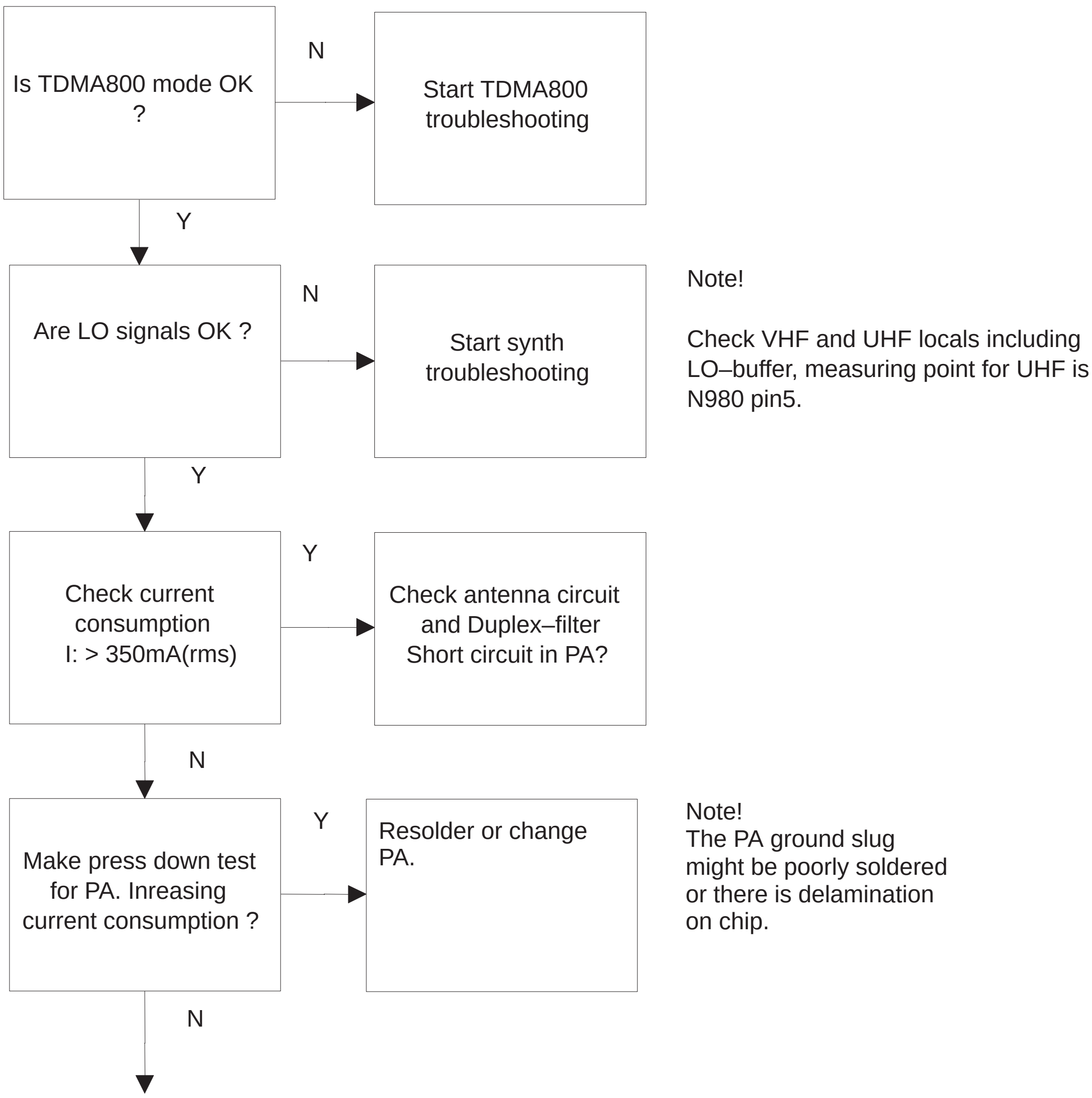
TDMA800 TX

The transmitter chain is exactly same as in AMPS–mode, but the power amplifier is biased to more linear mode, so it is important, that AMPS have no faults.

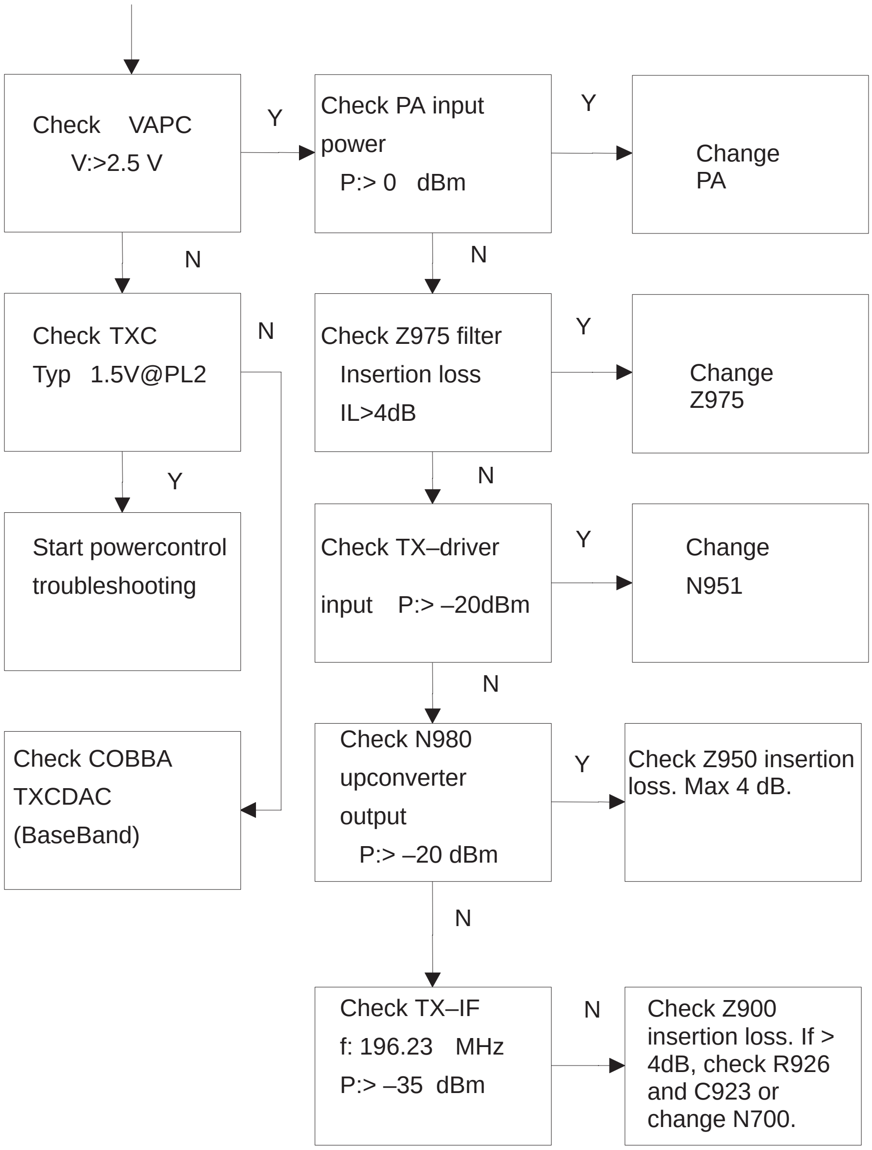


TDMA1900 TX

TDMA1900 mode and DAMPS mode have common IF section and antenna circuit and thus it is important that DAMPS mode have no faults.

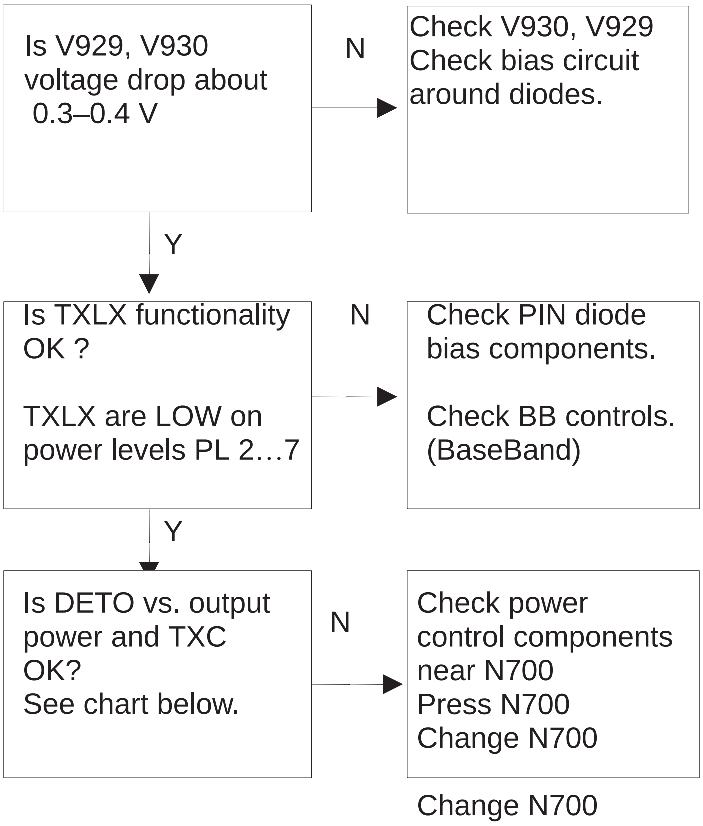


TDMA1900 continued next page


Check VAPC
V:>2.5 V
Y
Check PA input
power
P:> 0 dBm
Y
Change
PA
N
N
Check TXC
Typ 1.5V@PL2
N
Check Z975 filter
Insertion loss
IL>4dB
Y
Change
Z975
Y
N
Start powercontrol
troubleshooting
Check TX–driver
input P:> –20dBm
Y
Change
N951
N
Check COBBA
TXCDAC
(BaseBand)
Check N980
upconverter
output
P:> –20 dBm
Y
Check Z950 insertion
loss. Max 4 dB.
N
Check TX–IF
f: 196.23 MHz
P:> –35 dBm
N
Check Z900
insertion loss. If >
4dB, check R926
and C923 or
change N700.

Power control loop

Power control section is basically similar for both bands, except for that both bands have their own directional coupler and detector. The power control is actually made in EROTUS IC.



Note !

See DETO vs. Output power curve

Note:

1. DETO and TXC will be about same in each mode.

2. TXA is high during modulation.

3. TXLX signals will draw about 4mA current in high state.

TYPICAL DETECTED VOLTAGES AT POWER LEVELS PL2…PL10

800D					1900 D			
	Pout	TXC	LB–DETO			Pout	TXC	UB–DETO
PL	dBm	dac	mV		PL	dBm	dac	mV
2	26.8	250	1650		2	26.8	124	1478
3	23.5	77	1350		3	23.0	27	1275
4	20.0	–40	1120		4	20.0	–53	1120
5	16.0	–127	930		5	16.0	–128	937
6	12.0	–187	840		6	12.0	–177	831
7	8.0	–228	750		7	8.0	–215	762
8	4.0	–188	840		8	4.0	–205	768
9	0.0	–229	740		9	0.0	–253	693
10	–4.0	–290	650		10	–4.0	–329	531

Synthesizers

There are four oscillators generating the needed frequencies for RF–section. 19.44 MHz reference oscillator, 1GHz UHF VCO, 2Ghz UHF VCO and VHF VCO. Only VHF VCO is discrete solution and it has two fixed frequencies, 322.38 MHz for lowband and 392.46 MHz for upper band. VHF VCOs operating frequency is controlled by BAND–signal and PLL–circuit of EROTUS. All locals are locked to the stable reference oscillator.

The frequency range for 1GHz UHF VCO is 985.23 – 1010.2 MHz and for 2Ghz UHF VCO is 2046.2 – 2107.2 Mhz.

A practical way to check out synthesizer statusis to measure the control voltage of the VCO from the integrator capacitor C822 (LB) , C883 (HB) or C789 (VHF). The voltage must be stable and in the correct range, and the local oscillator is running correctly.

19.44 MHz Reference oscillator

The 19.44 MHz oscillator frequency (G850) is controlled by COBBA_D. This 19.44 MHz signal is connected to EROTUS and TDMA1900 PLL–circuit.

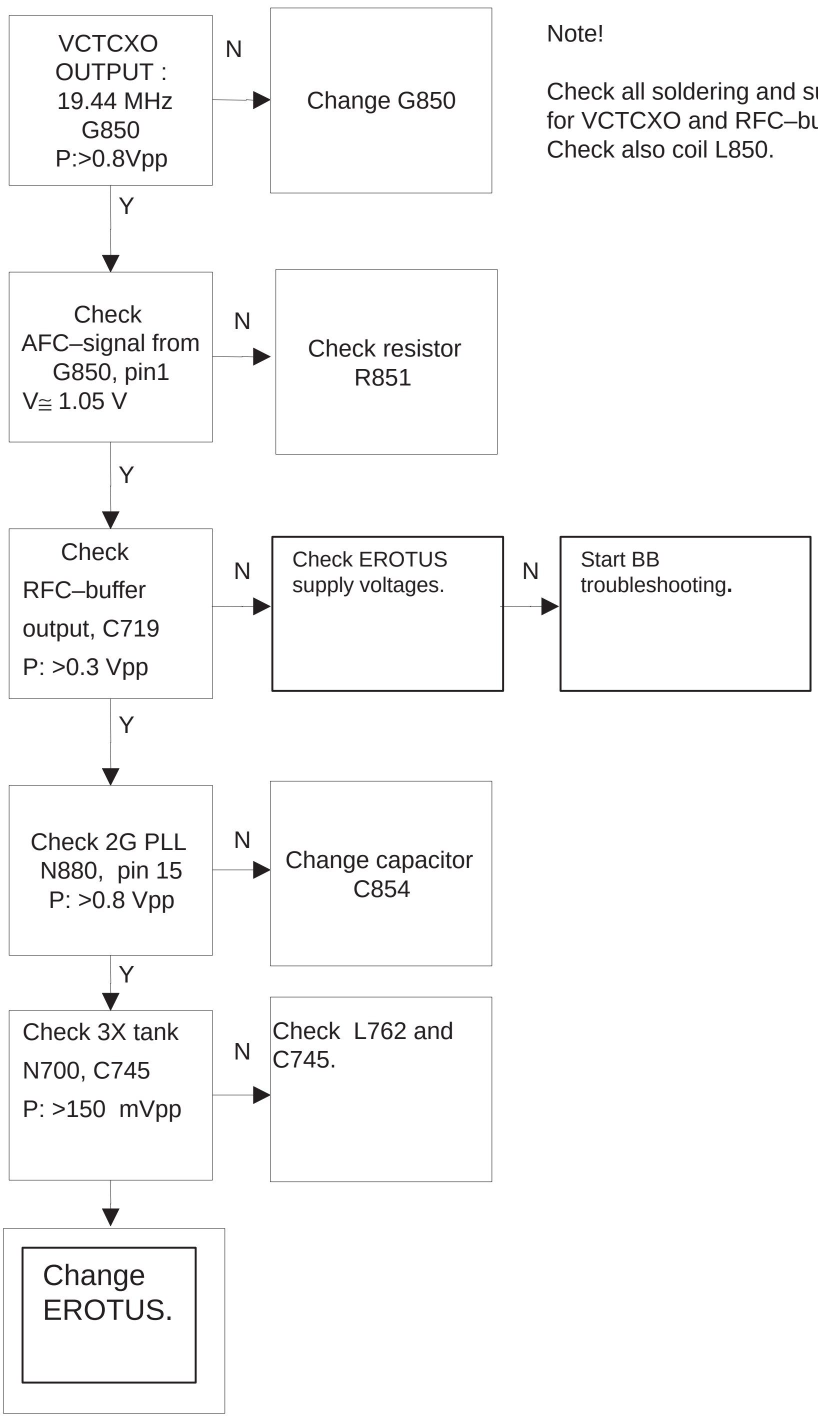
All synthesizers use the divided VCTCXO signal as reference signal for Phase locked loop to provide the correct LO–frequency. The VCTCXO output signal is also used to generate multiple LO frequency by multipliers.

Baseband also needs the reference signal so it can generate necessary clock signals, and the VCTCXO output signal is also buffered and connected to MAD.

58.32 MHz Triple Multiplier

The 3–multiplier is a integrated solution in EROTUS and it is used to generate second LO frequency for the receivers. The 3*multiplier output signal is multiplied by 2 and then it is fed to the 2nd downconverter.

19.44 MHz oscillator

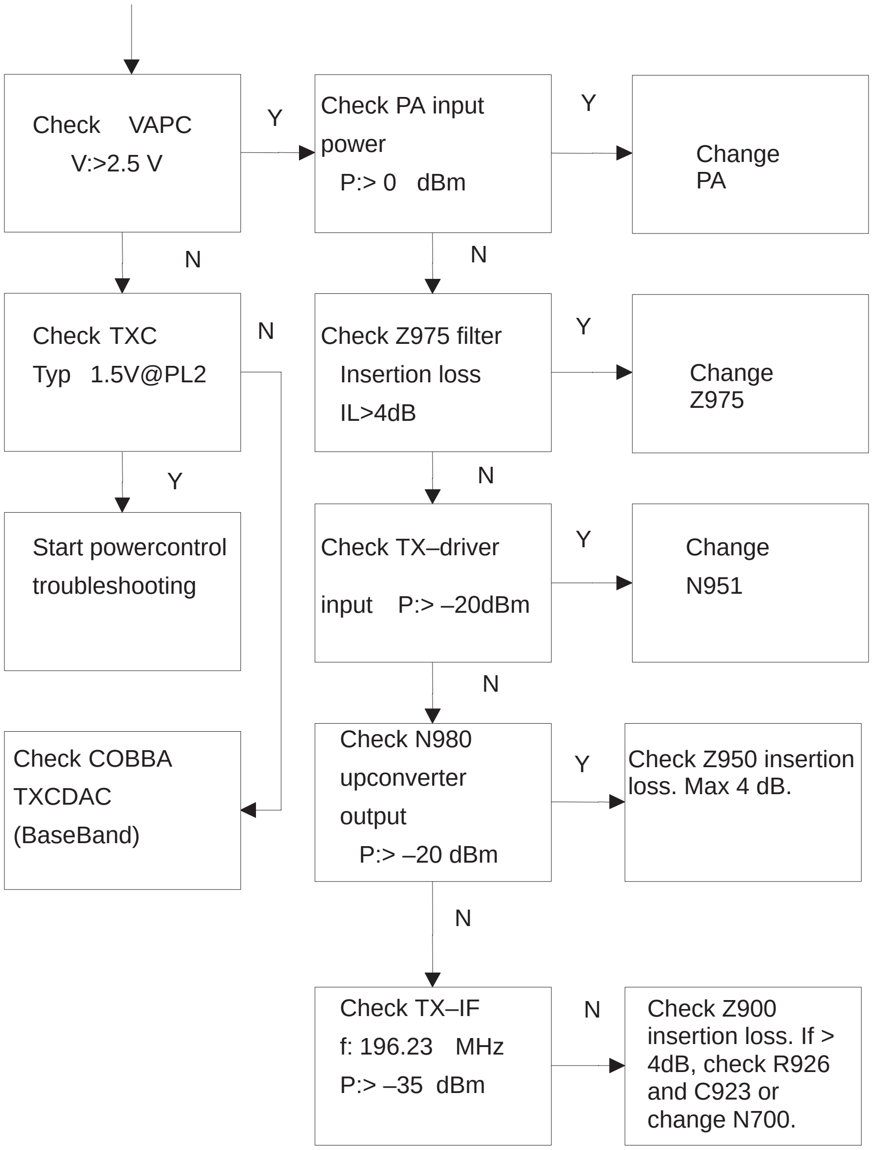


Note!

Check all soldering and supply voltages for VCTCXO and RFC–buffer.
Check also coil L850.

continues next page

19.44 MHz Oscillator (continued)

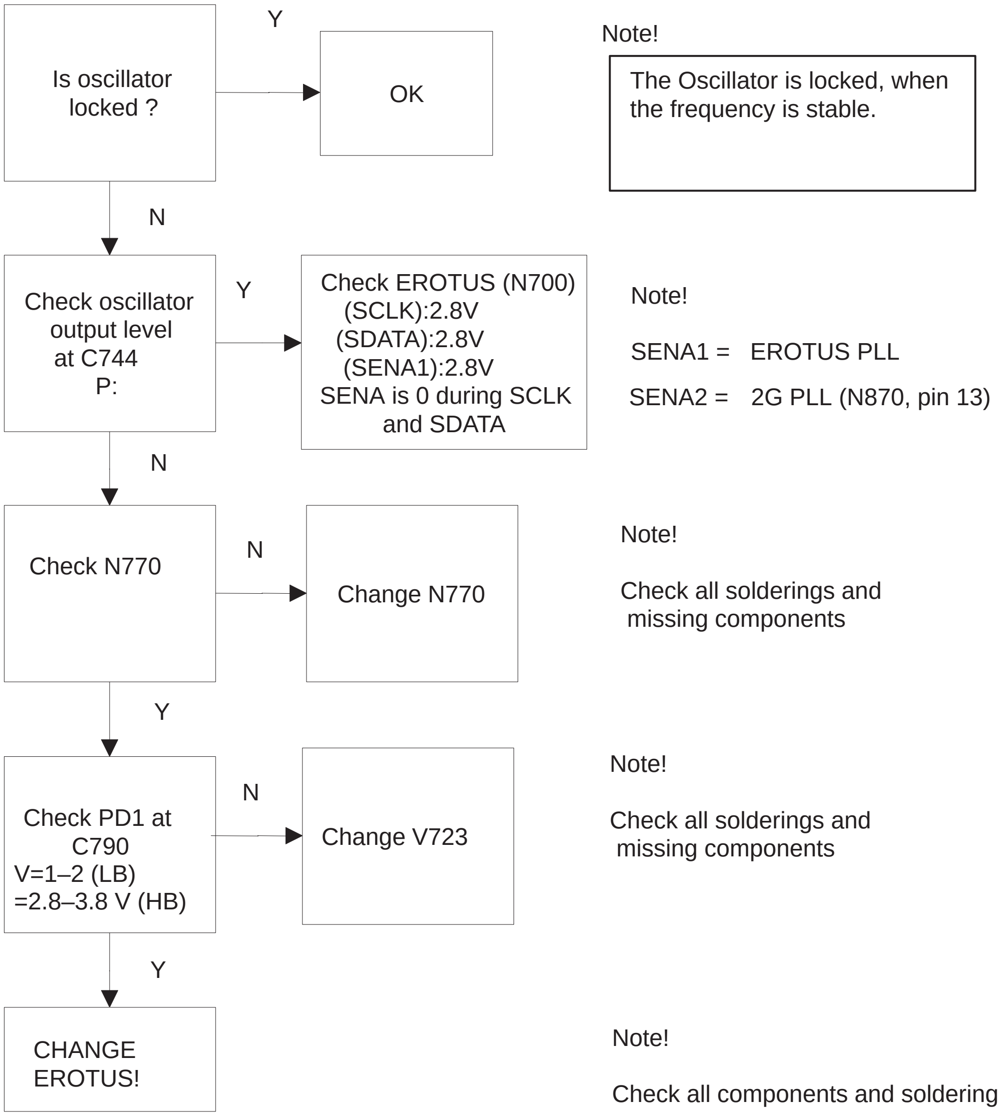


VHF VCO

The VHF VCO signal is used to generate transmitter Intermediate frequencies. The VHF VCO has two fixed frequencies. Operating frequency is locked in Phase locked Loop, which is controlled by baseband.

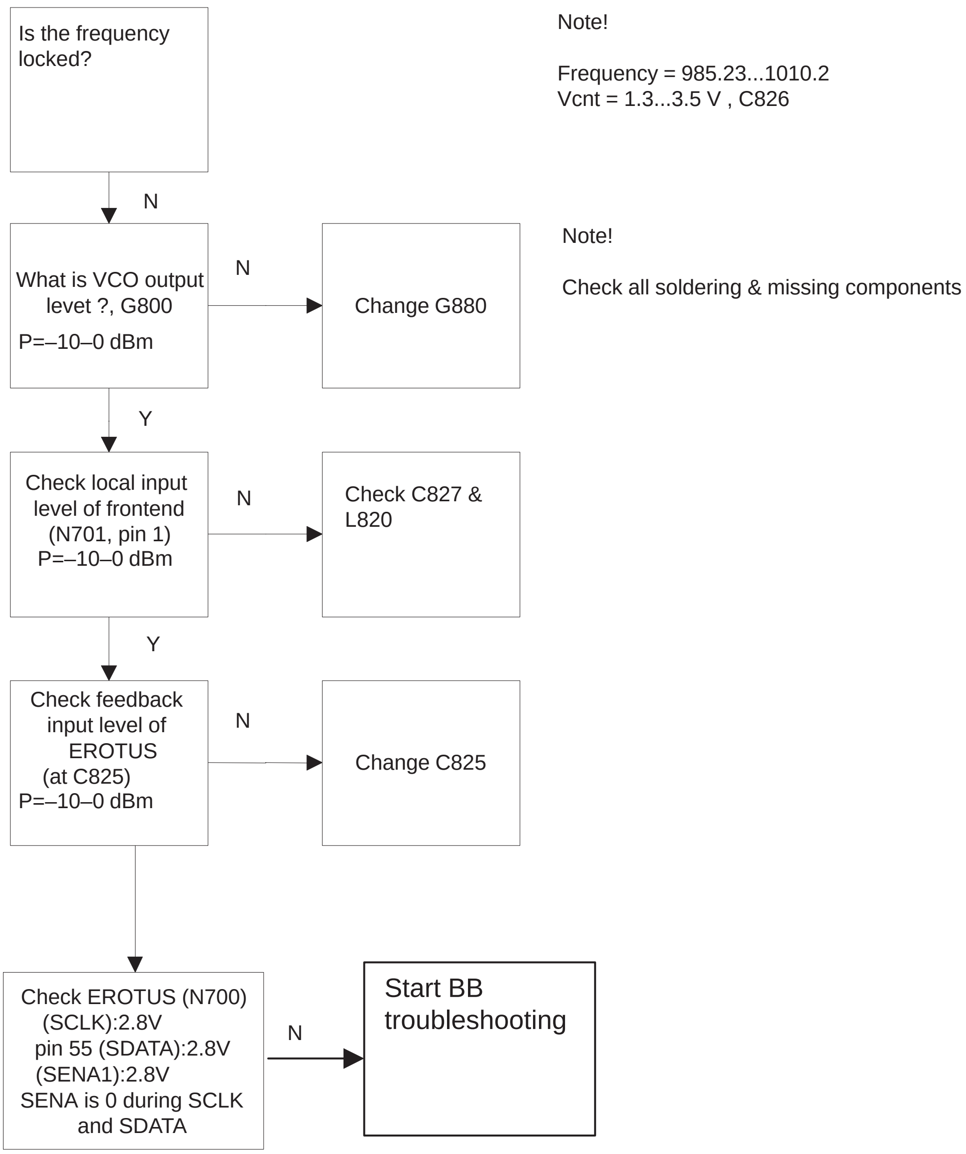
Because the oscillator has two frequencies, it has also two different switching modes. These modes are controlled by a BAND–signal. In AMPS and TDMA800 modes the VHF frequency is 322.38 MHz and logical level of BAND–signal is “HIGH”. In TDMA1900 mode a higher intermediate frequency is needed, so the operating frequency is increased to 392.46 MHz. The BAND– signal is set to logical level “Zero”.

The VHF VCO output signal is fed to EROTUS LO–pin VV_in. Inside the EROTUS, the signal is divided for the Phase detector and TX parts. Before injection to the I/Q–modulator, the frequency is divided by 2 .



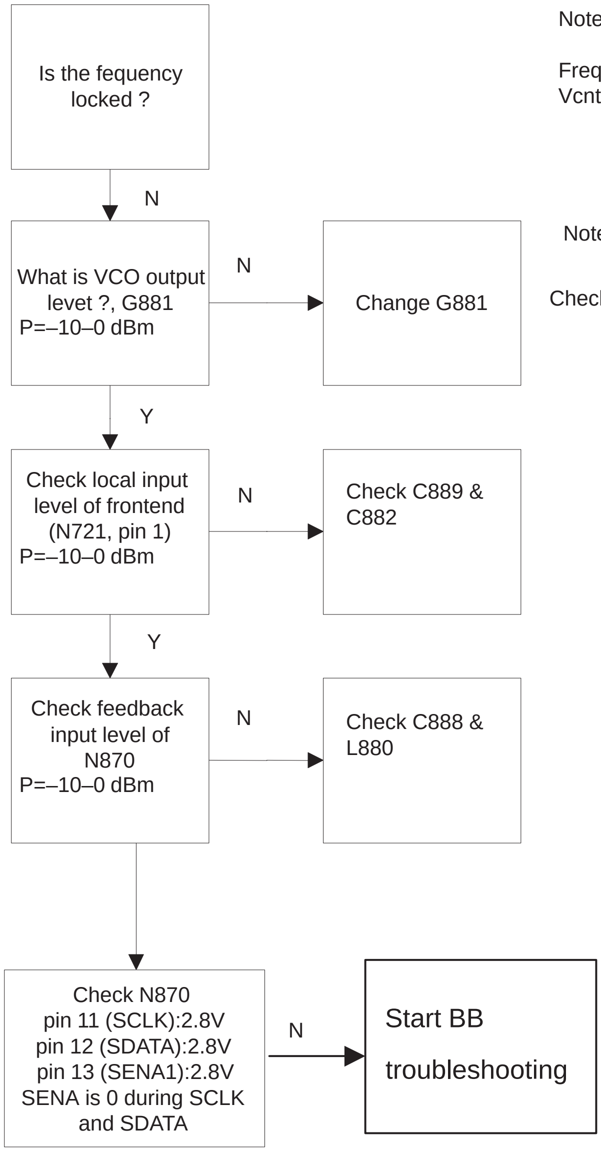
AMPS& TDMA800 UHF SYNTHESIZER

1 GHz UHF VCO (G880) generates the first injection for RX (869...897) and the final injection for TX (824...849 MHz). The output frequency of the module depends on the DC–control voltage supplied by EROTUS in line PD2.



TDMA1900 UHF SYNTHESIZER

2GHz UHF synthesizer generates desired injection frequencies for TX and RX chain. The output frequency of the VCO depends on the control voltage of the PLL–circuit.



Note!

Frequency = 985.23...1010.2
Vcnt = 1.3...3.5 V , C887

Note!

Check all soldering & missing components

RF ASIC DATA

General Info

EROTUS (N700) provides three main RF functions:

1. RX/TX IF blocks
2. PLLs for VHF and 1 GHz UHF
3. TX Power control circuits

The receiver block consists of IF buffers, active mixers, 6–multiplier (3*+2*), AGC amplifier and limiter.

The transmitter section includes a digital gain step amplifier, a linear gain control amplifier, a divider, an I/Q Modulator and control part for the Transmitter Power Control loop.

The PLL section is controlled via the serial bus and contains both 1GHz UHF and VHF PLLs and prescalers.

EROTUS ASIC

Erotus is a uBGA–package, so RF probing for the most signals is impossible at EROTUS pins. Signals can be checked at those components, to which the signals are fed to.

RX Front ends N701 and N721

Pin no.	Pin name	Nominal level	Description
1	LO IN	–5dBm	Mixer LO input
2	Vdd buf	2.8V	LO–buffer Vdd
3	LO out	0dBm	LO–buffer output
4	GND	0	Ground
5	Vdd LNA	2.8V	LNA Vdd
6	GND	0	Ground
7	LNA in	–	LNA RF input port
8	GND	0	LNA ground
9	Gain Sel	>2V	LNA gain select
10	LNA out	–	LNA output port
11	GND	0	Ground
12	Mxr RF	–	Mixer RF input port
13	GND/½IF	0	Ground (½–IF tuing in N721)
14	MXR IF	–	Mixer IF input port
15	GND	0	Ground
16	Vdd MXR	2.8V	Mixer LO–buffer Vdd and LO–buffer tuning

Power Amplifiers N903 & N960

RF9130 (N903)

Pin no.	Pin name	Description
1	VCC	Power supply pin for bias circuit. Add RF bypass capacitor.
2	L TUNE	Tuning pin for interstage matching network. A short (TBD) transmission line length is required for tuning interstage match.
3	GND	Ground
4	VCC1	Power supply pin for the first stage collector. A RF choke and a bypass capacitor is required for this pin.
5	GND1	Ground pin for the first stage.
6	RF IN	RF input. DC coupled.
7	N/C	No connection or GND
8	V_{reg}	Regulated power supply for bias circuit. PA shut down.
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	RF OUT	RF output and bias for the output stage.The power supply for the output transistor needs to be supplied to this pin.
13	RF OUT	Same as pin 12.
14	$2 * f_0$	Second harmonic trap. Add capacitor to ground.
15	GND	Ground
16	V_{bias}	Bias control 2.8V. Add RF bypass capacitor.
Package Base	Ground	Ground connection. The backside of the package should be connected to the ground plane through a short path.

RF9131 (N960)

Pin no.	Pin name	Description
1	N/C	No connection. (GND)
2	VCC Q2C	Power supply pin for the 2. stage. A bypass capacitor is required.
3	N/C	No connection. (GND)
4	VCC Q1C	Power supply pin for the 1st stage. A bypass capacitor is required.
5	N/C	No connection. (GND)
6	RF IN	RF input. DC block on chip.
7	N/C	No connection. (GND)
8	VREG	Regulated voltage supply for the bias circuit.
9	BIAS3	Bias ground.
10	N/C	No connection. (GND)
11	N/C	No connection. (GND)
12	RF OUT	RF output, Use this pin for an output matching capacitor. **Do not feed bias through this pin.** (DC coupled)
13	RF OUT	RF output and bias for the output stage. 3rd stage collector.
14	RF OUT	RF output and bias for the output stage. 3rd stage collector.

Pin no.	Pin name	Description
15	N/C	No connection. (GND)
16	N/C	No connection. (GND)
Package Base	Ground	Ground connection. The backside of the package should be connected to the ground plane through a short path.

PENTA regulator N702

Pin no.	Pin name	Nominal level	Description
1	Bypass	–	Pin for external bypass capacitor
2	Common enable	>2V	Enable for the whole circuit
3	VR1cntrl	>2V	Regulator 1 ON/OFF
4	VR2cntrl	>2V	Regulator 2 ON/OFF
5	VR3cntrl	>2V	Regulator 3 ON/OFF
6	VR4cntrl	>2V	Regulator 4 ON/OFF
7	VR5cntrl	>2V	Regulator 5 ON/OFF
8	GND	0	Ground
9	VR5	2.8V	Regulator 5 output
10	Vcc2	VBAT	VR4 and VR5 common input voltage
11	VR4	2.8V	Regulator 4 output
12	VR3	2.8V	Regulator 3 output
13	VR2	2.8V	Regulator 2 output
14	VR1	2.8V	Regulator 1 output
15	Vcc1	VBAT	VR1, VR2 and VR3 common input voltage
16	N/C		Not connected

TDMA1900 UPCONVERTER N980

Pin no.	Pin name	Nominal level	Description
1	VDD1	2.8V	Supply voltage
2	N/C		Not connected
3	N/C		Not connected
4	GND	0	Ground
5	LO IN	0dBm	TX local input
6	GND	0	Ground
7	RF OUT	–	RF output
8	VDD2	2.8V	Supply voltage
9	N/C		Not connected
10	N/C		Not connected
11	GND	0	Ground
12	VDD3	2.8V	Supply voltage
13	GND	0	Ground
14	IF IN	–	Intermediate frequency input
15	N/C		Not connected
16	TX ENA	>2V	TX enable

TDMA1900 PLL–circuit N870

Pin no.	Pin name	Nominal level	Description
1	FAST	2.8V	Enable input for fast chargepump
2	CPF	–	Fast charge pump output
3	CP	–	Normal charge pump output
4	VDD2	2.8V	Power supply voltage
5	Vss3	0	Ground
6	RFI	–	Main divider input
7	Vss2	0	Ground
8	POL	2.8V	polarity select
9	PON	2.8V	Power on input
10	Vss1	0	Ground
11	CLK	2.8V	Programming bus clock input
12	DATA	2.8V	Programming bus data input
13	E	2.8V	Programming bus enable input
14	Vdd1	2.8V	Power supply voltage
15	XTALB	–	Complementary crystal frequency input
16	XTALA	–	Complementary crystal frequency input
17	GND(CP)	0	Ground for charge pump
18	Vcc	4.8V	Supply voltage for charge pump
19	Iset	–	charge pump currents setting
20	LOCK	–	Out of lock detector

Warranty transfer

Items:	Service accessories:	Product codes:
1 Warranty Cable	XMS–3	0730174
2 Flash Adapter	FLA–9	0770187

The Warranty cable XMS–3 and 2 pcs Flash adapters FLA–9 are used to connect two phones and transfer the warranty data (user settings and serial numbers) from one phone to another. The warranty transfer procedure is described below:

Point of Sale

– Phone 1 is broken and Phone 2 is the swap phone.

– Number the phones 1 and 2 to avoid mix–up.

– Plug the warranty cable XMS–3 between the flash adapters and connect the adapters to the phones 1 and 2. (in place of the phone battery)

– Turn the phone 2 on and then on Silent Profile

– Start the warranty data transfer by selecting code ***#92772689#** in phone 2.

– Select option **”Transfer user data?”** and press OK, ”Confirm transfer?” Press OK.

– Wait untli the transfer is completed.

– Turn Phone 2 off, then back on and check welcome note and profile.

– After the transfer check with WinTesla the original and warranty ESN of the phone 2.

– Send the broken phone no.1 to the central service.

Service Center

– Check and repair the phone .

– Change Warranty State from ”defective” to ”exchange”.

– Win Tesla and PKD–1CS are needed

– Menu: Software –> Warranty Info –> Info State –> select ”Exchange”

– Send the repaired phone to the dealer.

Point of Sale

– Use the returned phone as a swap phone.

– When the Warranty Info is transferred into a swap phone the Warranty State changes to USE mode.

– Send the broken phone to the central service.

This page intentionally left blank.