Customer Care Solutions
NHL-4J Series Transceivers

Troubleshooting Instructions

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RF Troubleshooting

Introduction to RF troubleshooting

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

The RF-section is build around one RF-ASIC (HELGA N500). For easier troubleshooting, this RF troubleshooting document is divided in to sections.

Before changing HELGA, please check following things: Supply voltages are OK and serial communication coming from baseband to HELGA.

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

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

Please be aware that all measured voltages or RF levels in this document are rough figures. Especially RF levels varies due to different measuring equipment or different grounding of the used probe. When using RF probe usually a good way is to use metallic tweezers to connect probe ground to PWB ground as close to measurement point as possible.

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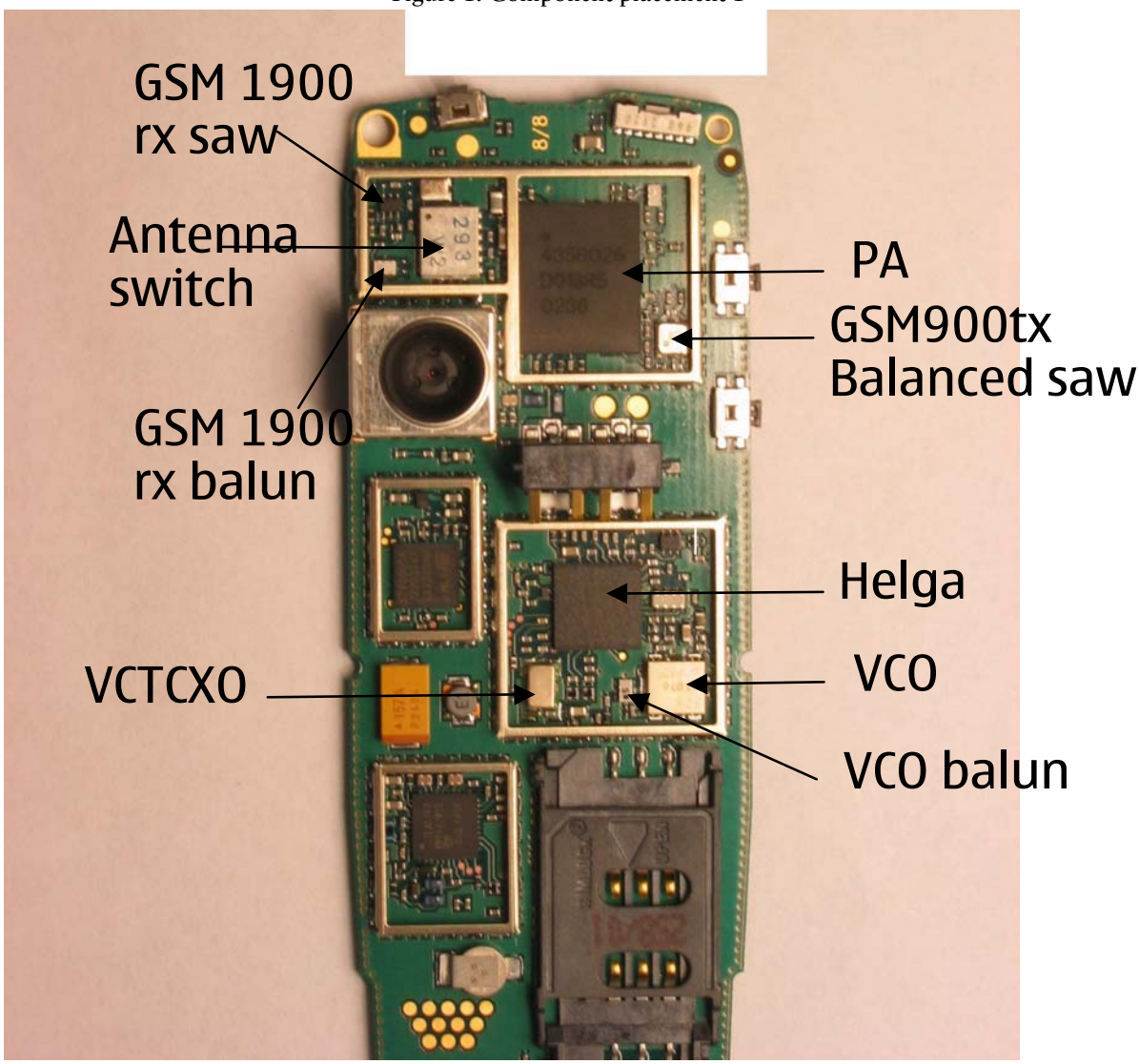
RF Key component placement

Figure 1: Component placement 1



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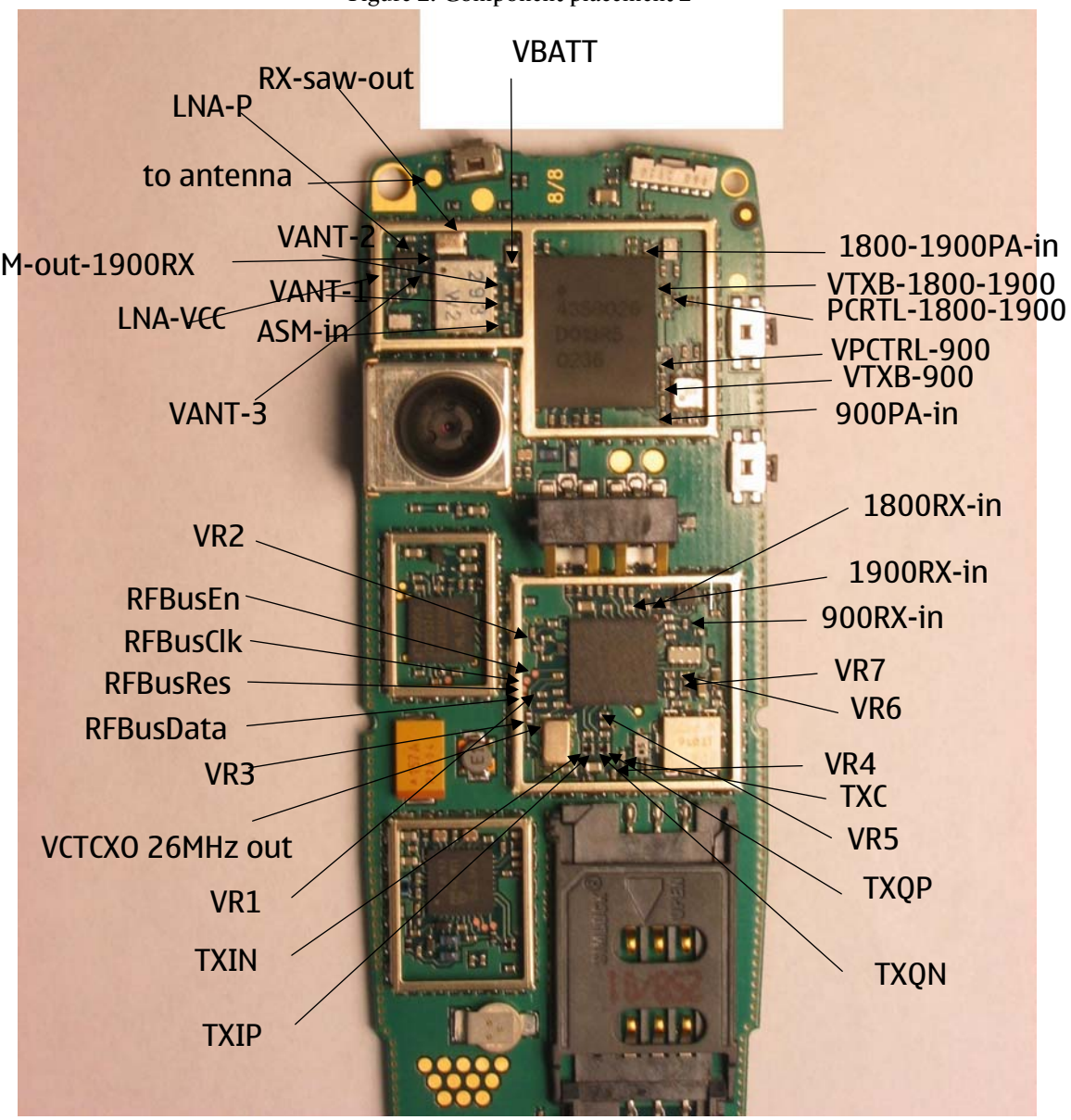
RF Measurement points

Figure 2: Component placement 2



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GSM900 & GSM1800 Transmitter

General instructions for Tx troubleshooting

Kindly refer to the Service Software Section, Service Concept dagram (p.40)

Connect test jig to computer with DAU-9S cable or to FPS-8 Flash Prommer with XCS-4 modular cable.

Make sure that you have PKD-1 dongle connected to computers parallel port.

Connect DC power supply to module test jig with FLC-2 cable.

Attention: When repairing or tuning transmitter use external DC supply with at least 3A current capability. Set the DC supply voltage to 3.9V and set the jumper connector on test jig to "bypass" position.

Connect a RF-cable to the module test jig (MJS-38) RF connector to and to measurement equipment or at least 10dB attenuator, otherfwise the PA may be damaged. Normally Spectrum analyzer is used as measurement equipment.

Attention: Normally Spectrum analyzer maximum input power is +30dBm. It is recommended to use 10dB attenuator on Spectrum analyzer input to prevent damage.

Set the phone module to test jig and start Phoenix service sofware

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8)

Select product from the menu

File -> Choose product -> NHL-4

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window

- Select band "GSM900" or "GSM 1800" or "GSM1900" (Default = "GSM900")

- Set Active unit to "Tx" (Default = "Rx")

- Set Operation mode to "Burst" (Default = "Burst")

- Set Tx data type to "Random" (Default = "All1")

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- Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults)

- Set Tx PA mode to "Free" (Default)

- Set power level to 5 (Default = 19) on GSM900 or to 0 (Default = 15) on GSM1800 or GSM1900

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Transmitter troubleshooting diagram

Figure 3: Transmitter troubleshooting

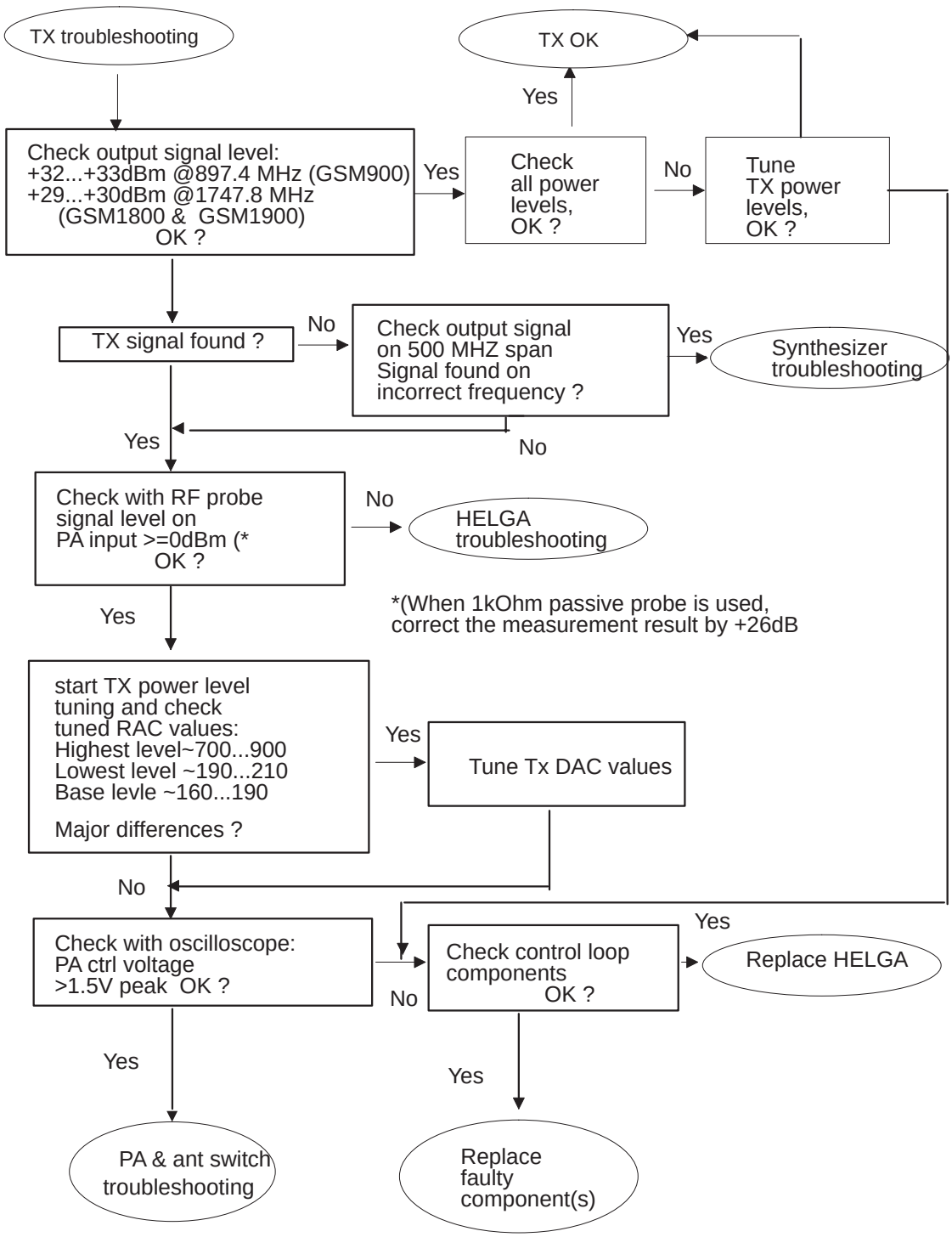


Figure 4: HELGA IC troubleshooting

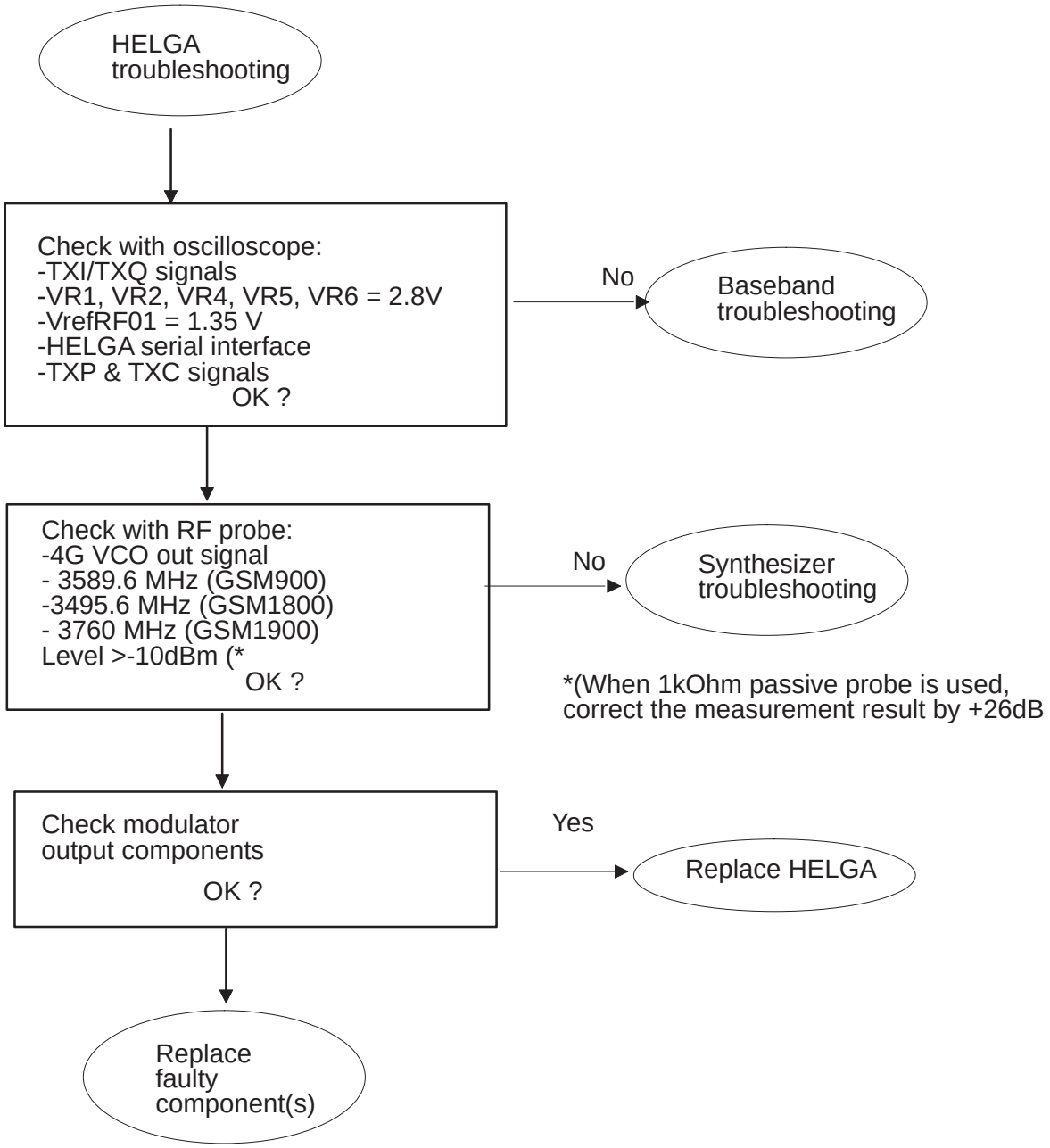
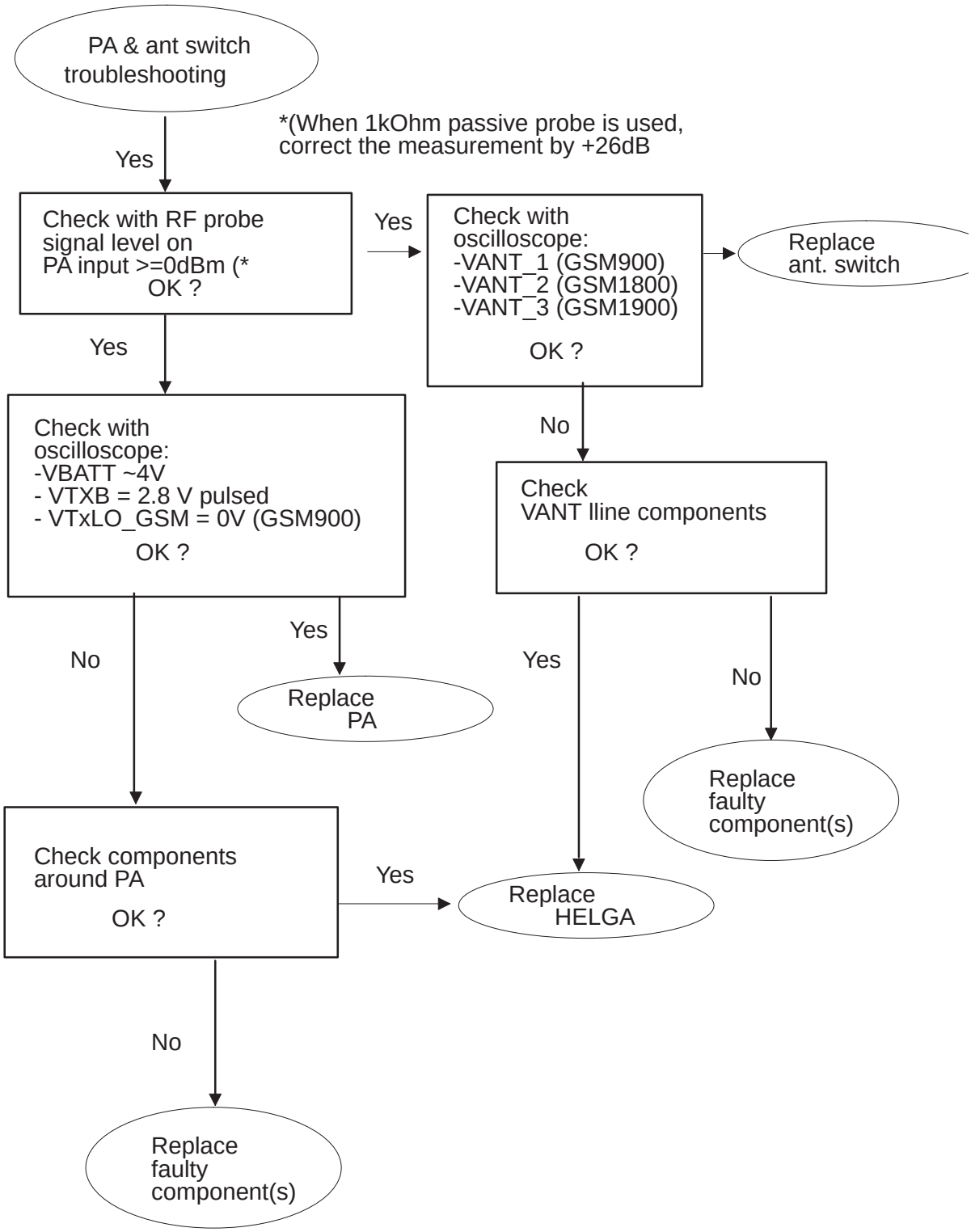
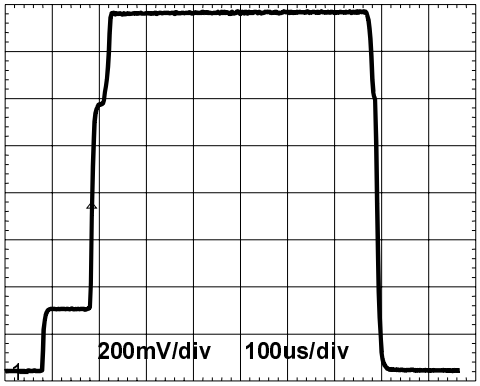


Figure 5: PA and Antenna Switch troubleshooting

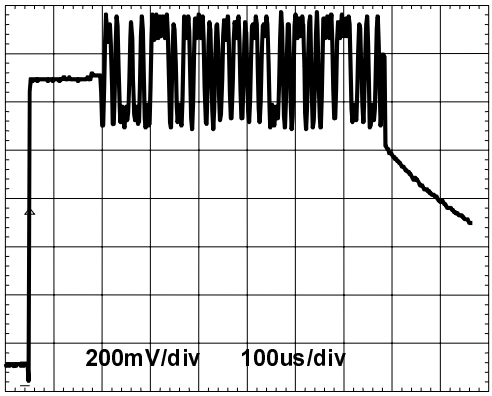


Pictures of transmitter signals

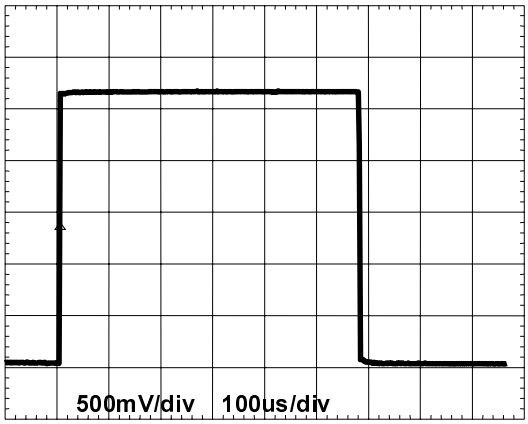
Figure 6: Transmitter signals



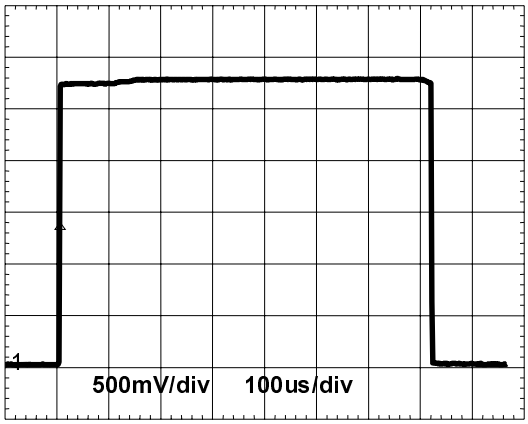
VPCTRL _900 power level high at R703/C703
VPCTRL_1800/1900 power level high at R704/C704_



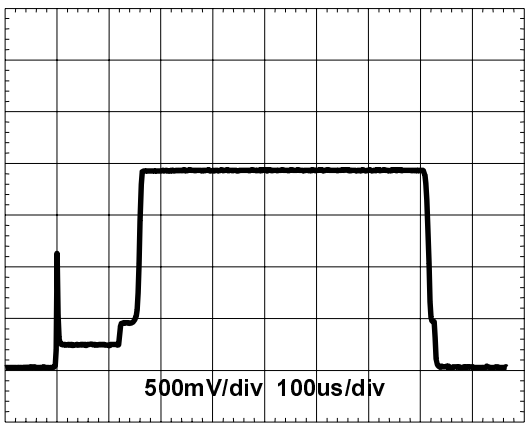
TX I/Q at R516/517 power level high Random data



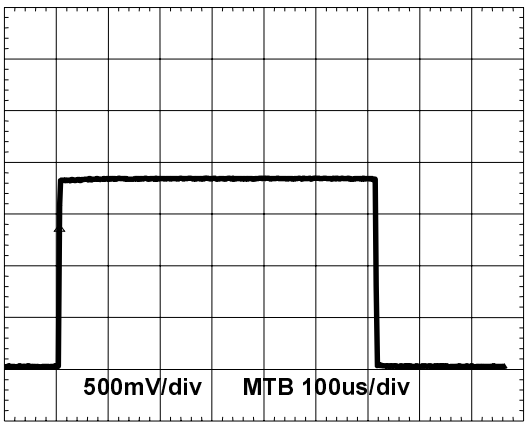
VANT_1 / GSM900 TX at C804
VANT_2 / GSM1800 TX at R808
VANT_3 / GSM1900 TX at C805 OV
(no signal/ Flatline on Oscilloscope screen)



VANT_1,VANT_2,VANT_3



VTXB_900 at C713
VTXB_1800_1900 at C714



TXP at J504

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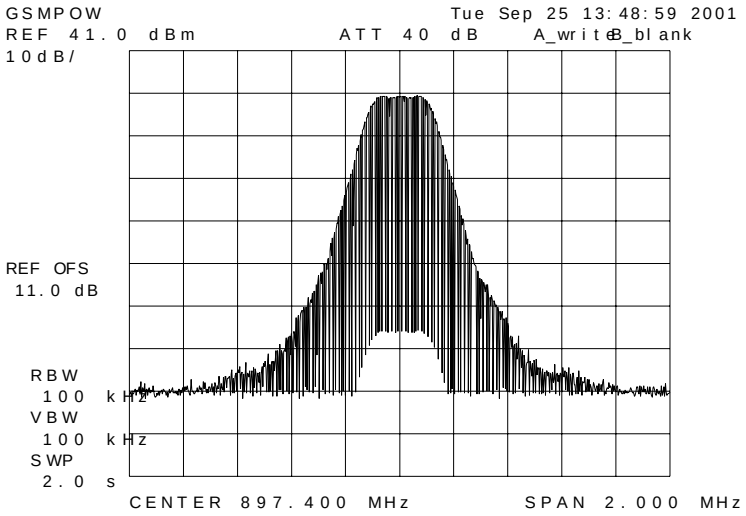
Figure 7: TX OUT signal



Tx out signal, 900 band, burst mode, channel 37

GSM900, GSM1800 and GSM1900 Receiver

General instructions for Rx troubleshooting

Connect test jig to computer with DAU-9S cable or to FPS-8 Flash Prommer with XCS-4 modular cable.

Make sure that you have PKD-1 dongle connected to computers parallel port.

Connect DC power supply to module test jig with FLC-2 cable.

Set the DC supply voltage to 6V (test jig has internal voltage regulator of output voltage 4V).

Connect an RF-cable to the module test jig (MJS-38) RF connector and to RF signal generator.

Set the phone module to test jig and start Phoenix service sofware.

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8)

Choose product from the menu

File -> Choose product -> NHL-4

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window:

- Select band "GSM900", "GSM 1800" or "GSM1900" (Default = "GSM900")

- Set Active unit to "Rx" (Default = "Rx")

- Set Operation mode to "Burst" (Default = "Burst")

For continuous mode:

- Set Operation mode to "Continuous"

- Set AGC to "12: FEG_ON + DTOS_ON + BB_30=Vgain60" (maximum gain setting used in normal mode)

(Default = "14: FEG_ON + DTOS_ON + BB_42=Vgain72")

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- Set Rx/Tx channel to 37 on GSM900 band, 700 on GSM1800 band or 661 on GSM1900 (Defaults)

Apply 942.46771 MHz (channel 37 + 67.710 kHz offset), 1842.86771 MHz (channel 700 + 67.710 kHz offset) or 1960.06771 MHz (channel 661 + 67.71 kHz) –90 dBm signal to the RF-connector (remember to compensate for cable attenuation).

Measuring with an oscilloscope on "RXI" or "RXQ" following screens should be seen on a working GSM900 , GSM1800 or GSM1900 receiver:

Figure 8: RX I/Q signal ,burst mode, input level –90dBm.

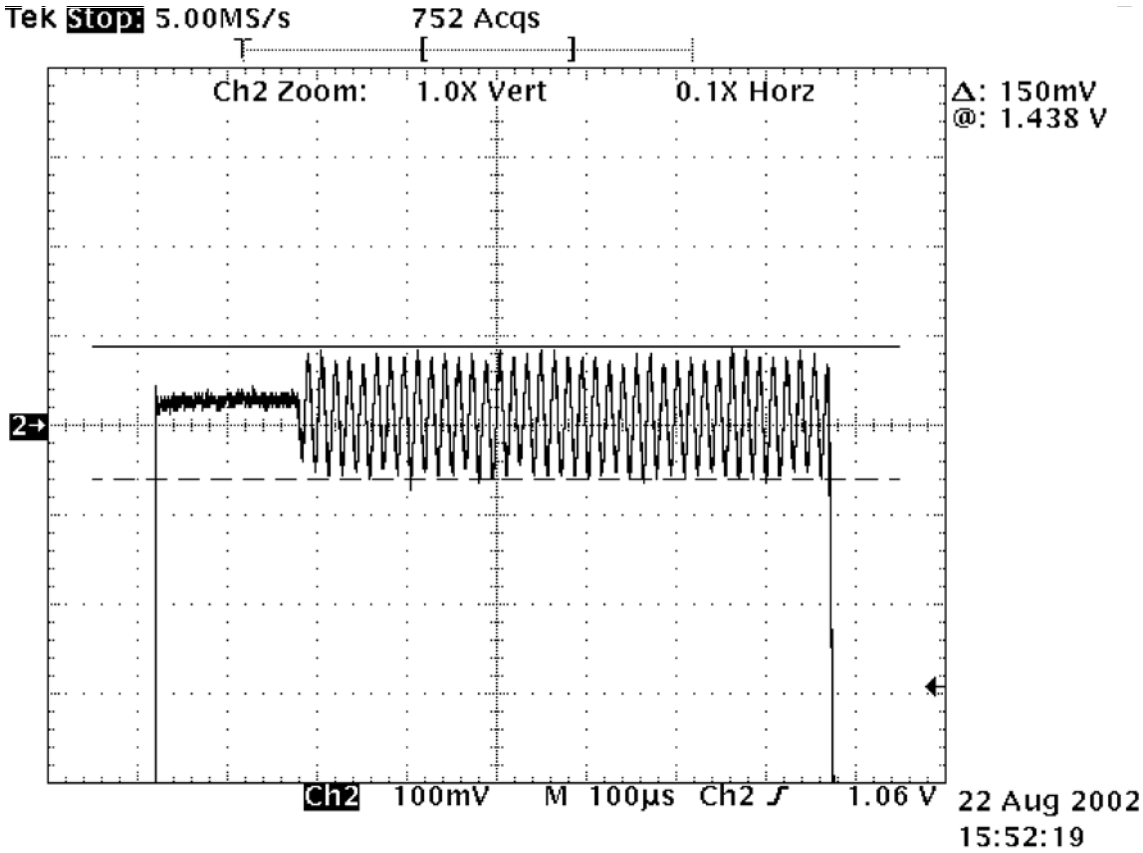


Figure 8, "RX I/Q signal ,burst mode, input level –90dBm.," on page 15: Receiver I or Q burst mode signal (channel 37) measured from testpoint RXI or RXQ with 942.467 MHz signal, input level –90dBm at RF-connector.

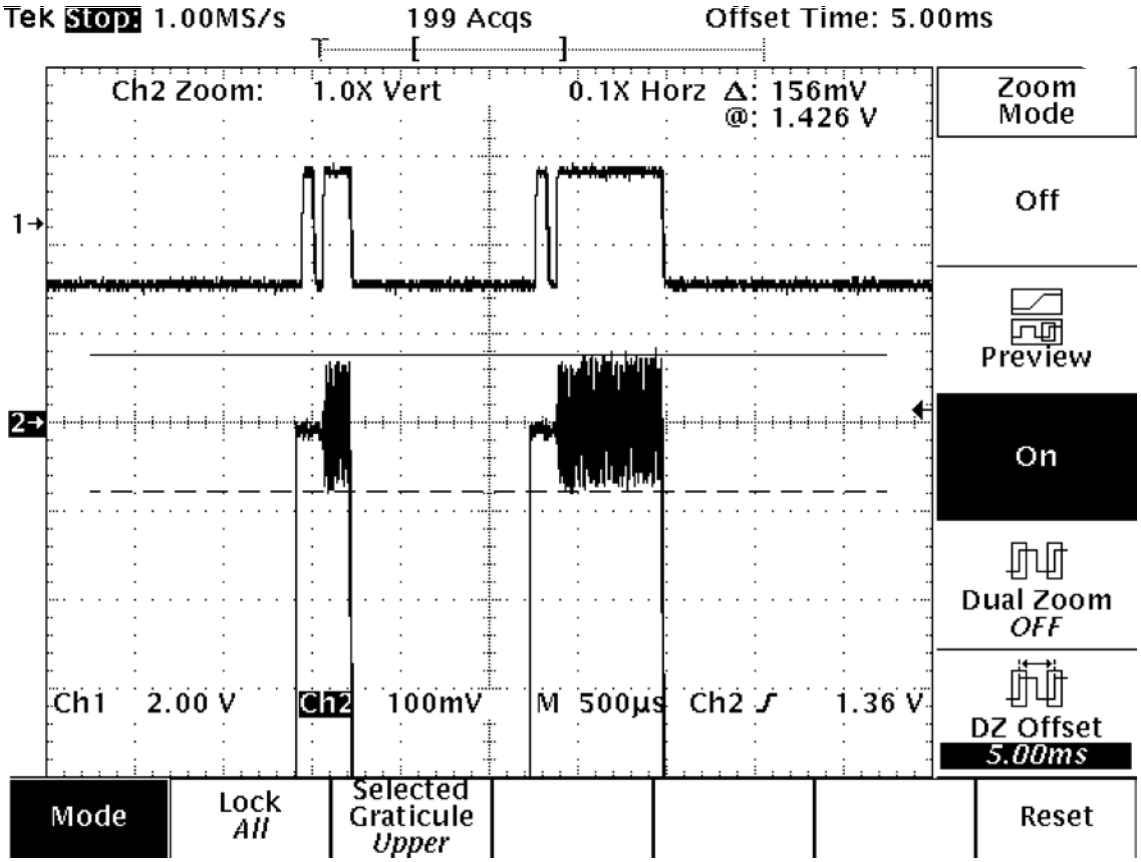
Correct signal amplitudes approximately:

- GSM900~170mVpp
- GSM1800~140mVpp
- GSM1900~160mVpp

Signal part frequency 67.7kHz sine.

DC level of signal part is 1.35V. DC level can variate about +/-100mV between I and Q signals and between different bands as well.

Figure 9: GSM1900 RX I or Q signal (trace2), burst mode.



For Figure 9, "GSM1900 RX I or Q signal (trace2), burst mode.," on page 16 GSM1900 receiver burst mode I or Q signal at ch 661 with input signal 1960.067MHz, level –90 dBm at RF-connector.

Trace2: With wider time scaling both monitoring and own RX bursts are seen, 1st burst (shorter) is monitoring and 2nd burst (longer) is own RX burst.

Trace1: External LNA VCC supply voltage at burst mode, input level –90 dBm. Measured from testpoint LNA_VCC.

Figure 10: RX I&Q, phase difference 90 deg between signals.

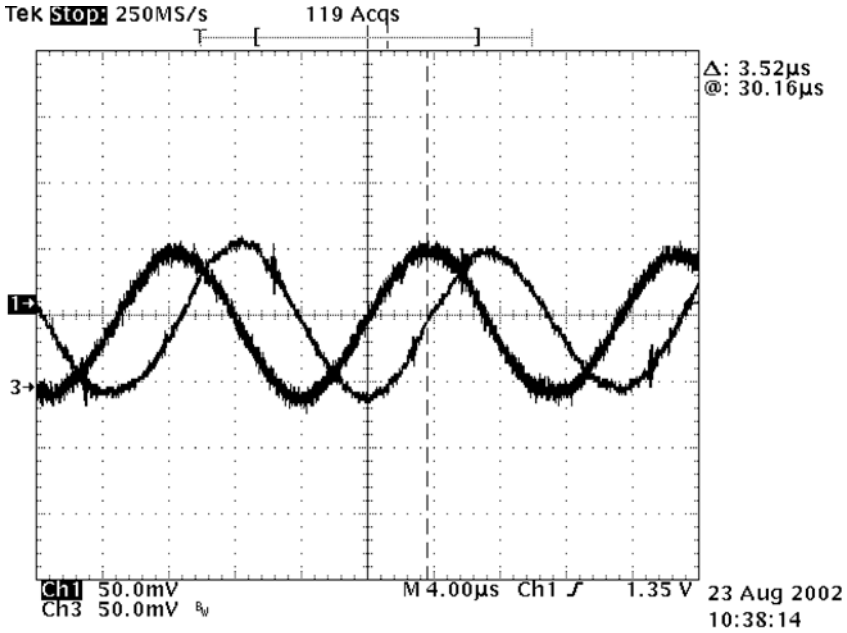


Figure 10, "RX I&Q, phase difference 90 deg between signals.," on page 17:

Detailed view of GSM900 continuous mode RX I and Q signals measured from testpoints RXI and RXQ simultaneously.

Used channel 37, input signal 942.467 MHz, level –90 dBm at antenna port, AGC setting 12.

Phase difference should be 90 degrees between RX I and Q signals at all bands.

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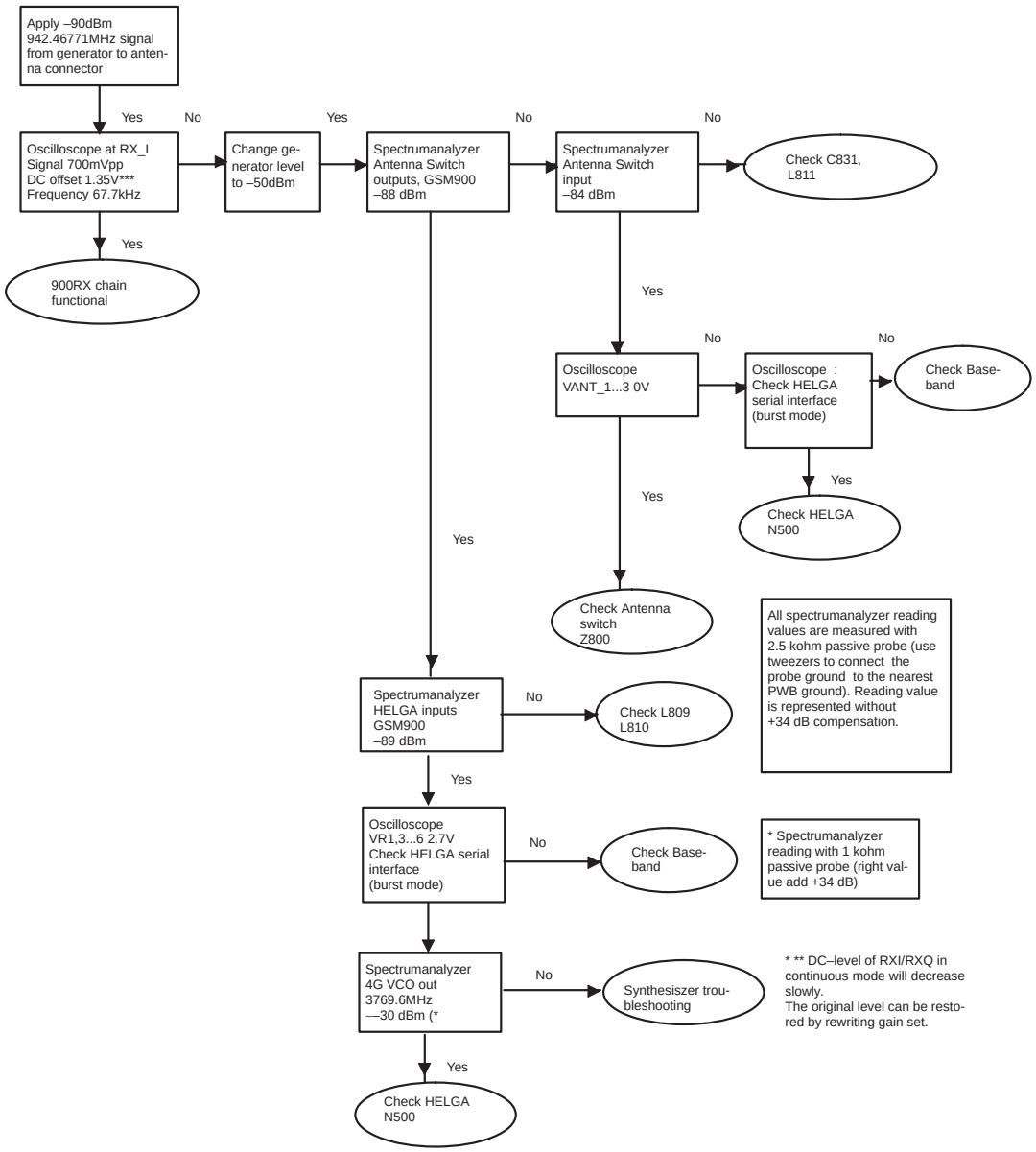
Troubleshooting diagram for GSM900 receiver

Phone in "Continuous" mode, AGC setting "12"

Figure 11: GSM900 receiver troubleshooting



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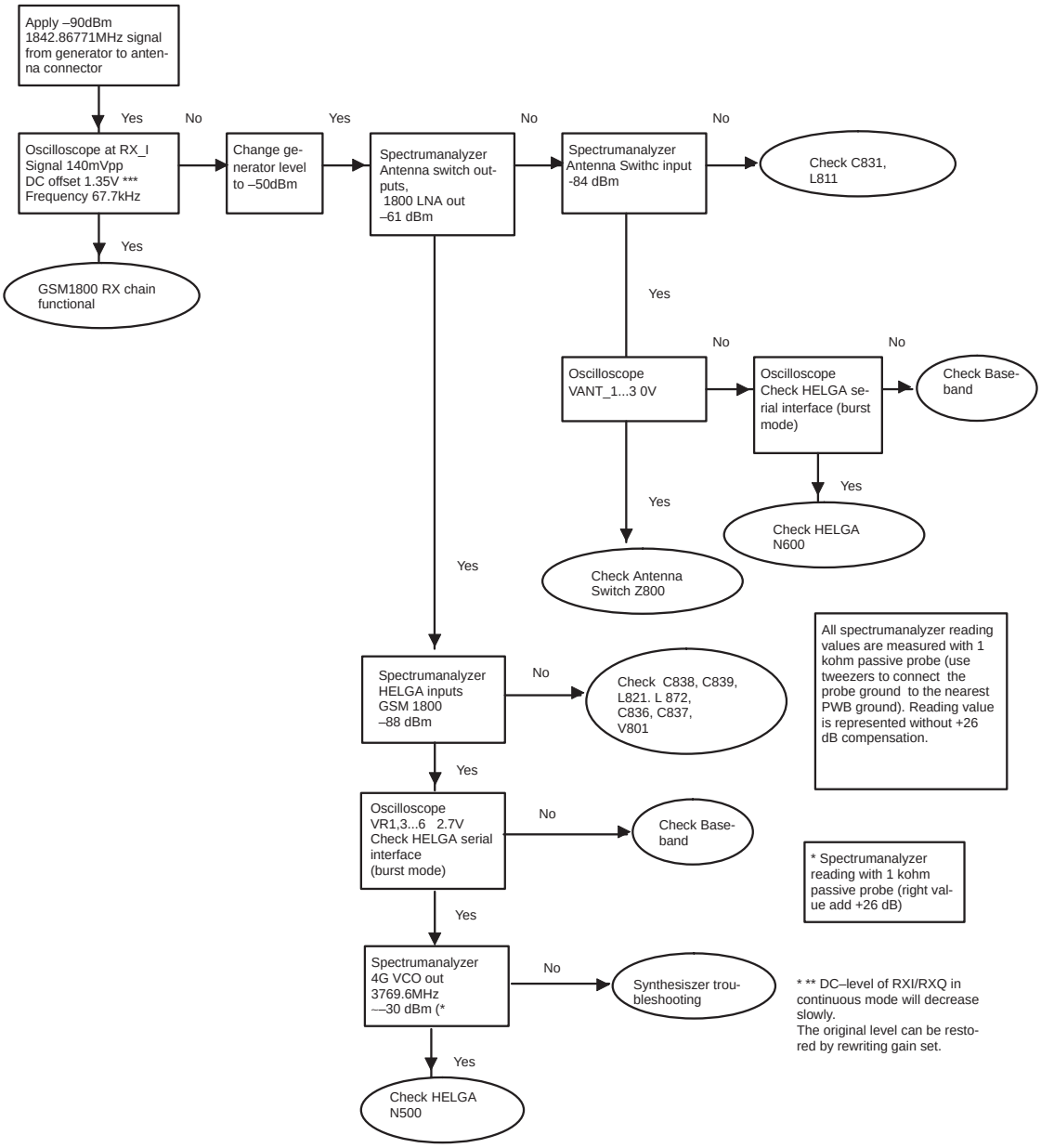
Troubleshooting diagram for GSM1800 receiver

Phone in "Continuous" mode, AGC setting "12

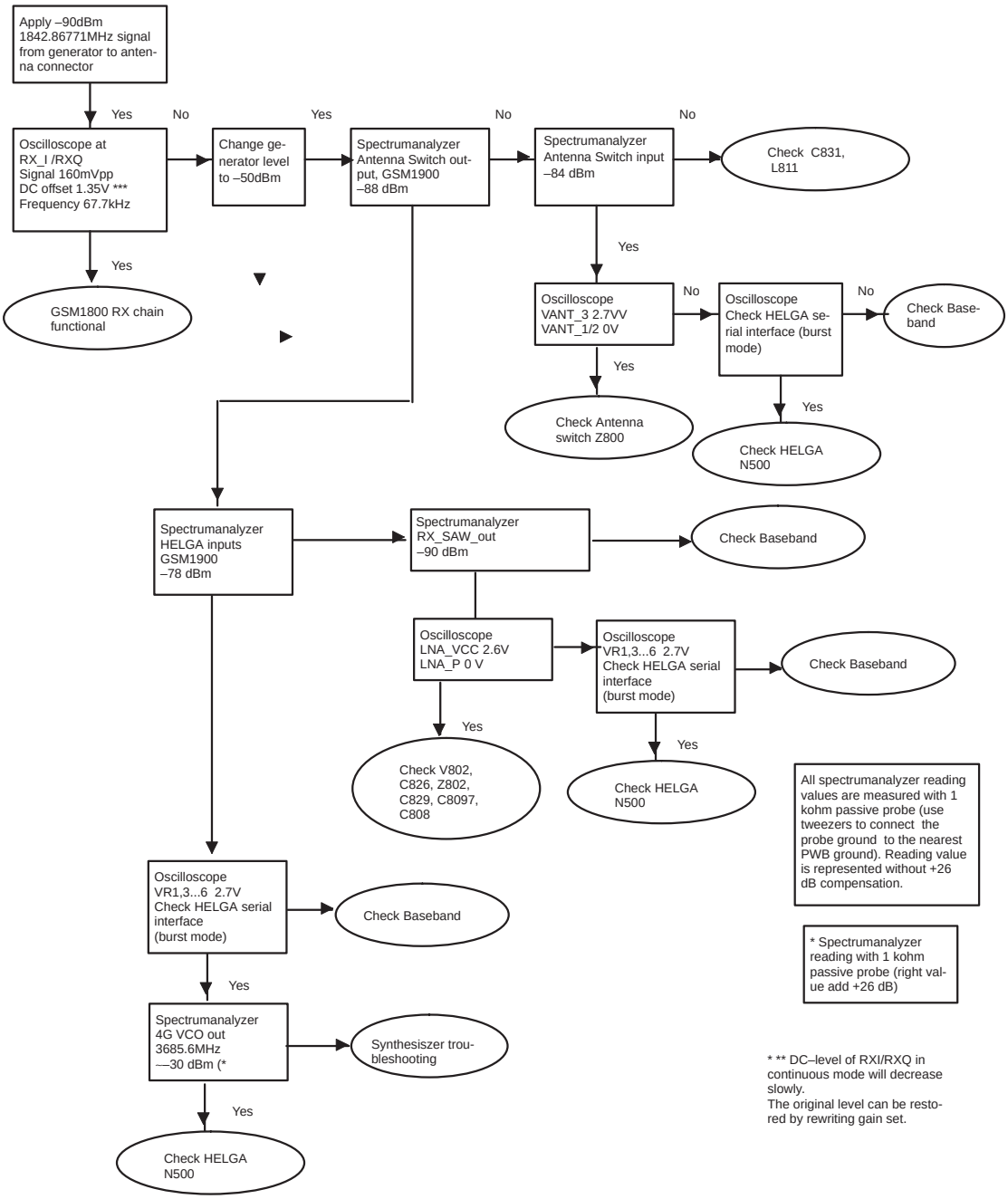
Figure 12: GSM1800 receiver troubleshooting



Troubleshooting diagram for GSM1900 receiver

Phone in "Continuous" mode, AGC setting "12

Figure 13: GSM1900 receiver troubleshooting



Synthesizer

General instructions for synthesizer troubleshooting

Connect test jig to computer with DAU9S cable or to FPS-8 Flash Prommer with XCS-4 modular cable.

Make sure that you have PKD-1 dongle connected to computers parallel port.

Connect DC power supply or FPS-8 to module test jig with PCS-1 cable.

Set the DC supply voltage to 3.9V and set the jumper connector on test jig to "bypass" position.

Set the phone module to test jig and start Phoenix service sofware

Initialize connection to phone. (use FBUS driver when using DAU9S and COMBOX driver when using FPS-8)

Select product from the menu

File -> Choose product -> NHL-4

From toolbar set operating mode to "Local"

Activate RF controls window from the menu

Maintenance -> Testing -> RF Controls

From the RF controls window

- Select band "GSM900", "GSM 1800" or "GSM1900" (Default = "GSM900")

- Set Active unit to "Rx" (Default = "Rx")

- Set Operation mode to "Continuous" (Default = "Burst")

- Set Rx/Tx channel to 37 on GSM900 band, 700 on GSM1800 band, 661 on GSM1900 band (Defaults)

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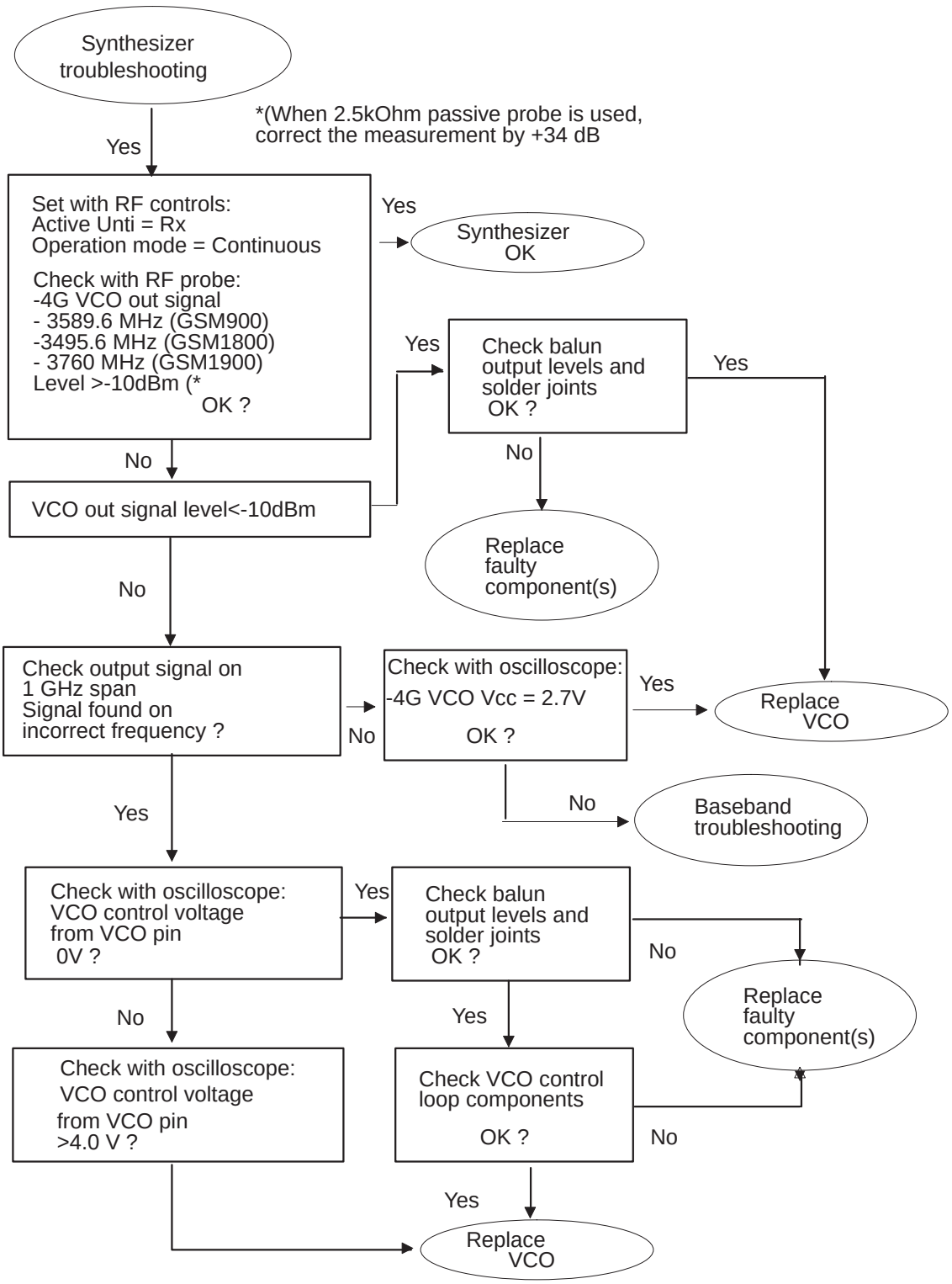
Synthesizer troubleshooting diagram

Figure 14:



Pictures of synthesizer signals

Figure 15: 26MHz at G501 pin out

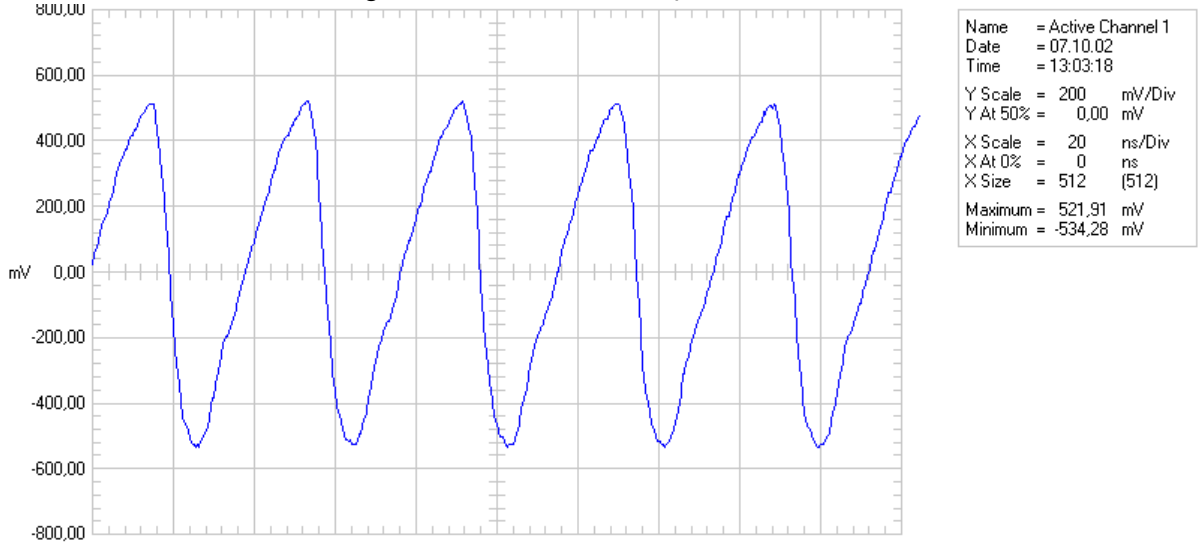


Figure 16: 26MHz RFCLK at R420/C420

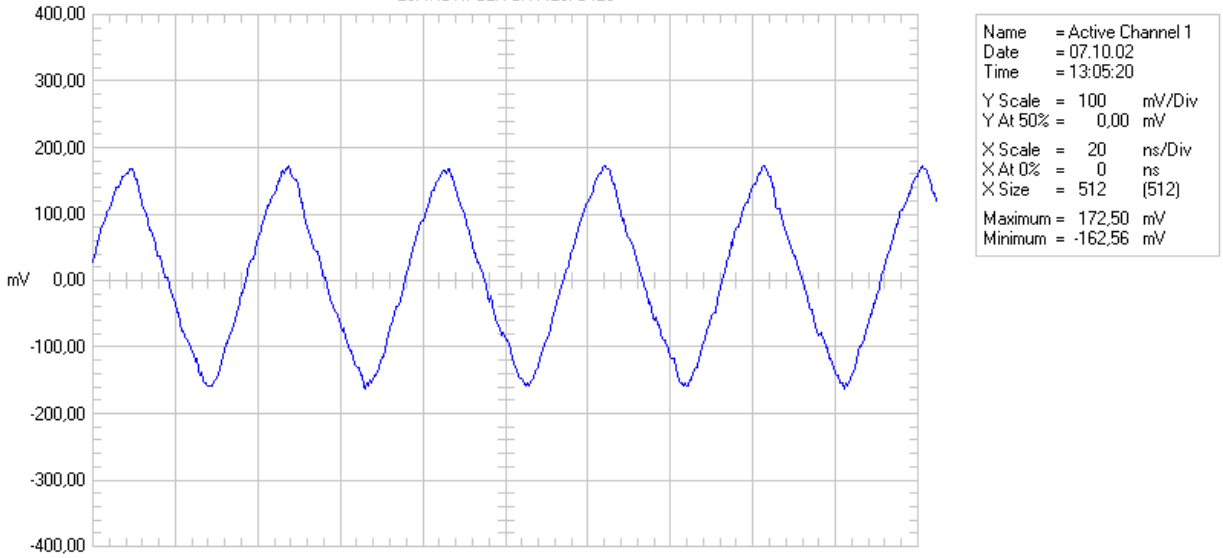


Figure 17: 1800 TX, channel 512, burst mode

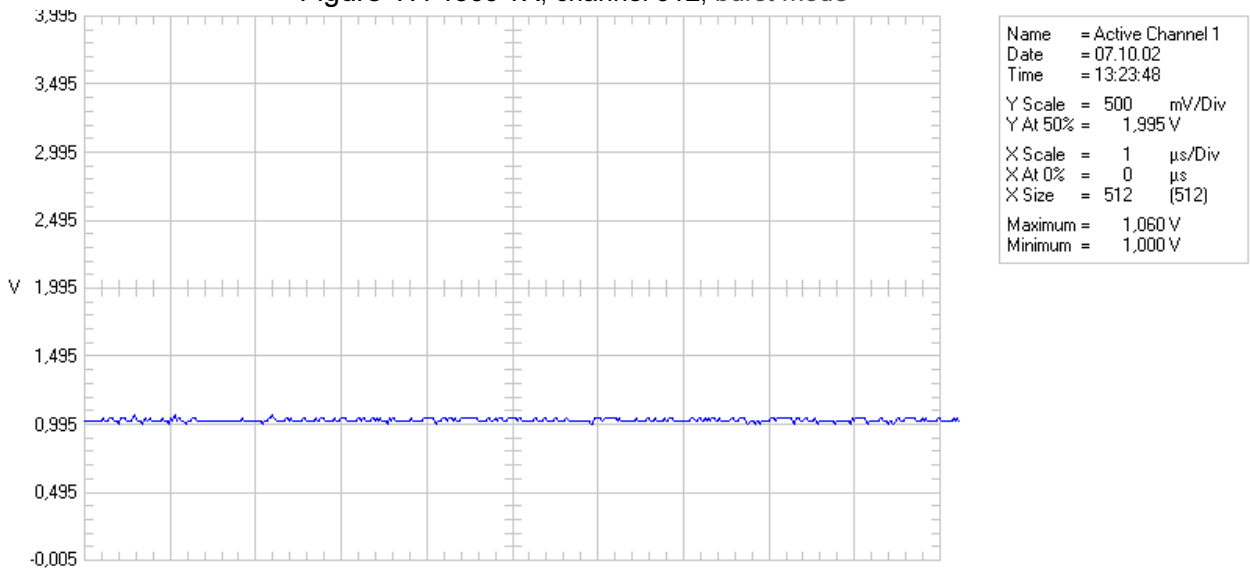


Figure 18: 1900 RX, channel 810, continuous mode

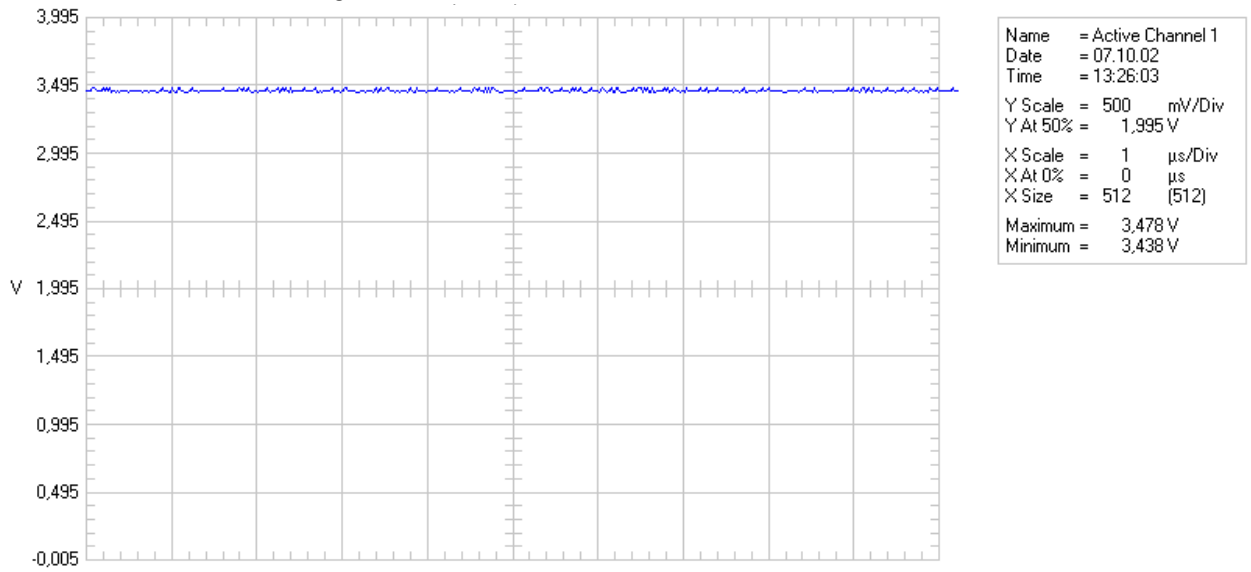
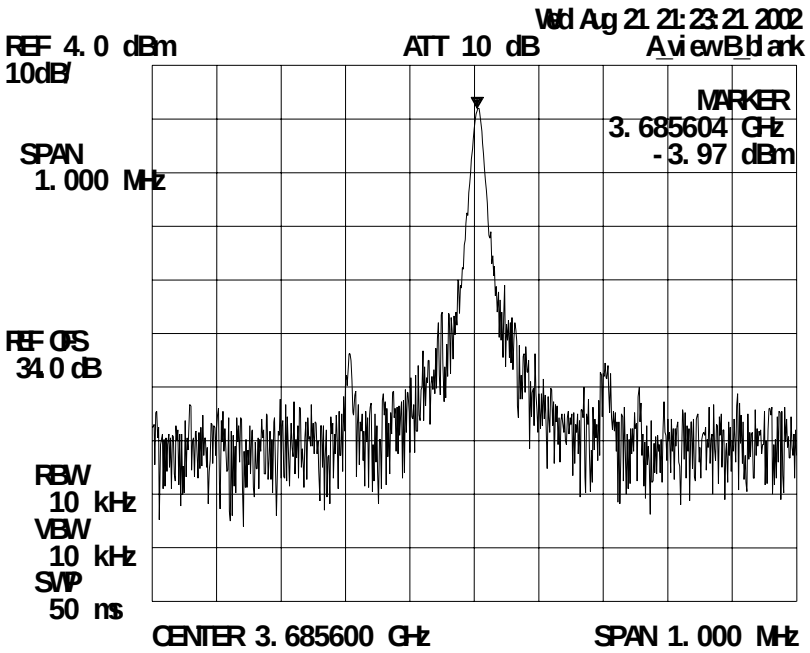


Figure 19: VCO output, 1800 band, RX on, continuous output



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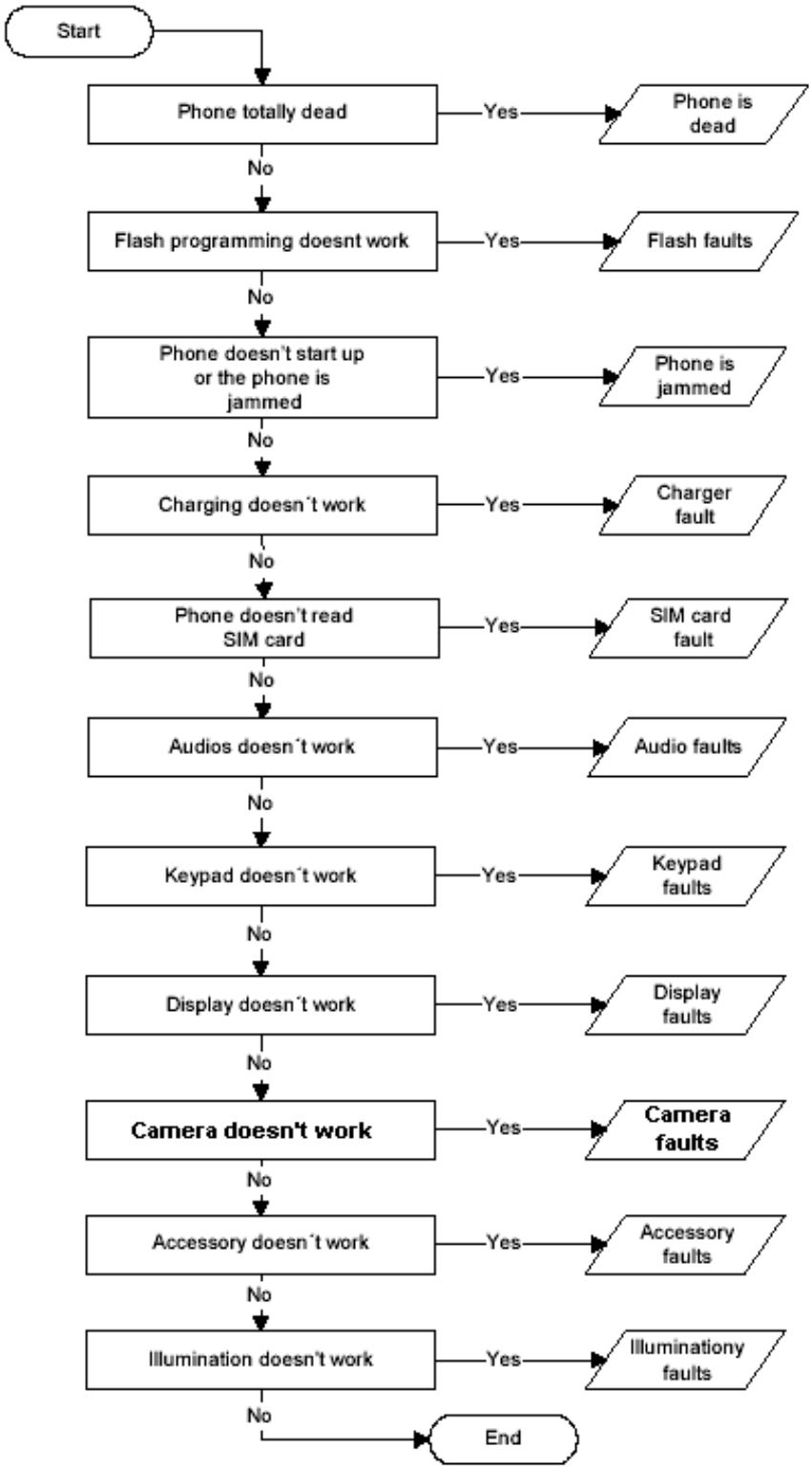
Baseband troubleshooting

The following diagrams describe baseband troubleshooting.

Main Troubleshooting Diagram

Figure 20: Baseband general troubleshooting



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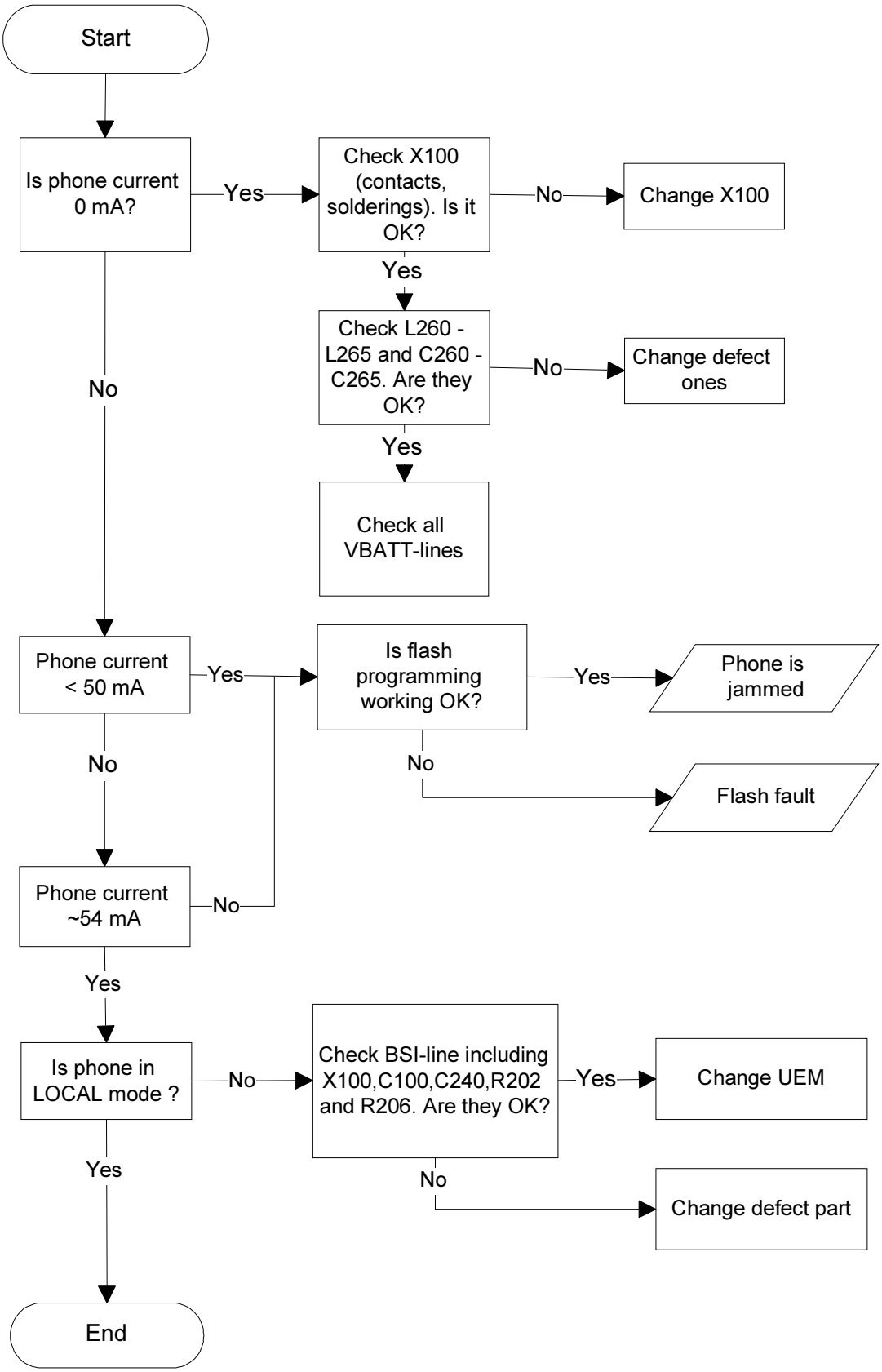
Phone is dead

Figure 21: Dead phone troubleshooting



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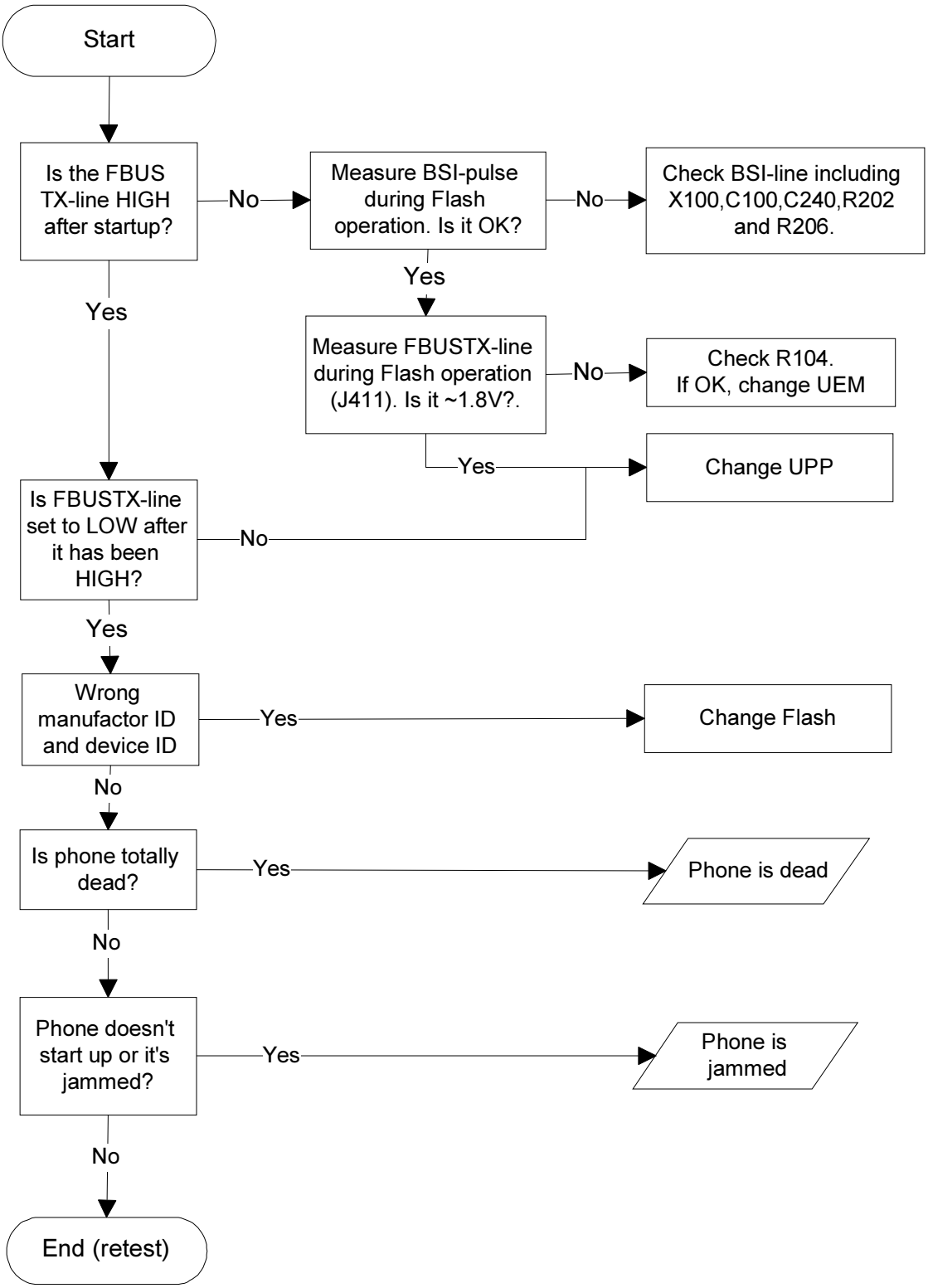
Flash Programming Fault

Figure 22: Flash programming troubleshooting



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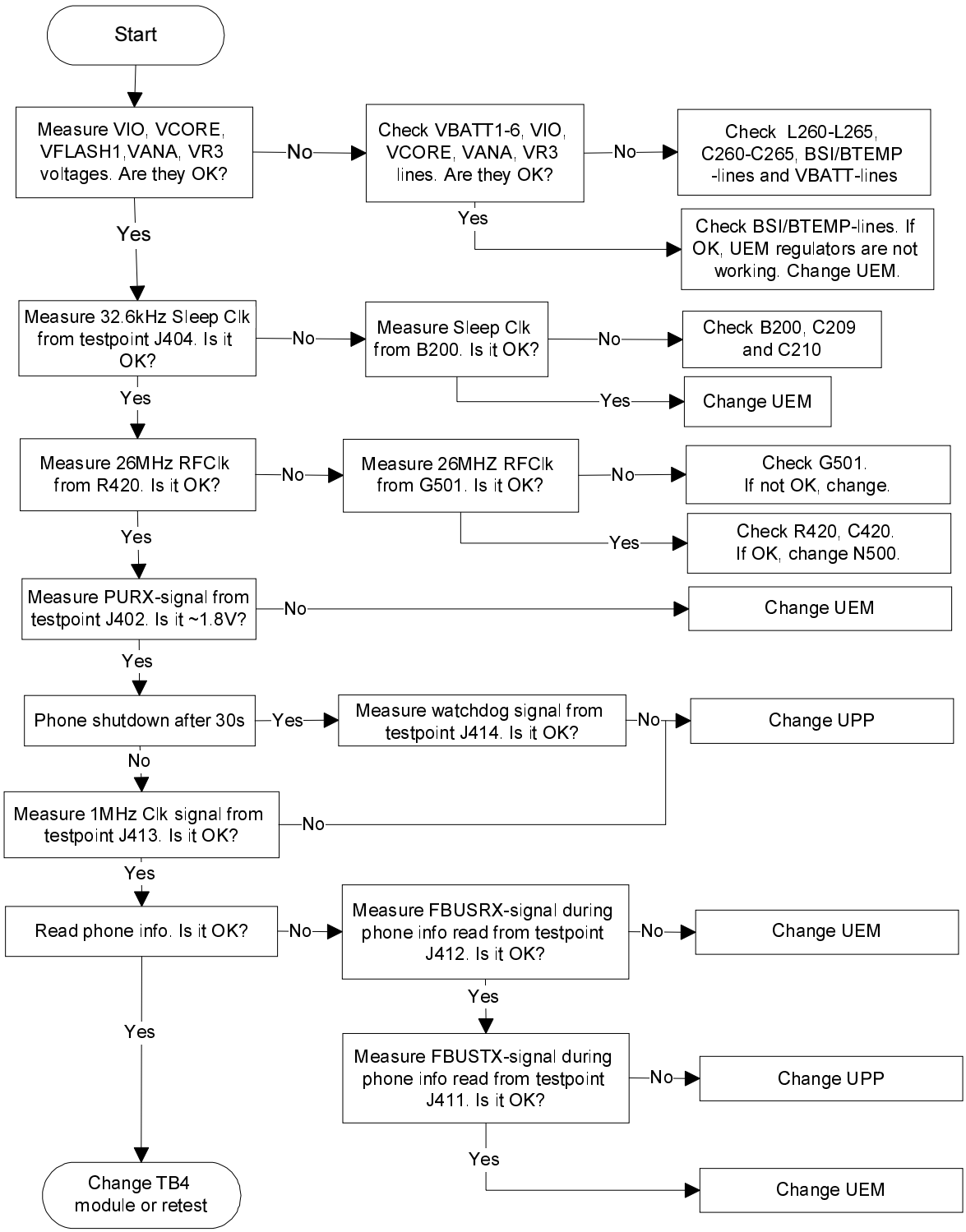
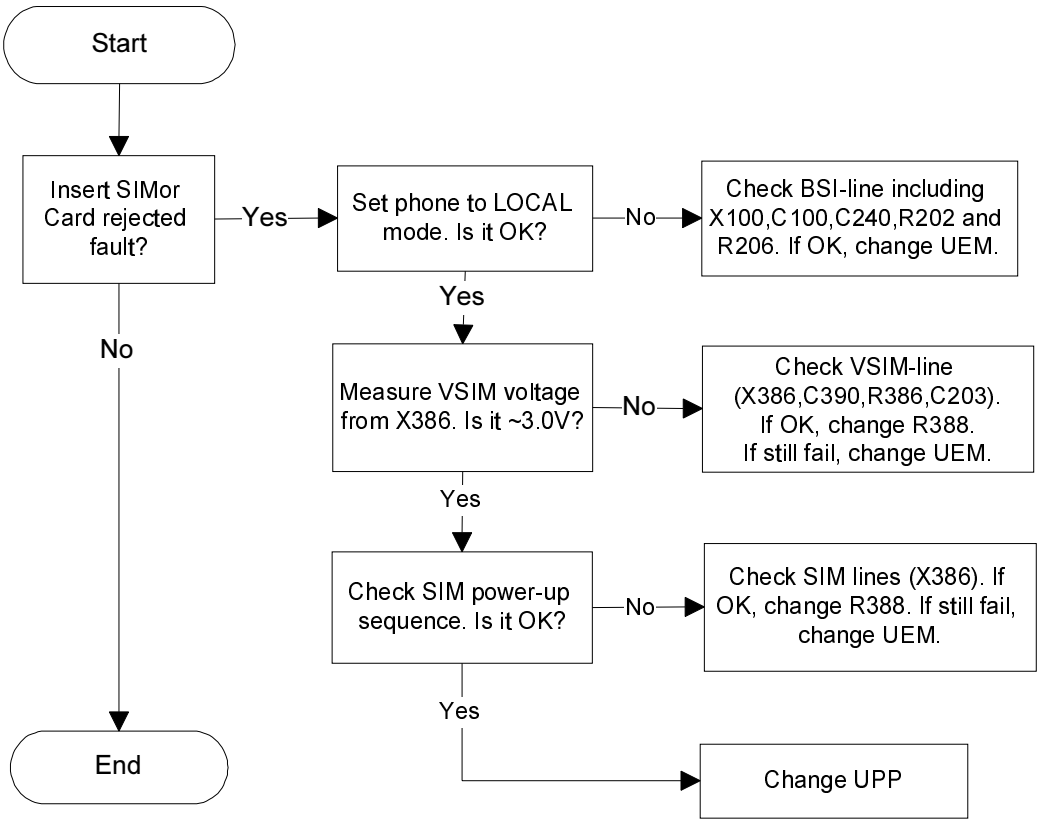
Phone is jammed

Figure 23: Jammed phone troubleshooting



SIM card fault (Insert SIM / Card rejected)

Figure 24: SIM card troubleshooting



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Keypad Fault

Figure 25: Keypad troubleshooting 1

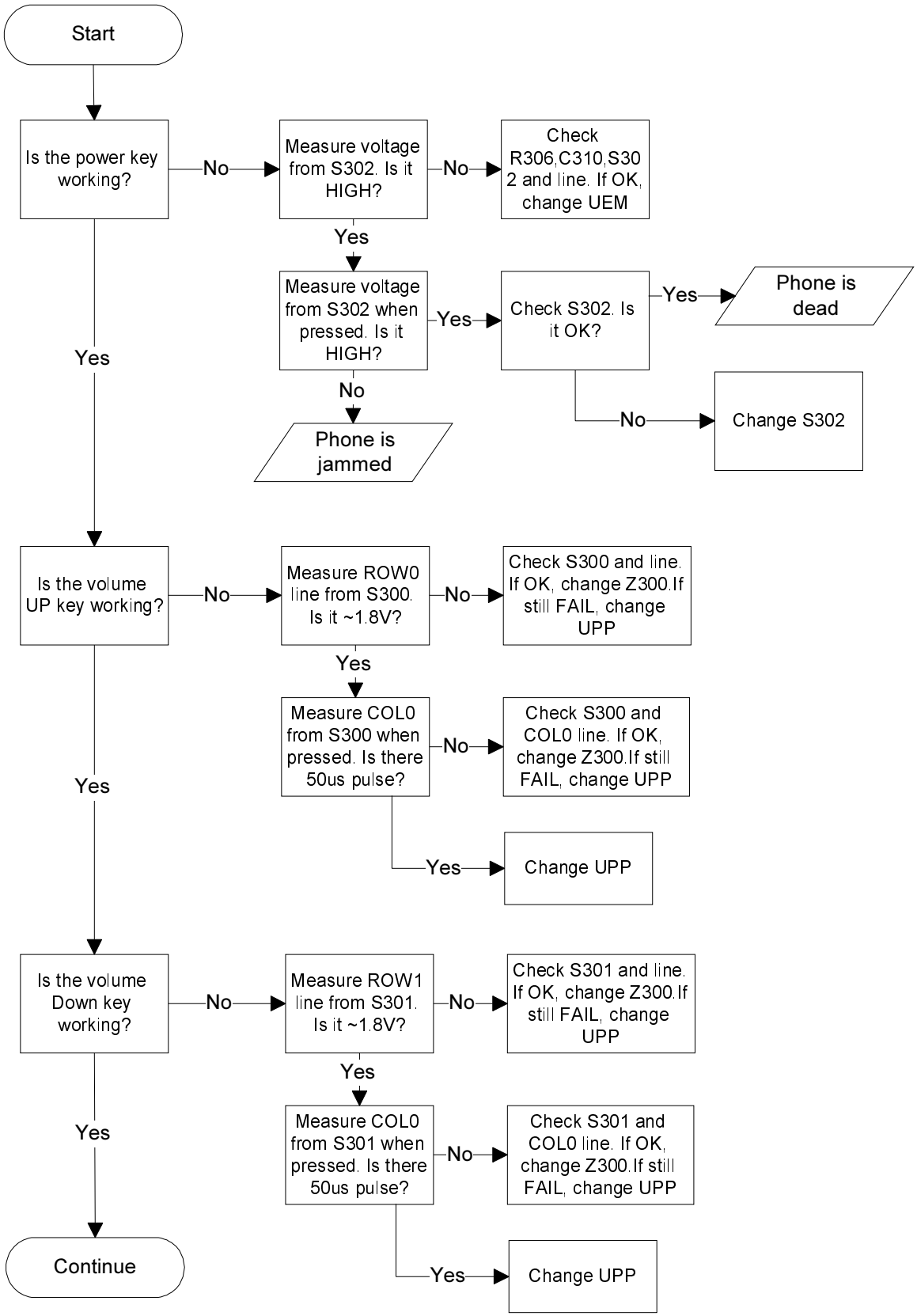
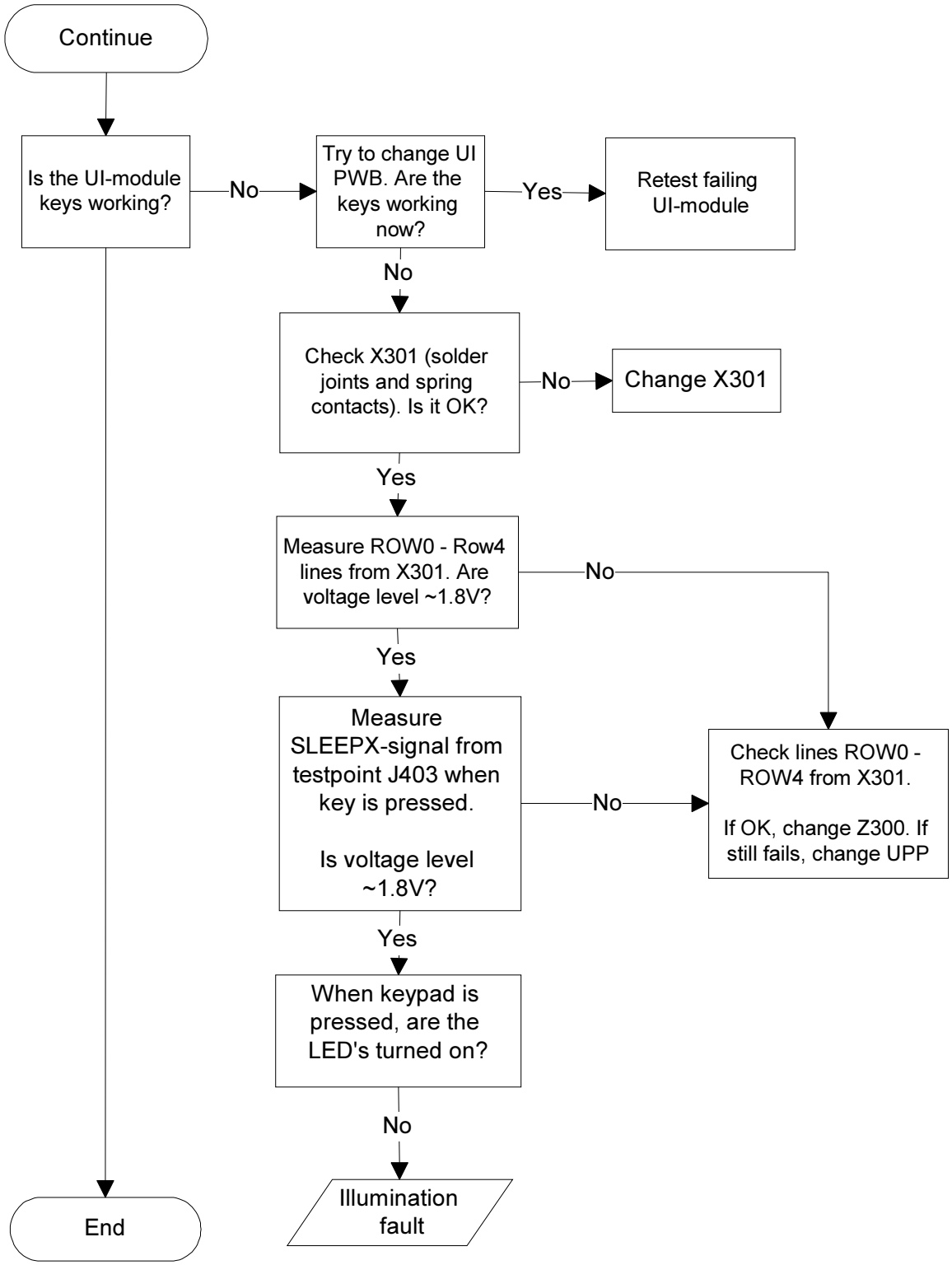


Figure 26: Keypad troubleshooting 2



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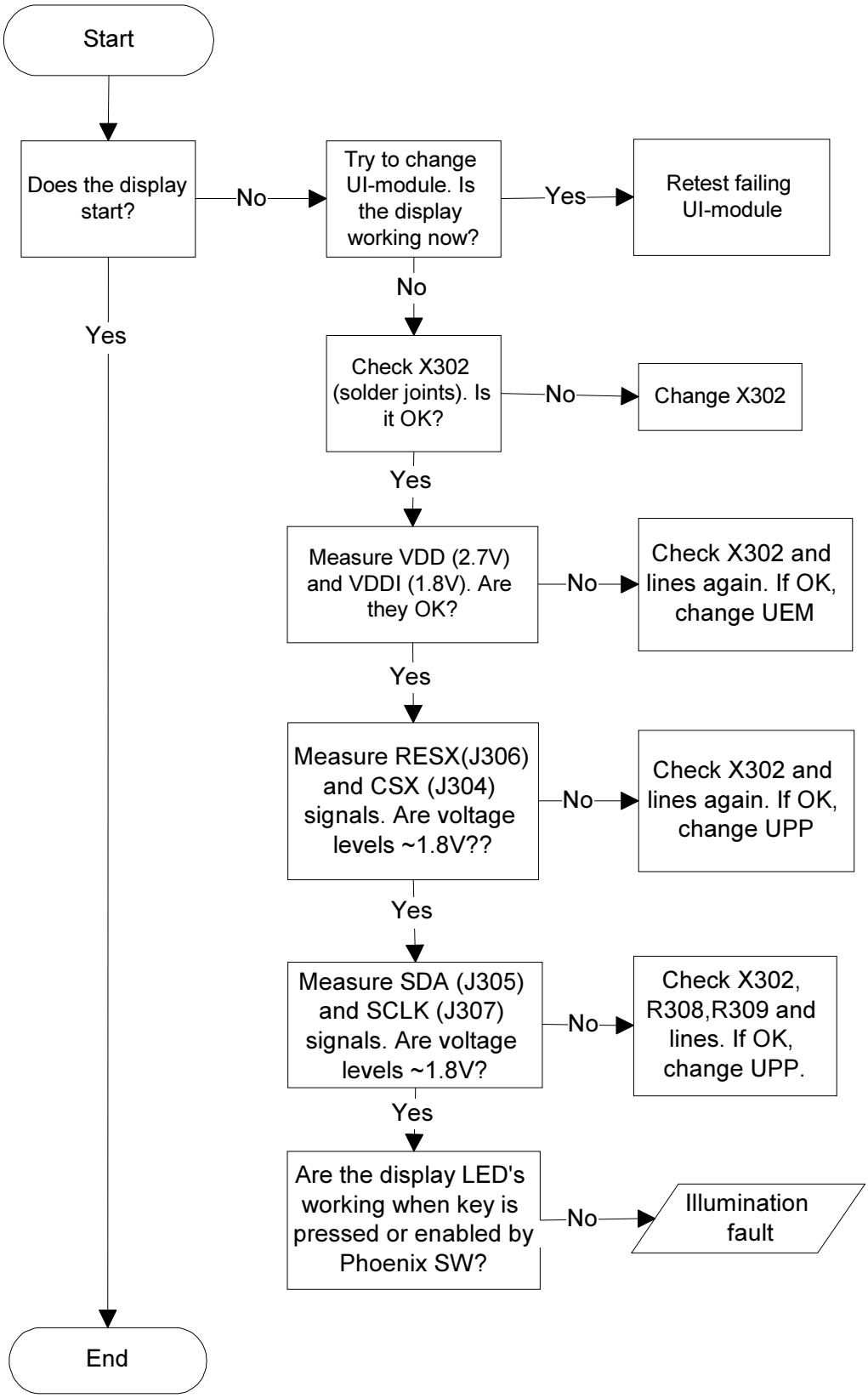
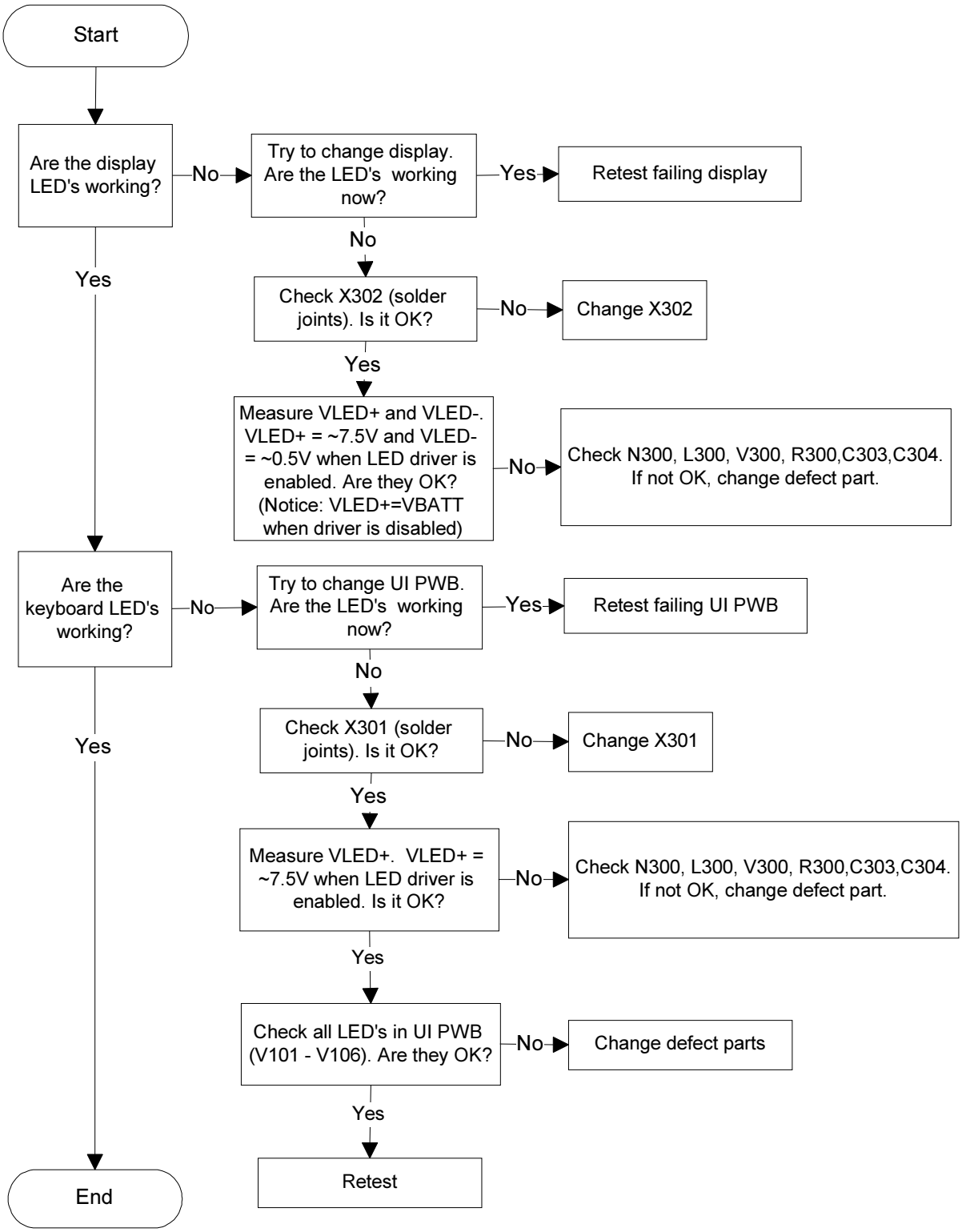
Display Fault

Figure 27: Display troubleshooting



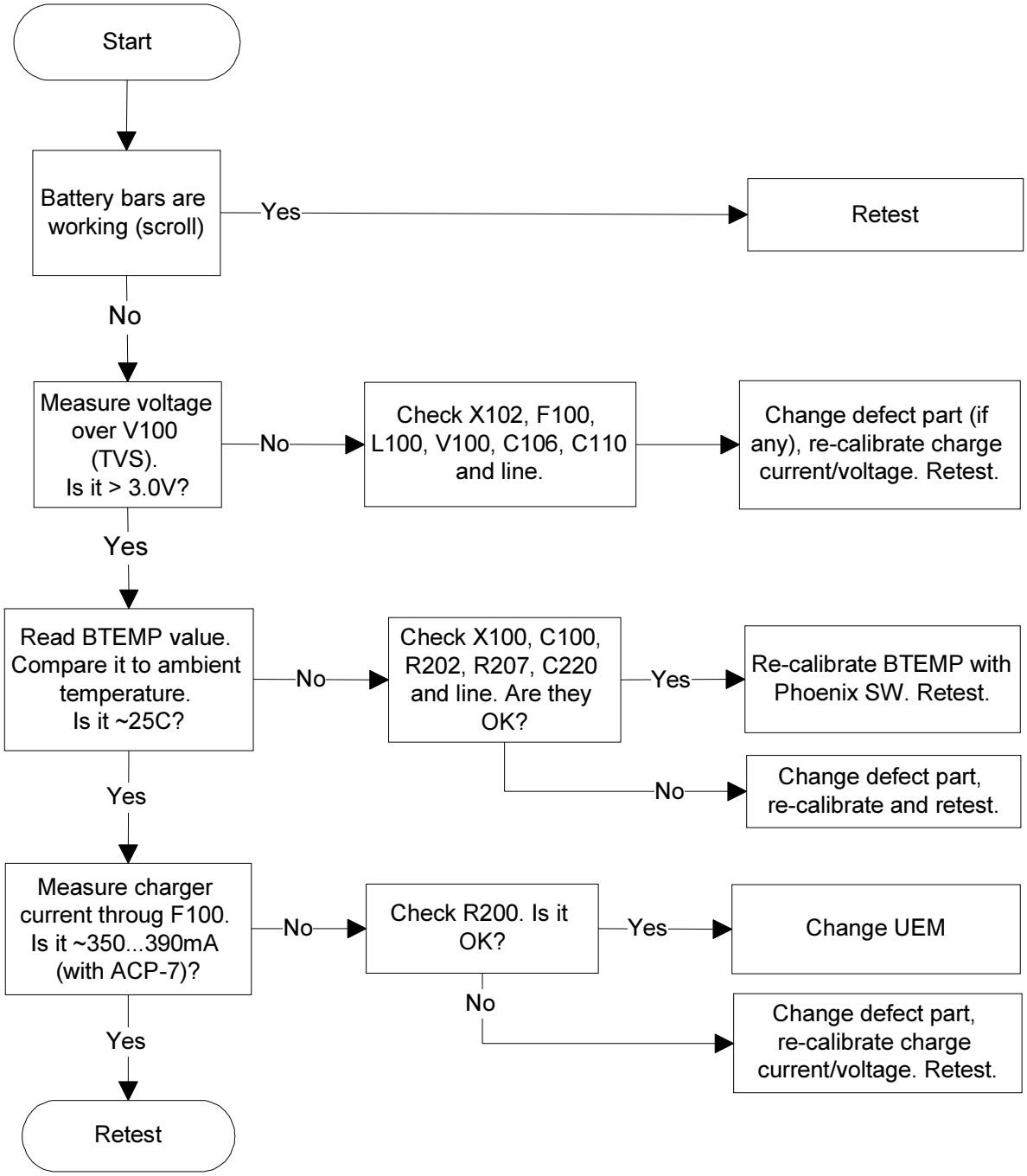
Illumination fault

Figure 28: Backlight troubleshooting



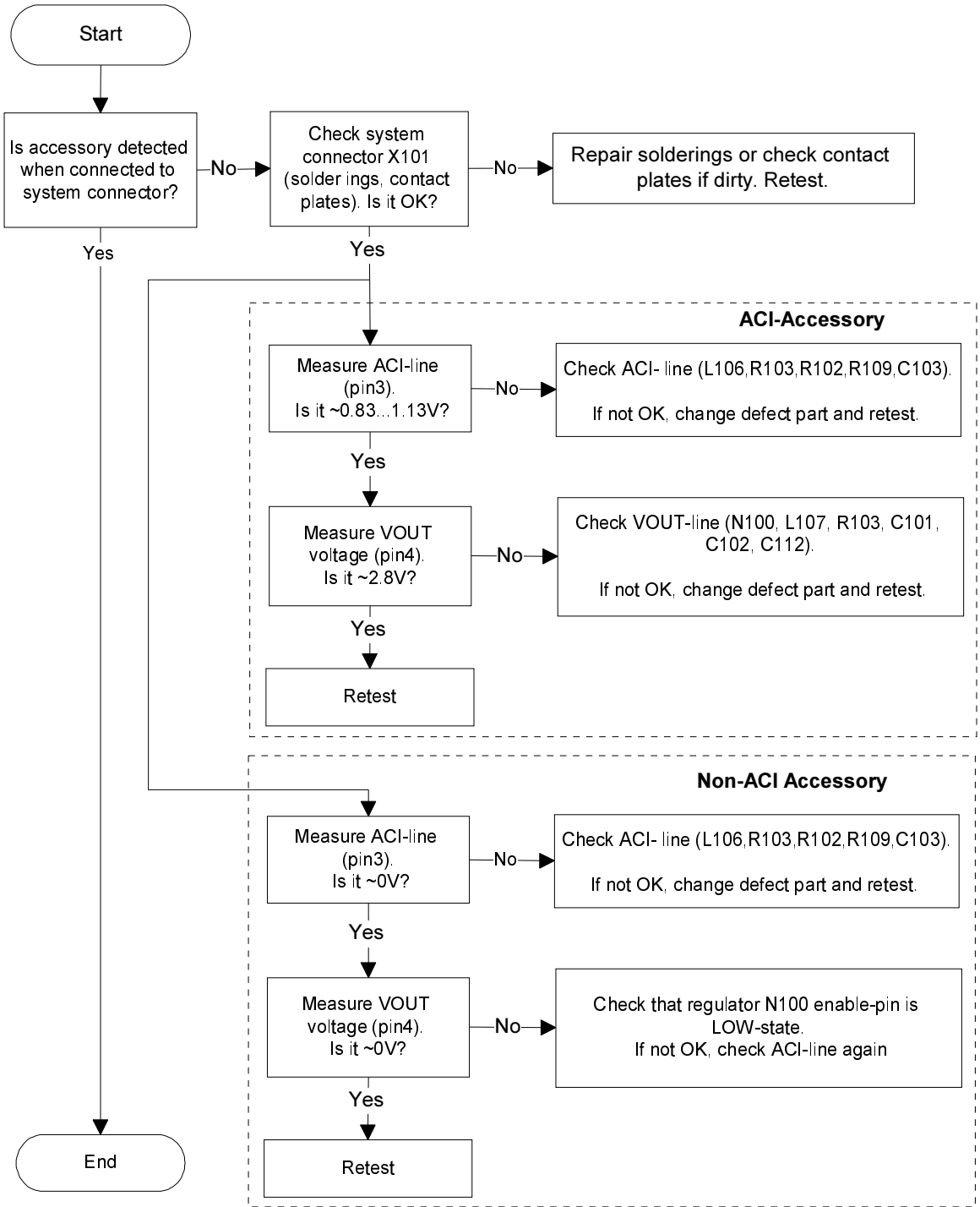
Charger Fault

Figure 29: Charging troubleshooting



Accessory Fault

Figure 30: Accessory troubleshooting



Camera Troubleshooting

Figure 31: Component placement

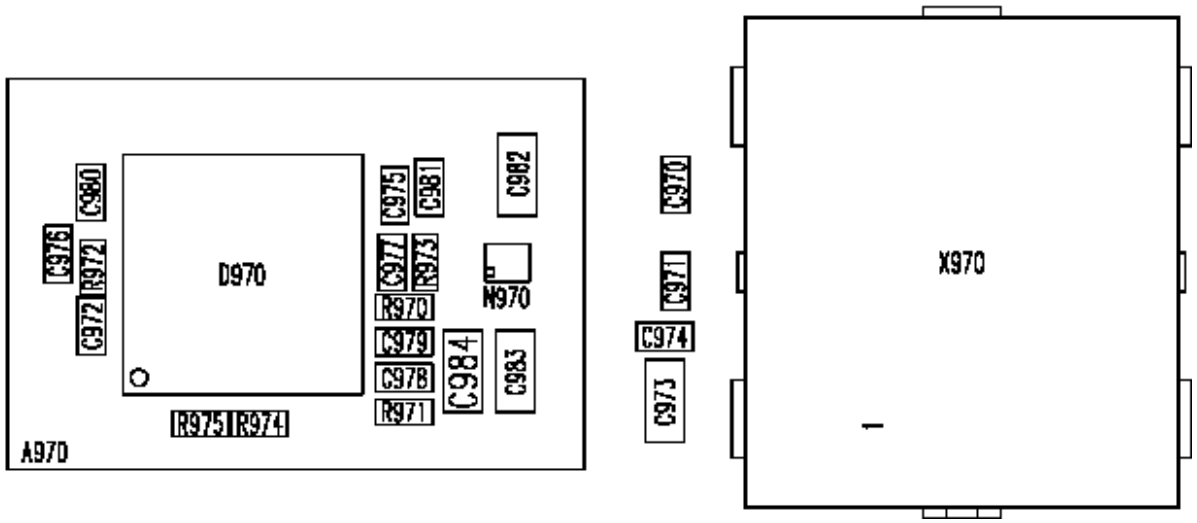
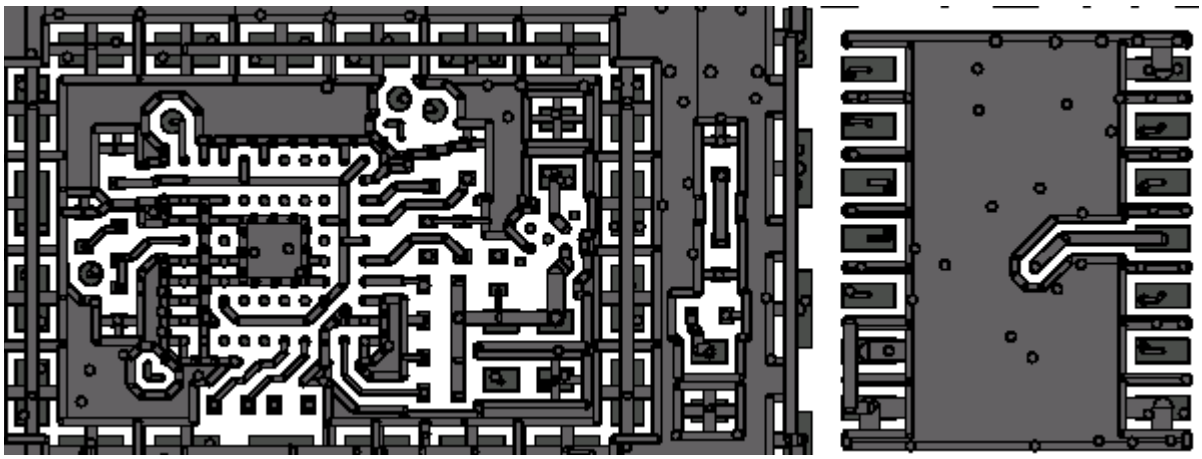


Figure 32: Trace layout



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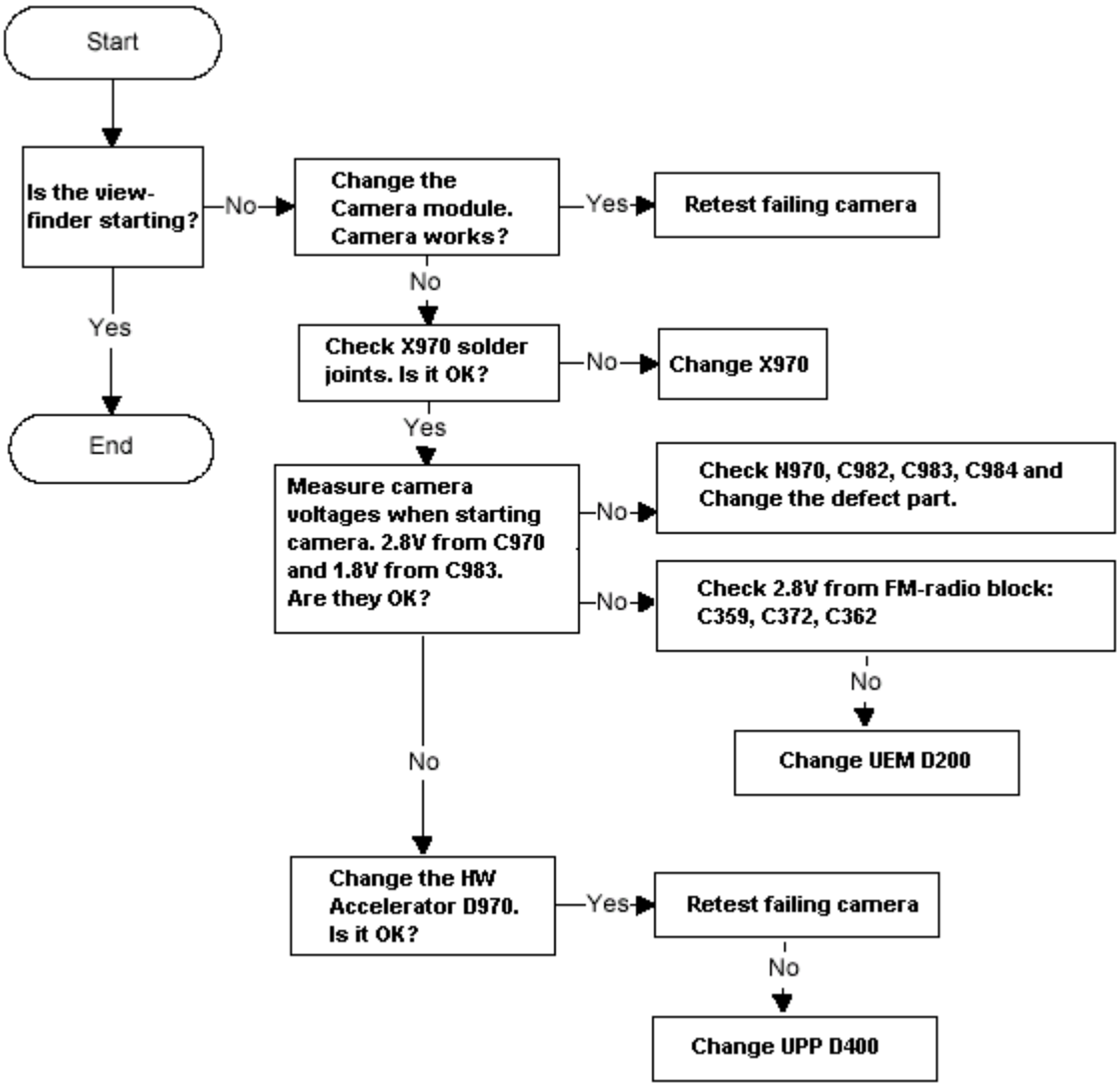
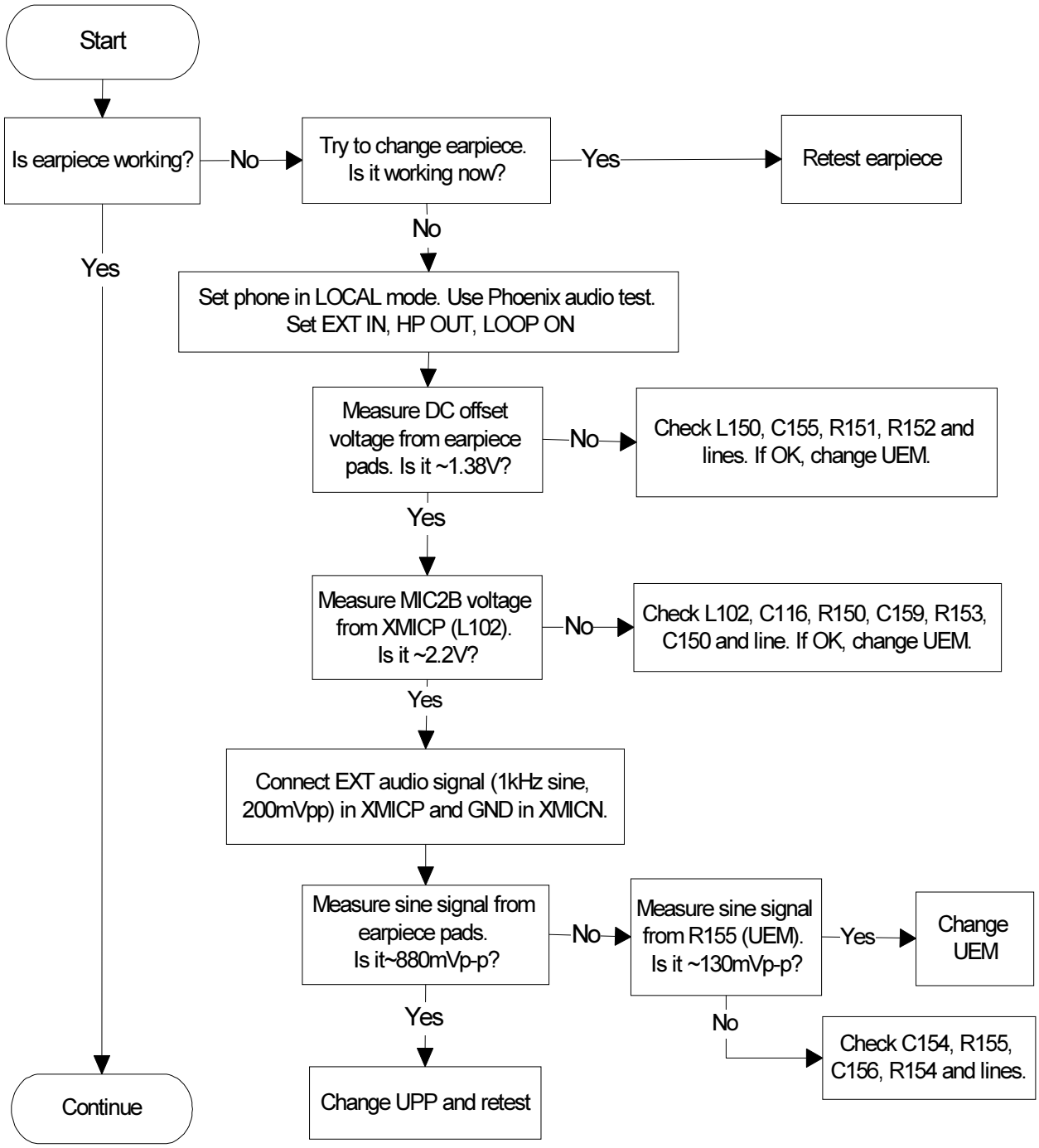
Camera Fault

Figure 33: Camera troubleshooting diagram



Audio Fault

Figure 34: Audio troubleshooting



FM Radio troubleshooting

FM Radio component layout

Figure 35: Component placement

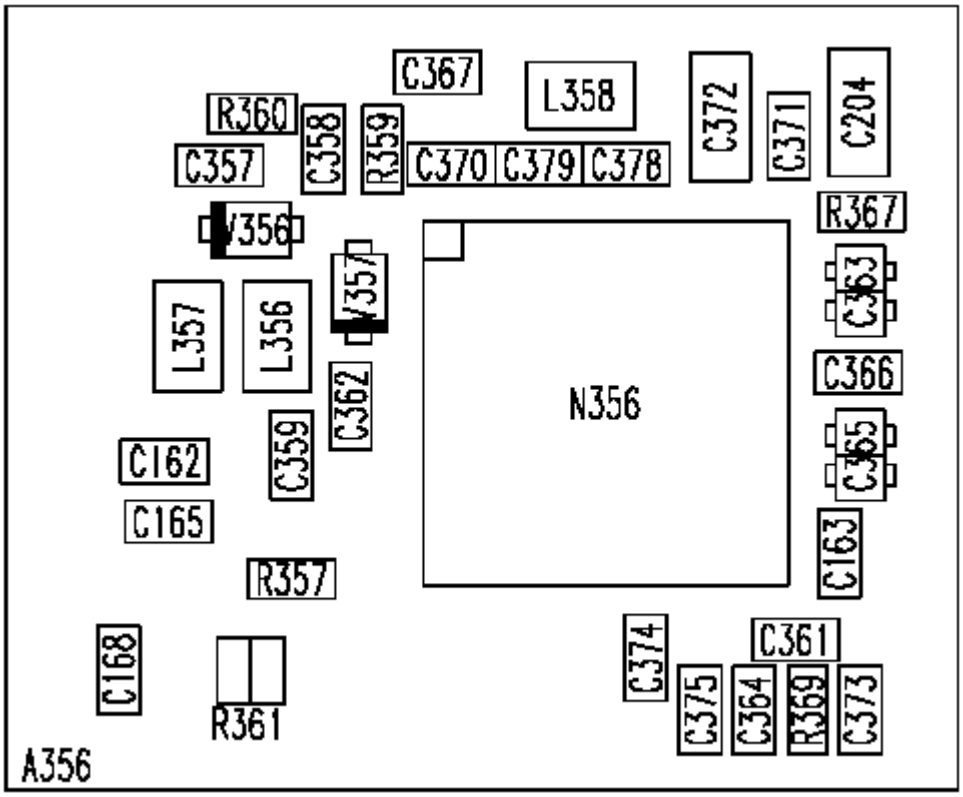


Figure 36: Trace layout.

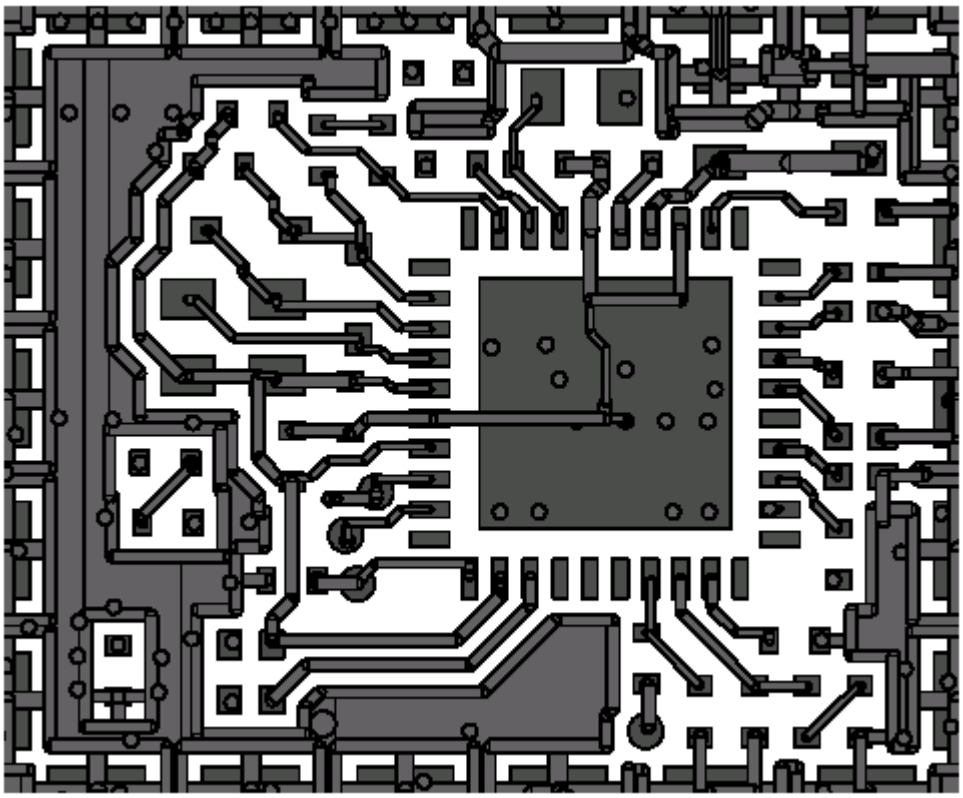


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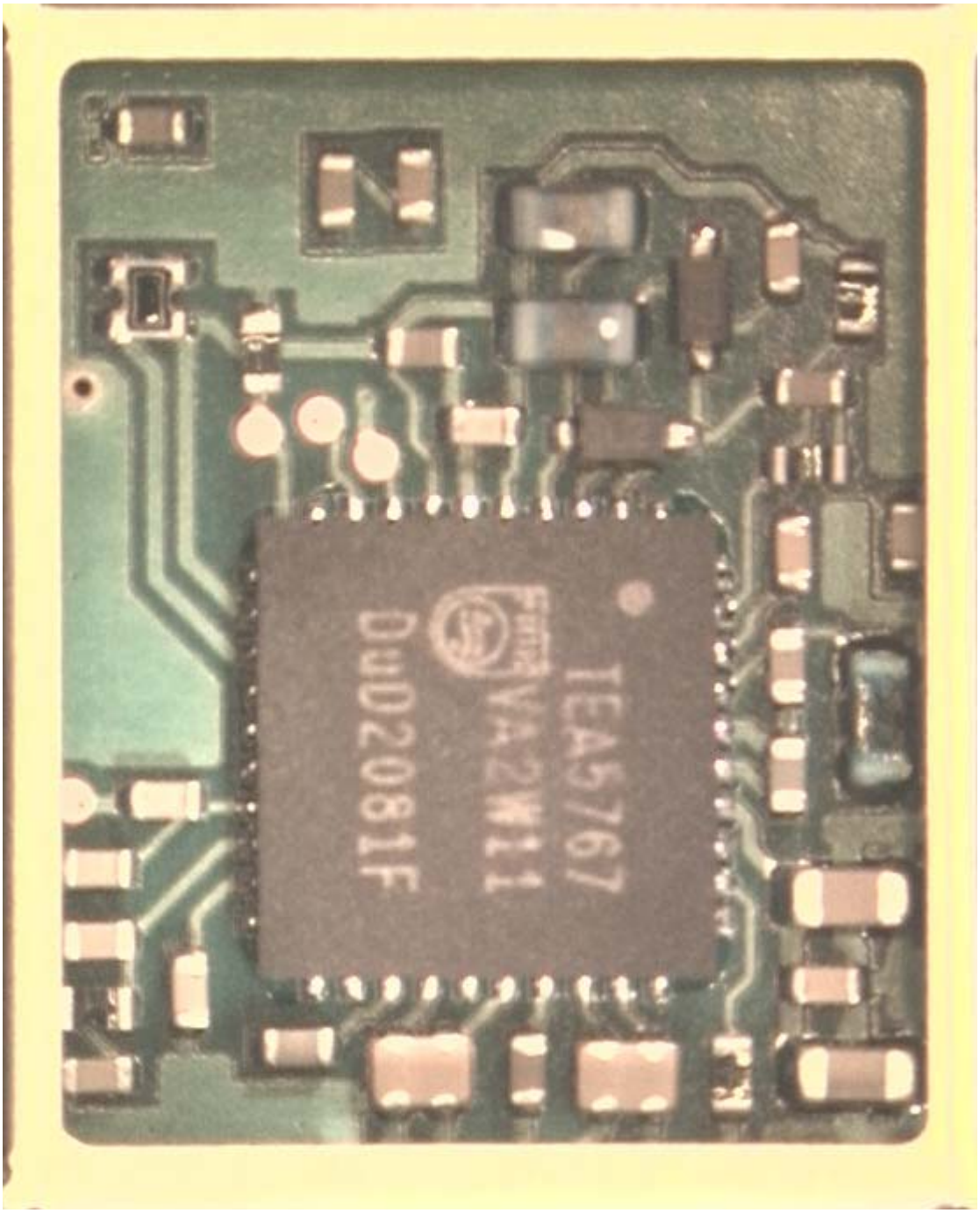
Figure 37: FM radio block layout.



Components L103, L104, L105, C107, C108, C109, C117, C162, C163, R164, R165, R166 and R167 are not shown in the picture. Those components are placed in baseband section, near audio amplifier N150.

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FM Radio troubleshooting diagram

Notes to "FM Radio troubleshooting diagram"

Use 1MHz 1X probe when measuring Audio and clock signals with oscilloscope.

Use active RF probe when measuring frequencies with spectrum analyzer.

Note 1. RF test signal parameters:

- Amplitude, A, –67.0 dBm
- Carrier frequency, f_c, 98,000 MHz
- Deviation, Δf, 75 kHz
- Modulating frequency f_m, 1,000 kHz (RF generator internal)
- FM stereo, mode R=L, pilot state ON

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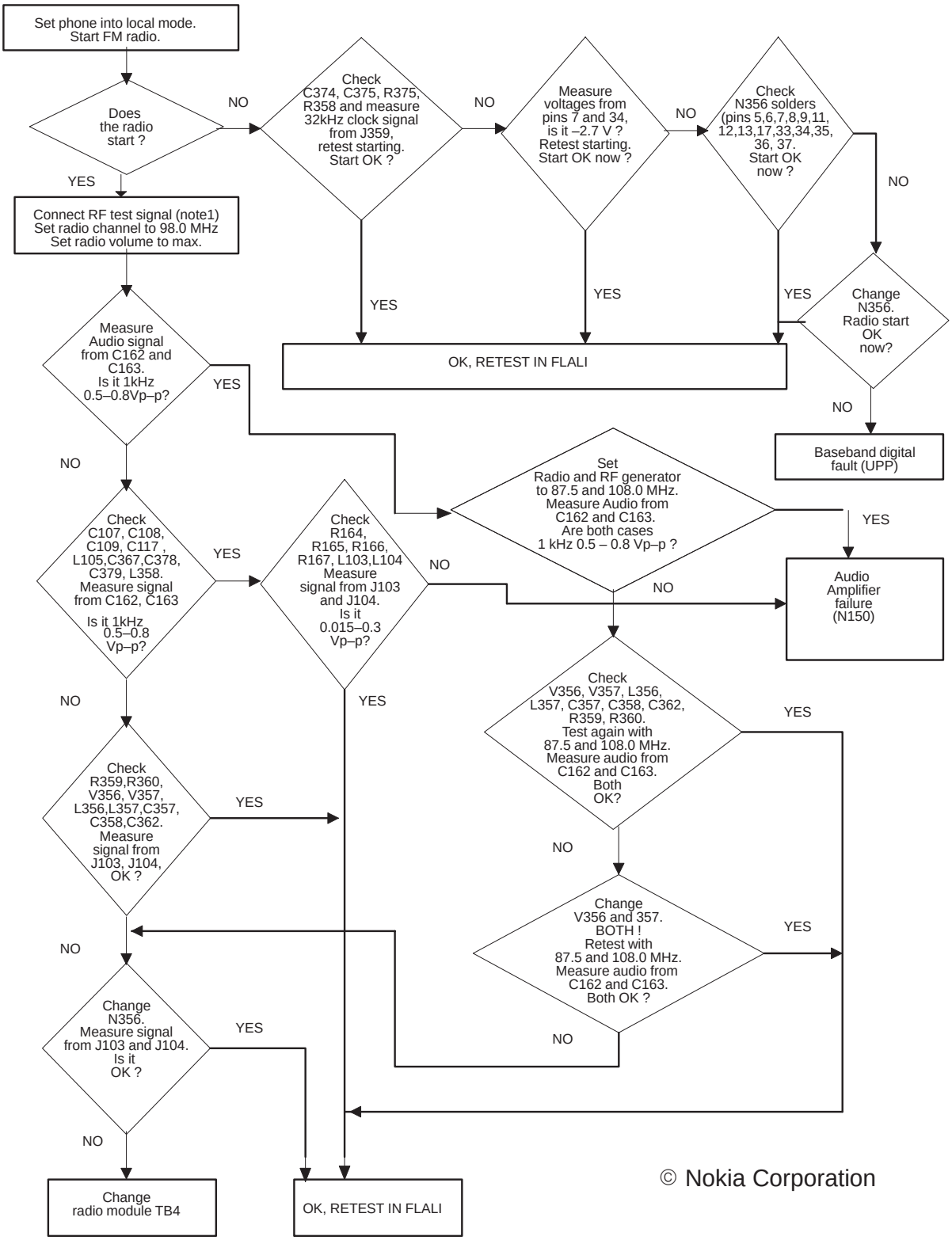
Figure 38: FM radio troubleshooting diagram



Diagrams of FM radio signals

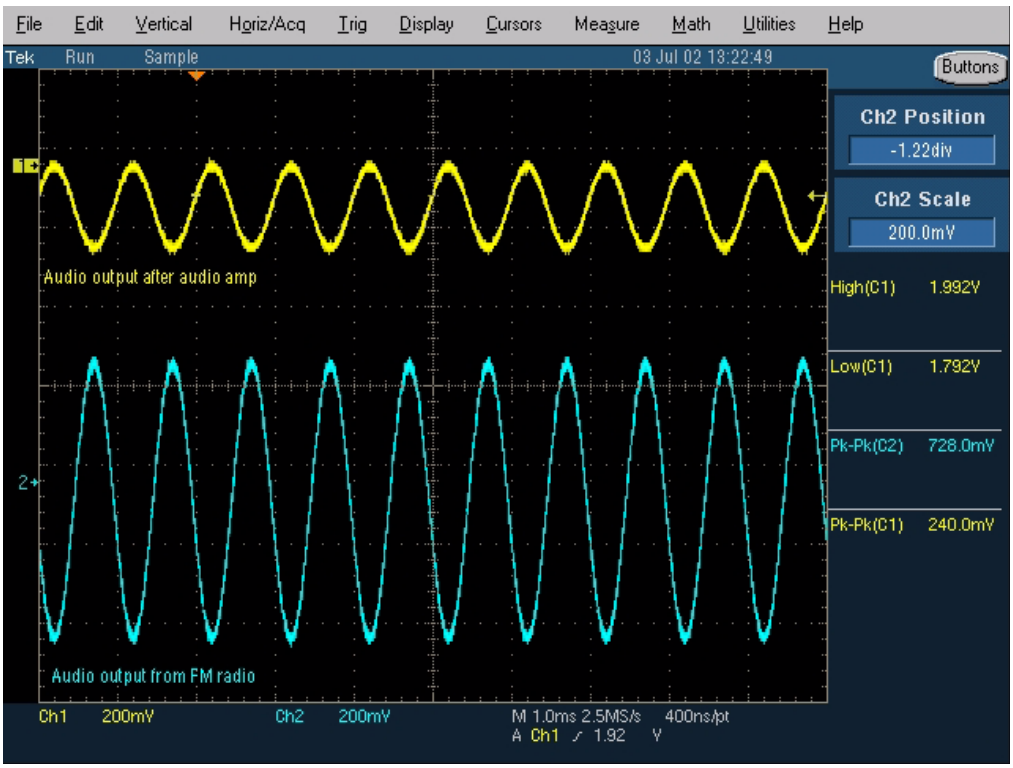


Figure 39: Oscilloscope screen shot, Audio output

Signal 1: Audio output from PWB test points J103 and J104, with FM test signal, volume 100%.

Signal 2: Audio output from FM radio pins 22 and 23(same as in C162 and C163), with FM test signal

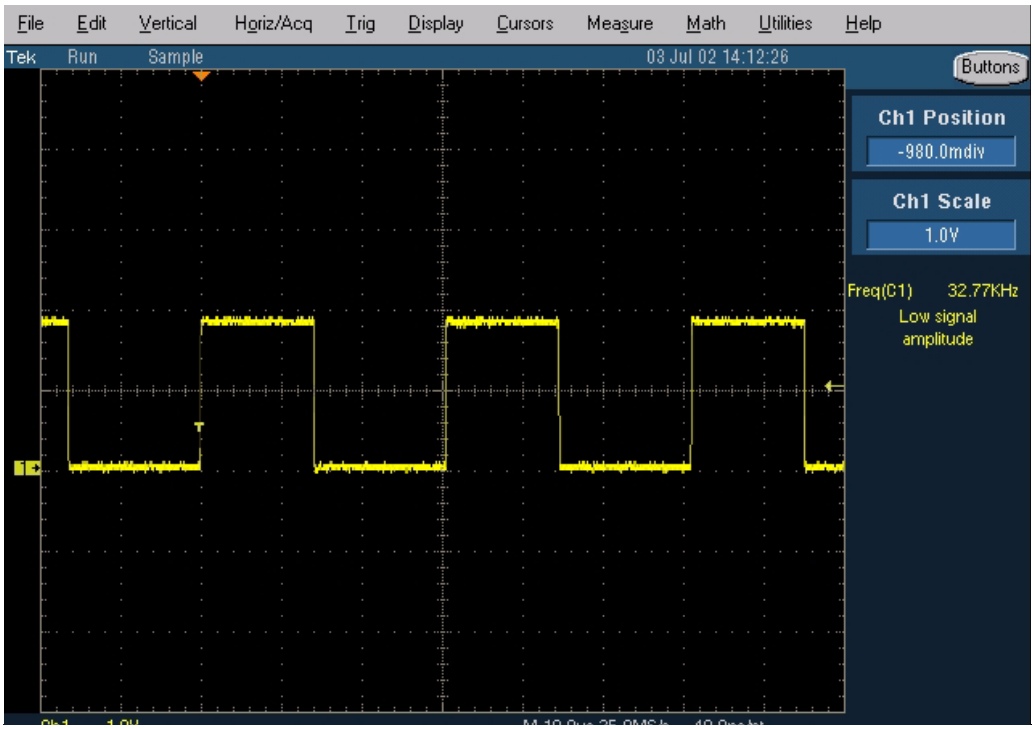


Figure 40: FM radio clock from test point J359, 32 kHz frequency clock signal, when radio is on.

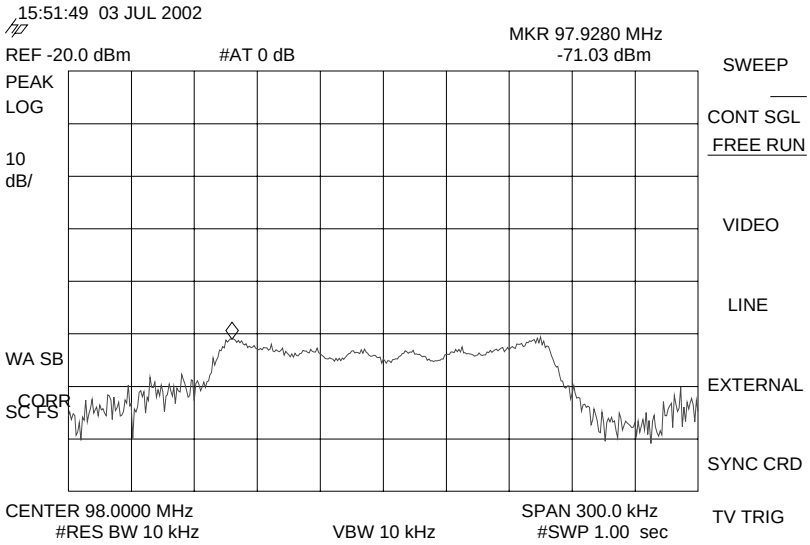


Figure 41: FM frequency from FM radio pin 37, the other end of L358, with FM test signal

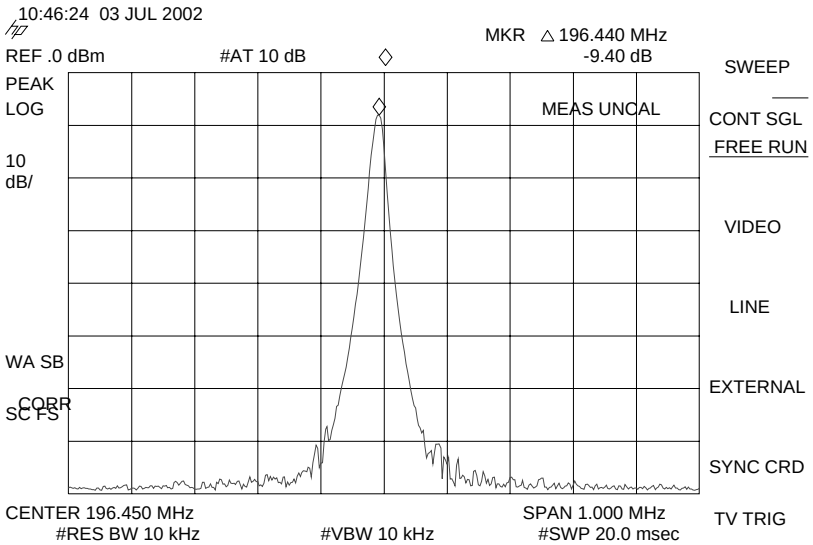


Figure 42: VCO frequency from FM radio pins 3 and 4, the other ends of V356 and V357, with FM test signal