Programmes After Market Services (P.A.M.S.)
Technical Documentation
NME–2A SeriesTransceivers

Troubleshooting Instructions

Original 08/97

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Troubleshooting Instructions

The purpose is to define fault block of the module and then find out the broken component. The trouble shooting diagram has been planned so that the fault, whatever it is, can be found by as simple measurements as possible.

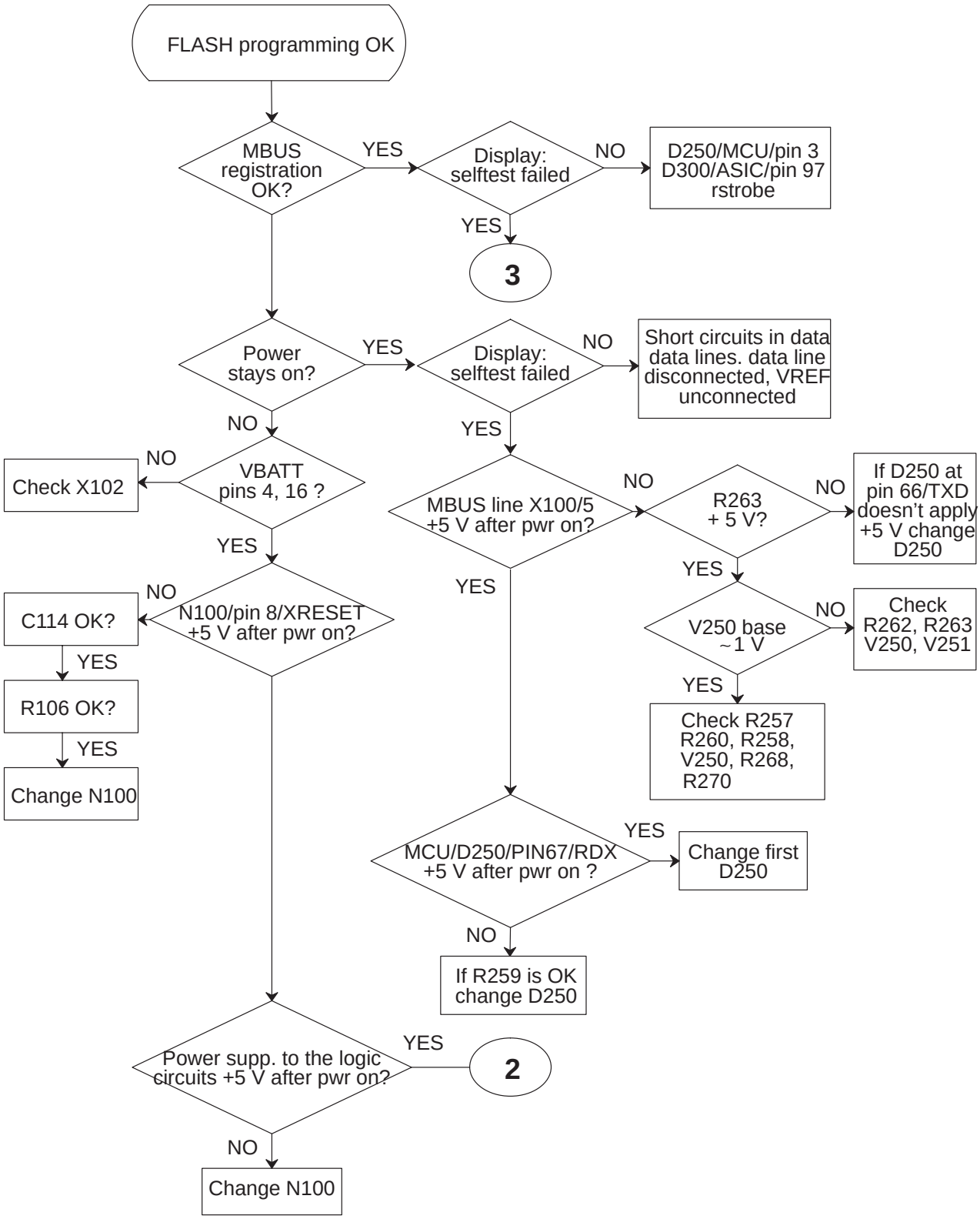
Required servicing equipment:

- PC for PCLocals
- Power supply (12 V 5 A)
- Digital multimeter
- Oscilloscope with 10:1 probes
- Spectrum analyzer (capable of 10 W input e.g. external attenuator)
- Signal generator
- Test SIM
- RF cables with BNC or N in the other end
- Modular cable
- RS232/M2BUS adapter DAU–2
- HP8922H

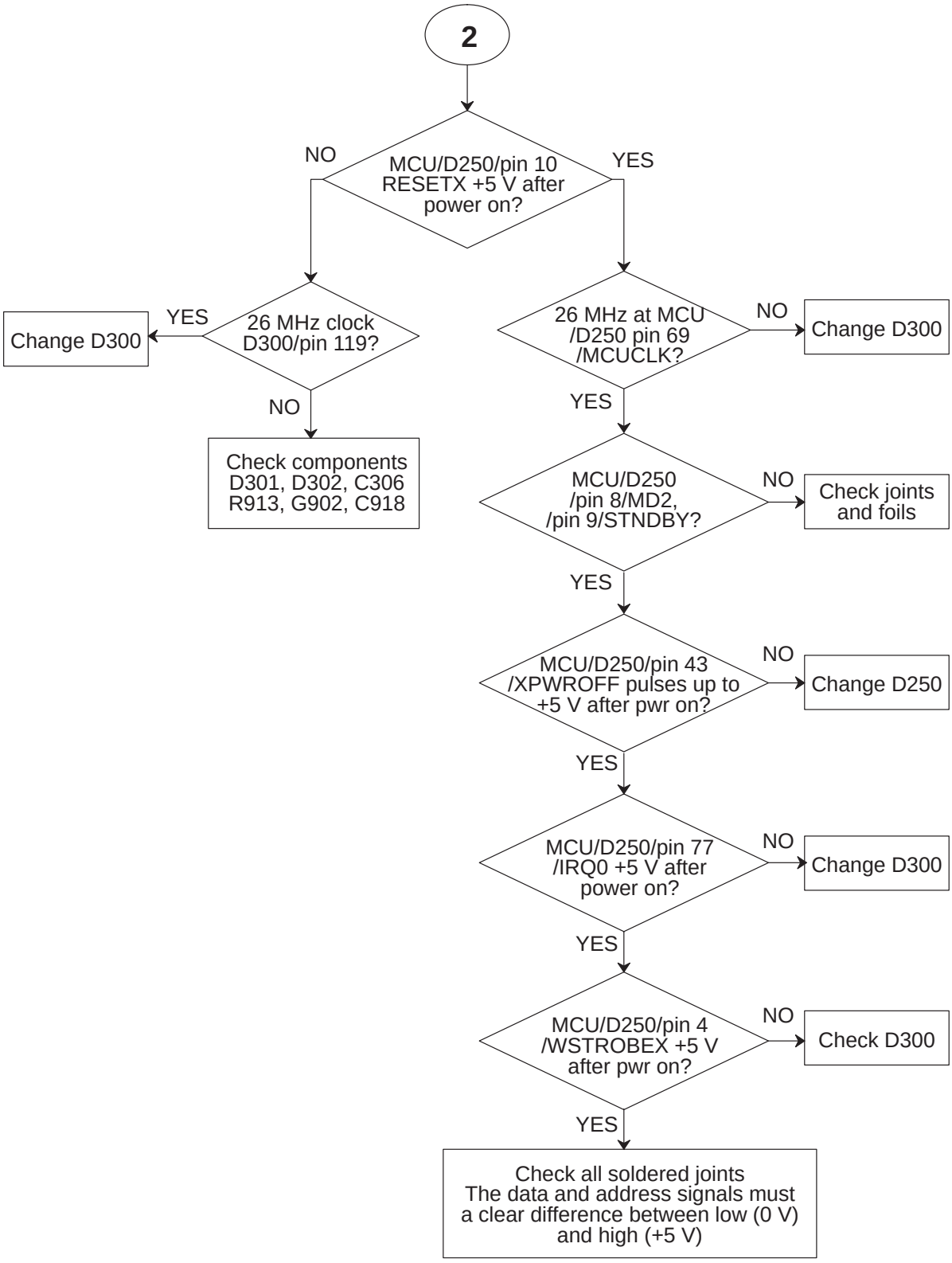
BB Troubleshooting Flow Diagrams

The baseband flow diagrams give you the overview of the blocks. The purpose is that you proceed through the flow diagram so that, if your answer is YES for the asked question, go straight to the next level, but if your answer is NO, you have to go the sub–branch.

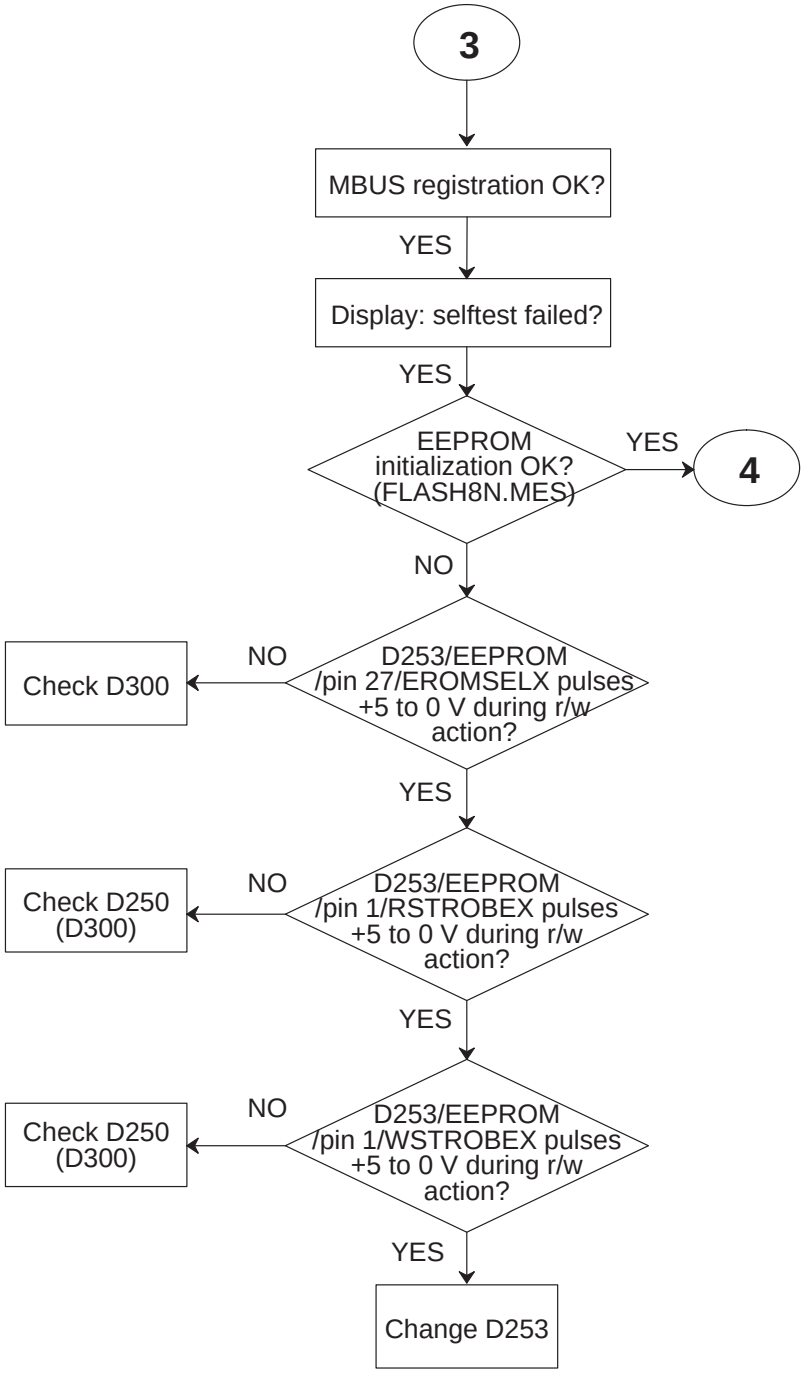
Flash Programming OK; part 1



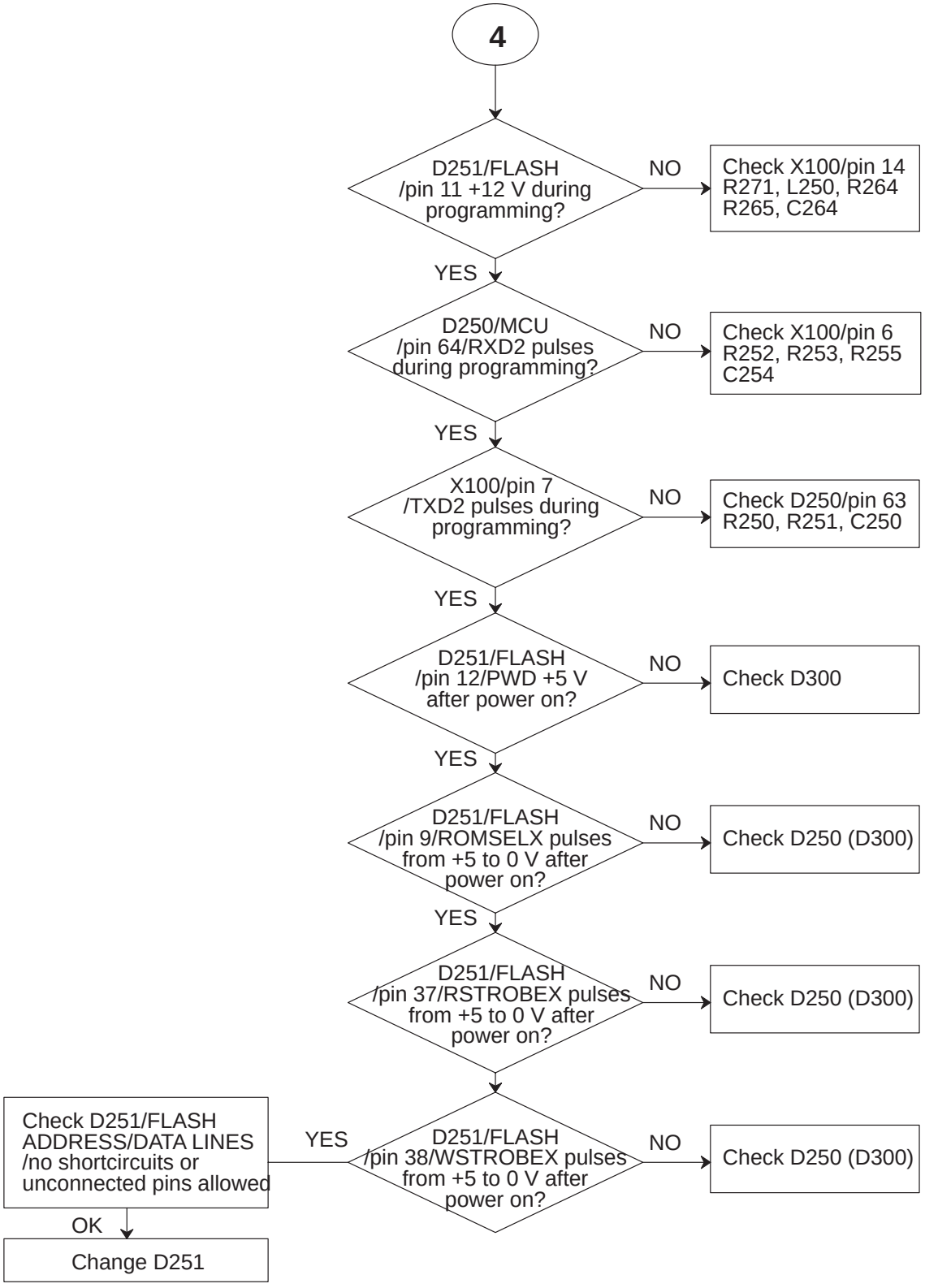
Flash Programming OK; part 2



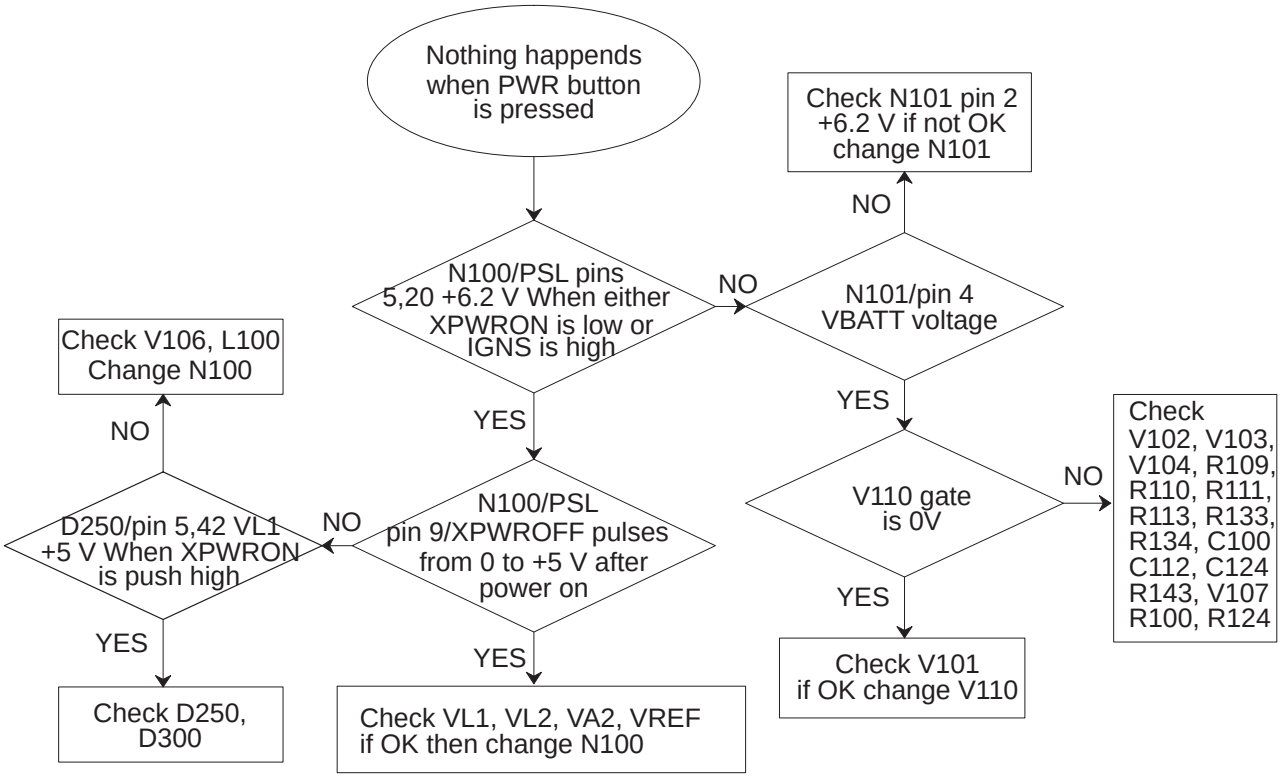
Flash Programming OK; part 3



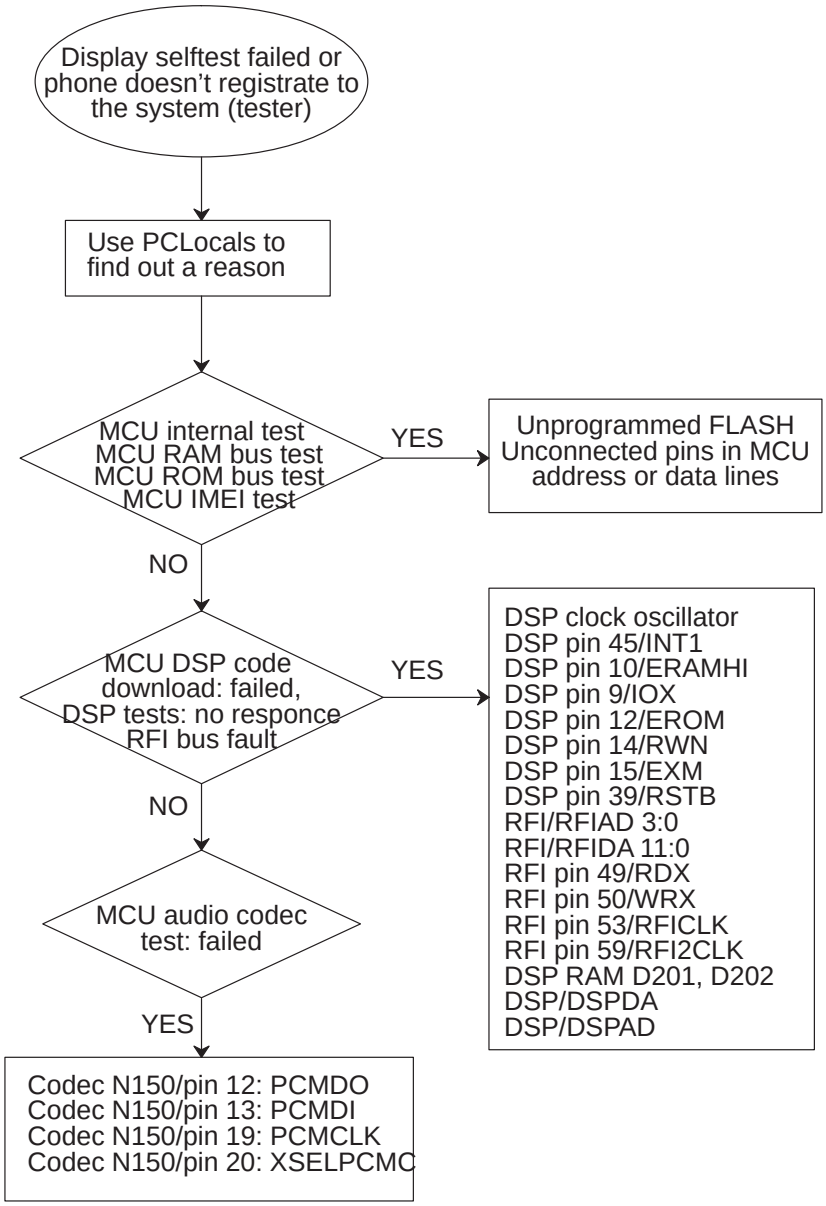
Flash Programming OK; part 4



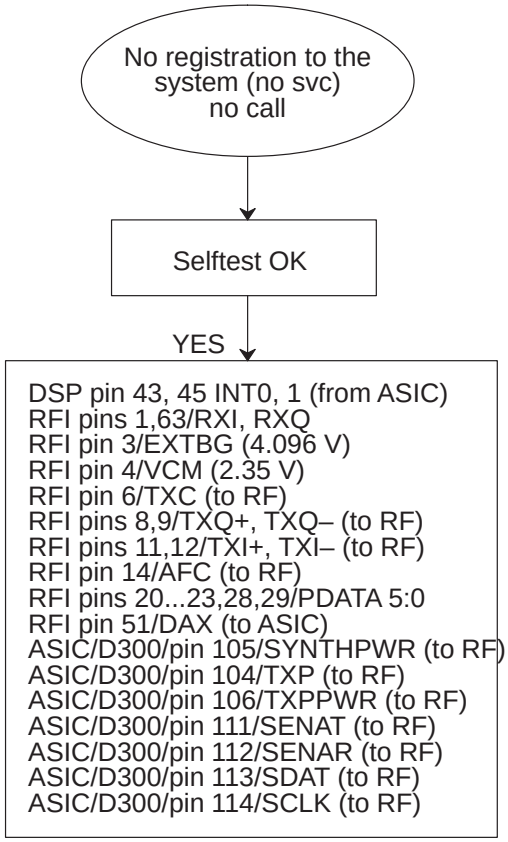
PWR Button Fault



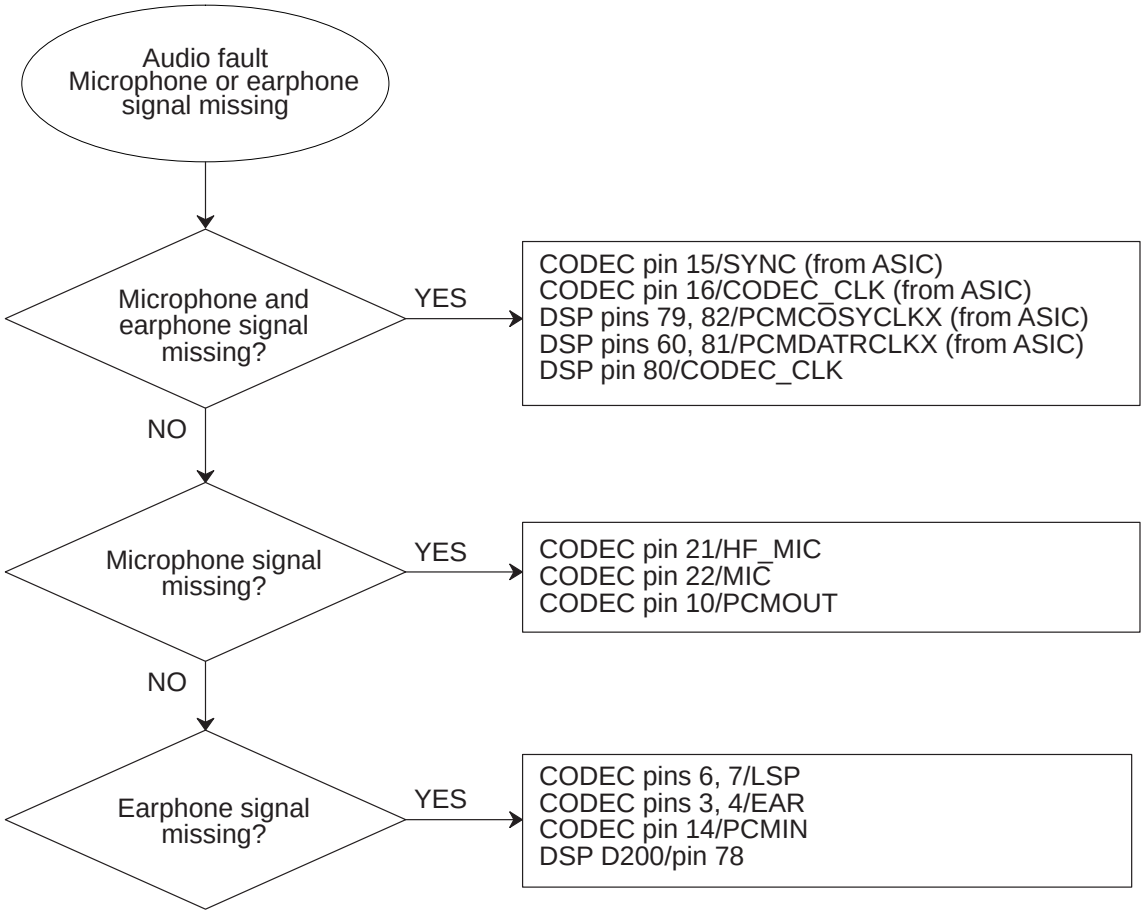
Display Selftest Failed



No Registration to the System (no serv)



Audio Fault


Audio fault
Microphone or earphone signal missing
Microphone and earphone signal missing?
YES
CODEC pin 15/SYNC (from ASIC)
CODEC pin 16/CODEC_CLK (from ASIC)
DSP pins 79, 82/PCMCOSYCLKX (from ASIC)
DSP pins 60, 81/PCMDATRCLKX (from ASIC)
DSP pin 80/CODEC_CLK
NO
Microphone signal missing?
YES
CODEC pin 21/HF_MIC
CODEC pin 22/MIC
CODEC pin 10/PCMOUT
NO
Earphone signal missing?
YES
CODEC pins 6, 7/LSP
CODEC pins 3, 4/EAR
CODEC pin 14/PCMIN
DSP D200/pin 78

RF Troubleshooting Instructions

The RF part consist of RX, TX and synthesizers as main blocks.

Interface to the rest of the radio is mainly through RFI.

In normal use, in the network, it is not possible to localize a malfunction to any of these parts alone, because all of them may be needed to operate the radio.

With a GSM tester like HP8922G/H it is possible to operate the radio in a simple network like manner, and in that way localize some faults, especially when you monitor the radio with PCLocals at the same time.

If the fault means, that the radio does not work with HP8922G/H then it is possible via PCLocals in local mode, to operate the parts individually, and in that way see if the parts can do what they are supposed to. It is also possible to operate the parts dynamic, to check the switching between the different modes, and that is more or less sufficient to tell if the RF is OK or not.

The following descriptions all starts with a simple and top level check. If that fails or if the radio still has a malfunction, then the checks goes deeper and deeper into the circuits to help finding the circuit that is responsible for the malfunction.

RX Part

1. RSSI calibration (Input –57 dBm, channel 60, 947.06771MHz):

Checks the signal path from antenna to RFI and the AGC. The RFI operates only as level detector in this mode. The offset value is a measure of the total gain in the RX.

- –37 < Offset < 49 dB
- Calibration values between ±2 dB
- If it is OK, go to 2.
- If it fails then select via PCLocals RF control, Active unit RX, Operation mode continuous, Continuous mode channel 60, AGC 93. Input –57 dBm 947.06771 MHz.

Measure with probe and oscilloscope or with the probe and spectrum analyzer.

Note: When measuring levels with an oscilloscope probe to the spectrum analyzer, some calibration is needed!

1.1. Check 13 MHz signal:

- RXI and RXQ > 0.3 V_{PP} at 12.93 MHz.
- J702 input to 13 MHz filter > 0.5 V_{PP}
- Check RXPWR J705 = 5 ±0.1 V
- Check 8.5 RX TX SW J703 = 7.7 ±0.1 V

1.2. Check 71/13 MHz mixer:

- N701, 71/13 MHz mixer: pin 15 4.8 ±0.2 V
- Enable: pin 21 > 4 V
- AGC5: <0.5 V (<2.5 V in burst)
- Output: J702 2.75 ±0.1 V
- LO: pin 6 >–10 dBm, 232 MHz

1.3. Check 71 MHz signal:

- AGC1 to AGC4 low (AGC4<2.5 V in burst)
- N702: pin1 and pin14 4.8 V ±0.2 V
- Enable: pin 6 >4 V
- Input: pin12, 13 –50 dBm, 71 MHz
- Output: pin 4, 5 –10 dBm, 71 MHz

1.4. Check UHF mixer:

- LO C934: +9 dBm ±3 dB, 1014 MHz
- Signal in C722: –50 dBm, 947.07 MHz (–57 dBm input)
- Signal in C722: –30 dBm, 947.07 MHz (–37 dBm input)
- Signal out C726: –57 dBm, 70.93 MHz

1.5. Check 71 MHz amp:

- Output to filter: –35 dBm, 70.93 MHz

2. AFC (Input –57 dBm, channel 60, 947.06771MHz):

Checks the signal path, the VCXO and some parts of the demodulator. The VCXO is tuned high, mid and low while the frequency deviation is measured.

- 10 kHz < High < 20 kHz
- –5 kHz < Mid < 5 kHz
- –20 kHz < Low < –10 kHz

2.1. Check the VCXO:

After AFC is done, the tuning voltage will stay high.

In other modes the tuning voltage will be in mid.

- Measure at J902: > 3 V_{PP}
- High tuning: freq = 26 MHz +400 Hz ±100 Hz
- Low tuning: freq = 26 MHz –400 Hz ±100 Hz
- Mid tuning: freq = 26 MHz ±50 Hz

2.2. Check burst mode:

Select via PCLocals RF control, Active unit RX, Operation mode burst, Continuous mode channel 60, AGC 93. Input –57 dBm 947.06771 MHz.

AGC is in that mode internally controlled.

Measure with scope ac coupled on RXI and RXQ, the output to RFI. Trig the scope on RXPWR or 8.5RX TX SW or AGC0.

- Signal should be about 30 mV_{PP}, and vary as the AGC operates.
- If not check the signal path and the LO signals as above.

3. Noise and sensitivity:

Checks the overall RX performance, except real demodulation.

Use F2 to measure clipping level and difference between I–Q.

Disconnect or switch off the RF signal from the generator.

Use F3 to measure SNR and Sensitivity.

- Clipping + SNR >50
- SNR > 20
- Sensitivity < –103 dBm
- I–Q < 1 dB
- If not repeat from 1 again.

4. Check camp on to HP8922G/H:

Set HP8922G/H up with neighbors for its own BCCH and some empty and some used channels. In cph use 3, 5, 20 (=own BCCH), 59 and 90.

Use PCLocals F8 to monitor the radio.

- RXlevel within ±2 dB from the BCCH level.
- RXlevel for empty neighbors less than 3.
- Decoding of the information in the used neighbors
- If not OK, the malfunction may be in the RFI and the circuits that control the RFI.

TX Part

1. Check burst output:

Via PCLocals select local mode, RF control, TX mode, Power level 10 (23 dBm), Operation mode burst, Data type random, Continuous mode channel 60, Channel 60, Monitoring channel 1.

Measure with spectrum analyzer on the antenna connector (40 dBm max signal needs an external attenuator), and with scope on the power amps control input pin 2.

– The output burst should have peak amplitude at 23 dBm ±3 dB, and center at 902 MHz.

– If it is OK, check at higher and lower levels, up to level 2 (39 dBm) and down to level 15 (13 dBm).

1.1. Check power tuning:

Via PCLocals select local mode, Power tuning.

– Coefficients from 0.8 at level 2 to about 0.1 at level 15.

– Tolerance of ±0.1 at level 2 to ±0.050 at level 15.

– The control signal should follow the RF amplitude with a maximum of 4 to 6 V at level 2 and 2 to 2.5 V at level 15.

1.2. TX buffer and level regulator:

Via PCLocals select local mode, RF control, TX mode, Power level 10 (23 dBm), Operation mode burst, Data type random, Continuous mode channel 60, Channel 60, Monitoring channel 1.

Measure with spectrum analyzer on the antenna connector (40dBm max signal needs an external attenuator), and with scope on the power amps control input pin 2.

– If control signal goes up and RF does not follow, check with a probe the RF input to the power amp at pin 1. It should be at 3 to 5 dBm.

– Follow the RF signal back to see if it is at the output of the balun T802.

– When measuring before the power amplifier continuous mode is possible.

1.3. Modulator and LO signal generation:

Via PCLocals select local mode, RF control, TX mode, Power level 10 (23 dBm), Operation mode continuous or burst, Data type random, Continuous mode channel 60, Channel 60, Monitoring channel 1.

Measure with oscilloscope probe and spectrum analyzer.

– Output of modulator on T802: –10 dBm ±5 dB.
– Input to the modulator consist of three discrete frequencies, where the wanted is the lowest frequency, and at a level about 15 dB higher than the other two. Absolute level about –10 dBm for the wanted signal.
– Check the LO generating mixer (UHF TX and VHF RX PLL), the amplifier and the filter.
– UHF LO: 5 dBm ±5 dB, 1014 MHz
– VHF RX PLL: –5 dBm ±5 dB, 116 MHz
– Check the modulating input, balanced pairwise for I and Q, about 1 Vpp for every signal, d.c. at 2.4 V.
– Check the power and enable to the modulator.
– Check the UHF and VHF synthesizers.

2. Modulation spectrum:

Select I and Q TUNING in PCLocals. Measure with spectrum analyzer on the antenna connector (up to 40 dBm output!). Span 0.2 MHz, resolution BW 10 kHz, video 10 kHz, sweep time 0.5 sec.

– Relative to the mainslope the signal at +67 kHz should be more than 30 dB down, and the signal at +135 kHz should be more than 50 dB down.
– If not tune the offset values, I and Q d.c. offset to change the signal at +67 kHz, phase and amplitude offset to change the signal at +135 kHz.

UHF Synthesizer

Via PCLocals select local mode, RF control, TX mode, Power level 10 (23 dBm), Operation mode burst, Data type random, Continuous mode channel 60, Channel 60, Monitoring channel 1. The synthesizer will switch between channel 60 and channel 1.

- Freq. ch 1 = 1006.2 MHz, ch 124 = 1039.8 MHz.
- Measure with probe and scope on J904 to see the tuning voltage. It should switch between 1 and 2 volt. Select channel 124 and it should switch between 1 and 4.5 volt.
- J902, 26MHz ref: 26 MHz, >2 V_{PP}
- Measure at the collector of V904 (UHF TX) and of V906 (LO UHF) to see that they alternately are on.
- With a probe connected to the spectrum analyzer, check the RF signals. The level when they are active should be about 6 dBm.

VHF Synthesizer

Via PCLocals select local mode, RF control, TX mode, Power level 10 (23 dBm), Operation mode burst, Data type random, Continuous mode channel 60, Channel 60, Monitoring channel 1.

- Freq. all channels = 232 MHz. The prescaler is placed in V701 and divides the frequency with 2.
- Check the tuning voltage at J903, 3 ±1.5 V, and check that it moves when a finger is placed at the oscillator.
- J902, 26 MHz ref: 26 MHz, >2 V_{PP}
- Check the supply at V902 or C903, 5 V.
- Output level at C914/R911 should be –10 dBm.

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