10. Troubleshooting

Contents

Troubleshooting

Baseband Troubleshooting

Each main portion of the circuit will be described in enough detail for the troubleshooter to determine whether or not that part of the circuit being evaluated is functional. It will be helpful to use the placement diagram, which illustrates all of the necessary testpoints in the baseband circuit, to troubleshoot the phone. The placement diagram is intended to be used concurrently with this document. Herein, **TPD** refers to Test Point Designation.

Main Circuit Sections

Power Circuitry

There are two ASICs in the baseband section, which supply power to most of the phone. CCONT is the main power management ASIC. Two discrete linear regulators are used as well.

CCONT

CCONT is the main power management ASIC. Its features include eight 2.8V linear regulators, a linear regulator with adjustable output, a reference voltage output, a 5V switch mode regulator, an 8-channel A/D converter, and 32kHz clock circuitry. Each of the main functions and signals is described below, including information on how to verify correct operation.

Vbat

CCONT is powered directly from the battery voltage (Vbat). Since CCONT is a uBGA, the physical connection of CCONT's power pins cannot be verified. Vbat must be checked instead at the closest external component, which is shown as TPD. Valid voltages are 3.2 – 4.2V and should always be powered, assuming voltage is applied to the battery terminals.

Vref

Vref is used as a reference voltage both internal and external to CCONT. It is switchable between the nominal voltages of 1.500V and 1.251V, with the default at power-up being 1.500V. The phone uses the 1.251V reference, so once flash software is running, Vref should switch to 1.251V.

Check Vref at TPD. Valid voltages are 1.478 – 1.523V and 1.244 – 1.258V, respectively.

Linear Regulators

1. Vbb

Vbb supplies power to most of the baseband circuitry. This regulator should be on at all times during CCONT's power on, reset, and sleep modes. Nominal voltage is 2.8V, but anything in the range 2.7 – 2.87V is valid. Vbb is found at TPD30.

2. RF Regulators (VR1–VR7)

VR1 through VR6 are referred to as the RF regulators. Most are switchable, and all should be within 2.67 – 2.85V when they are on (2.8V nominal). VR1 and VR6 are always on during CCONT's power on mode. The rest of the regulators are switchable and are normally on during one or more of the various phone states, but may be turned on at any time with the service software in order to verify their output. The RF regulators can be checked at the following test points.

a) **VR1 –** TPD

b) **VR1_SW –** TPD

c) **VR2 –** TPD

d) **VR3 –** TPD

e) **VR4 –** TPD

f) **VR5 –** TPD

g) **VR6 –** TPD

h) **VR7 -** TPD

3. V2V (VMAD)

The V2V (VMAD) regulator is intended to power the MAD4 ASIC core. The output is adjustable from 1.3V to 2.65V in 0.225V steps, and is used with MAD4 ver 3 (but not MAD4 ver 2). The output at V2V, when MAD4 ver 3 is mounted, should be 1.750V ±5% and can be checked at TPD27.

Switch mode regulator

1. V5V (+5V_POWER)

V5V is a 5V switch mode regulator, which always remains on during CCONT power on mode. Valid voltages are 4.8V to 5.2V, and it can be checked at TPD2.

2. VSIM (3V_5V)

VSIM is powered by the same switch mode regulator as V5V; however, it is switchable between 3V and 5V. The phone uses VSIM as the 3V FLASH programming voltage, so it should remain off unless the phone is being flashed. Valid voltages are 2.8V to 3.2V, and it can be checked at TPD1.

A/D Conversion

CCONT contains a 10–bit A/D converter that is multiplexed between eight different inputs. They are used mainly for battery and charger monitoring. The eight inputs are: Vbat (battery voltage), ICHAR (charger current), VCHAR (charger voltage), BSI (battery type), BTEMP (battery temperature), VCXOTEMP (PA temperature), and EAD (accessory detection). These readings can be accessed through the service software. Check for shorts or opens on the resistor networks connected to these signals if the flash align test software reports that they are out of range.

Watchdog

CCONT's watchdog circuitry consists of an 8-bit down counter that causes CCONT to power down when zero is reached. The counter may be reset by loading a new, non–zero value into the watchdog register via CCONT's serial bus. It is difficult to verify the watchdog function, but the serial bus may be verified.

There is a watchdog disable pin, which allows the watchdog timer to expire without shutting down the phone. This pin is mainly used as one of the methods to turn on CCONT from power off mode. While the phone's power key is pressed, this pin should be pulled low and can be checked at TPD 26 using a 70k resister. The watchdog can be disabled by pulling down the above-mentioned pin (WD_DIS) by shorting TPD 26 and ground.

Serial bus

Since the serial bus is used to control almost all of CCONT's functions, any shorts or open circuits on these three lines would cause CCONT to be completely nonfunctional. The main symptoms are the following:

CCONT will turn on when the power key is pressed (verify this by checking Vbb), but will then power off after 32 seconds. All three serial bus signals (CCONTCSX, UIF_CCONT_SDIO, and UIF_CCONT_SCLK) should toggle when attempting to write to a CCONT register.

Note: If the LCD does not come on during this time, it may indicate that the serial bus is functional, but the phone does not have valid flash code.

Clocks

Sleep Clock

The 32kHz sleep clock is generated by CCONT, and can be checked at TPD32. The 32kHz square wave will be present only after the phone is turned on.

System Clock

The 19.2MHz system clock is generated by the VCTXO in the RF section, and then squared in CAFE. Check TPD11, which should be a 2.8V squarewave. This clock is not active during the phone's sleep mode (CLK_EN is low during sleep mode).

CDMA Clock

The CDMA clock is 9.8MHz and is generated in CAFE with a PLL. This should be a 2.8V squarewave and can be verified at TPD10.

Charging Circuit

The charging switch, CHAPS, is controlled by a PWM from CCONT. This PWM can be at

1Hz or at 32Hz, with varying duty cycles, and should only be active when a charger is detected. The frequency depends on charger type. To verify correct operation of CHAPS, monitor the charging current (ICHAR) with the service software. When the PWM is off, current should be approximately 200uA. When the PWM is on, it must be greater than approximately 300mA.

CAFE

The CAFE ASIC performs various functions with respect to the RF circuitry and audio. It digitizes the analog voice signals from the microphone as well as converts received digital data to voice signals to be sent to the earpiece. This also includes accessory microphones and speakers. It also generates and decodes I and Q data for CDMA signals. CAFE also acts as a clock squaring circuit and CDMA clock generator.

Microphones

The internal microphone is biased using transistor V280, which is powered by VR1_SW. MICP should be about 1.7VDC, and MICN should be about 0.4VDC. Internal microphone bias should only be active during a call. The XMIC is biased by the AUXOUT signal through R240 and R241. The AUXOUT output provides 1.5V bias voltage to the external microphone.

Earpiece and XEAR

The internal earpiece is driven differentially (EARP and EARN). The DC voltage on these two pins is 1.35V. The difference in the DC voltage between these two pins should not be more than 50mV.

The XEAR signal drives audio to the external accessories. The CAFE signal name is HF. The DC level on this pin should be 1.35V. HFCM should also be at 1.35V. The difference in DC voltage between these two pins should not be more than 50mV.

Note that SGND is the return path for XMIC and XEAR.

Transmit and Receive RF Signals

In CDMA mode, receive I and Q channel RF signals [RXIQ(3:0)] come into CAFÉ pins. C201, C202, C203, and C204 can also be checked for these signals since they are in series with the CAFÉ pins. Transmit I and Q RF signals [TXIQ(3:0)] can be seen at C205, C206, C207, and C208.

MAD4

The MAD4 ASIC is the core of the baseband functionality and basically contains the DSP, MCU, and CDMA logic. The DSP is used to perform functions such as RF control, DTMF tone generation, and implementation of the vocoder. The MCU is used to perform functions that do not require as much power — higher-level functions such as UI software (key presses, backlighting, LCD functions, etc.) and mode control.

DSP

The DSP sends control signals to the RF via PDMs. In order to control RF parameters such as TX_LIM_ADJ, a continuously variable analog signal must be used. Since the DSP out-puts only digital signals, a PDM RC circuit is used to convert the digital output signal to an average analog voltage. A PDM line will always have a series resistor followed by a shunt capacitor. The output of the MAD4 PDM lines will appear as squarewave signals. However, after the shunt capacitor, the signals will appear to be DC with perhaps a slight ripple. The RC circuit acts as an integrator in order to yield the average value (DC) of the squarewave signal.

The transmit data bus (TXD(7:0)) is 8 bits wide. In CDMA mode, this bus is multiplexed between sending I and Q data. The signals required to transfer TX data are CAFE_TX_GATE, CLK9M80, and IQSEL. CAFE_TX_GATE must be high to transfer data, and the data is clocked by CLK9M80, which is running at 9.8MHz.

MCU

The MCU is used to perform functions that require less processing power than the DSP. It runs UI software and mode control; interfaces to MBUS; downloads code to flash; reads and writes the EEPROM; controls charging; and interprets A/D data from CCONT.

Memories

MAD4 interfaces to three memories — Flash, SRAM, and EEPROM. All of them are powered by 2.8V (Vbb). During Flash programming, Vpp (signal name is Vff_flash on schematic) is driven to Flash memory.

Troubleshooting Instructions

The first thing to do is to carry out a thorough visual check of the module. Make sure that there is no mechanical damage and that solder joints are okay. Most failures will be the result of SMD errors. Common errors include: solder placed where it shouldn't be, parts sliding off their pads, or parts placed incorrectly. A good visual inspection will pin-point a large percentage of failing phones.

Before changing anything, also check all supply voltages and the system clock/sleep clock.

The Troubleshooting Instructions section contains five modules:

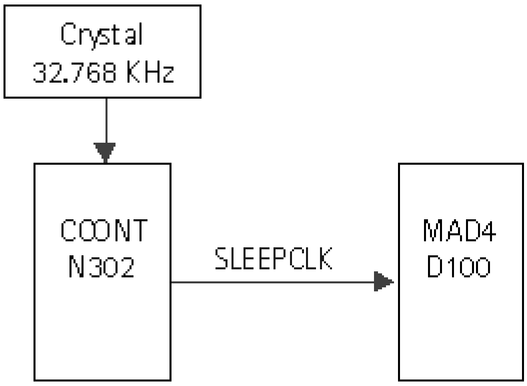
- How to check/fix the system/sleep clock

- How to check/fix the power supplies

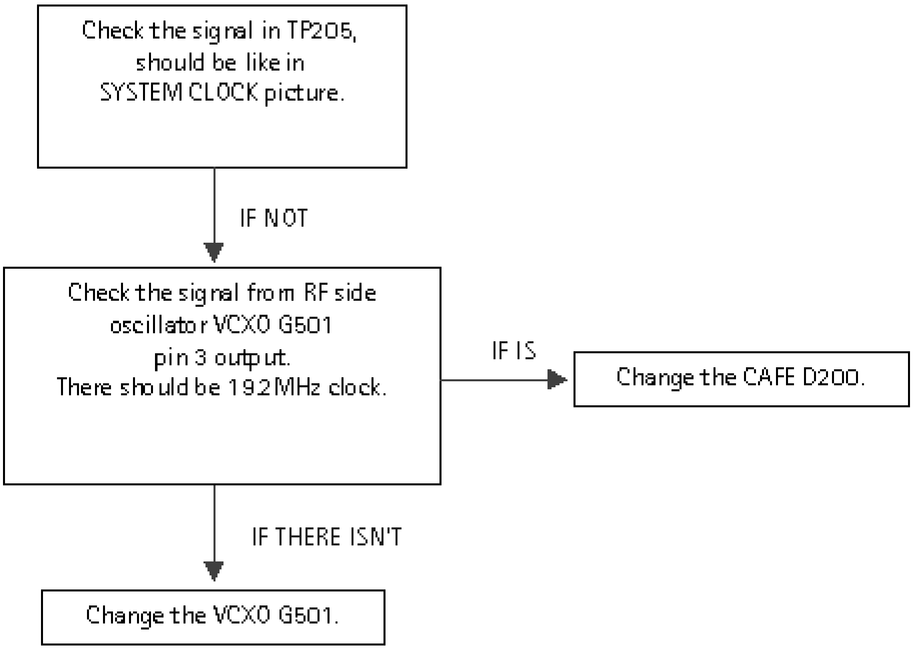
- How to check/fix the flashing faults

- How to check/fix the audio faults

- How to check/fix the charger faults



Check System Clock



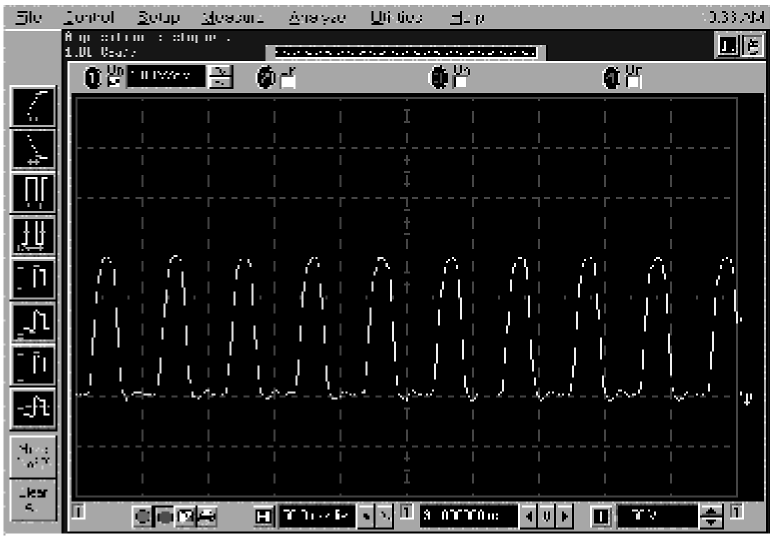
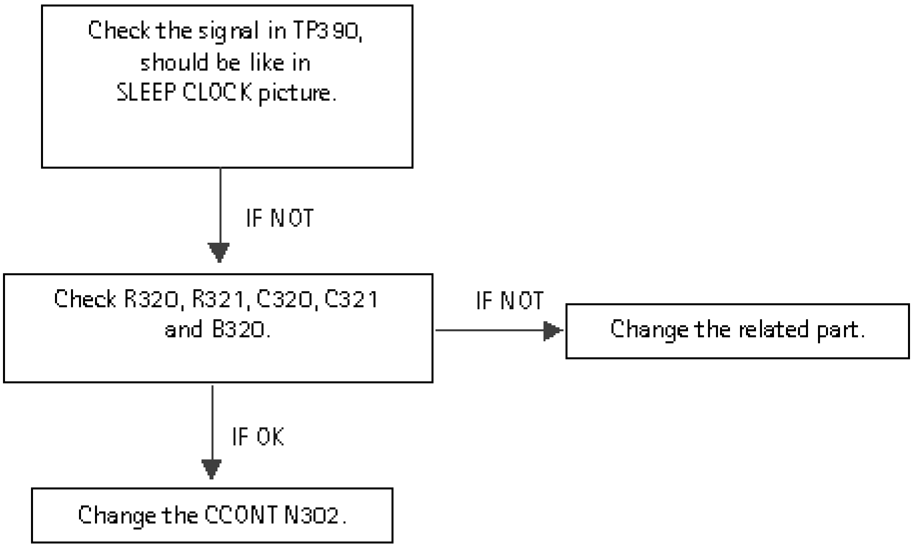


Figure 1: System clock picture

Check Sleep Clock



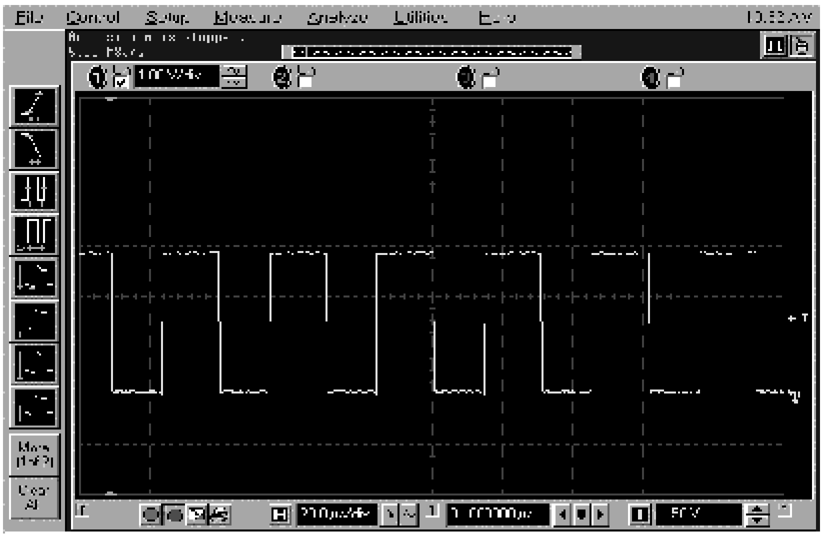


Figure 2: Sleep clock picture

In the Field

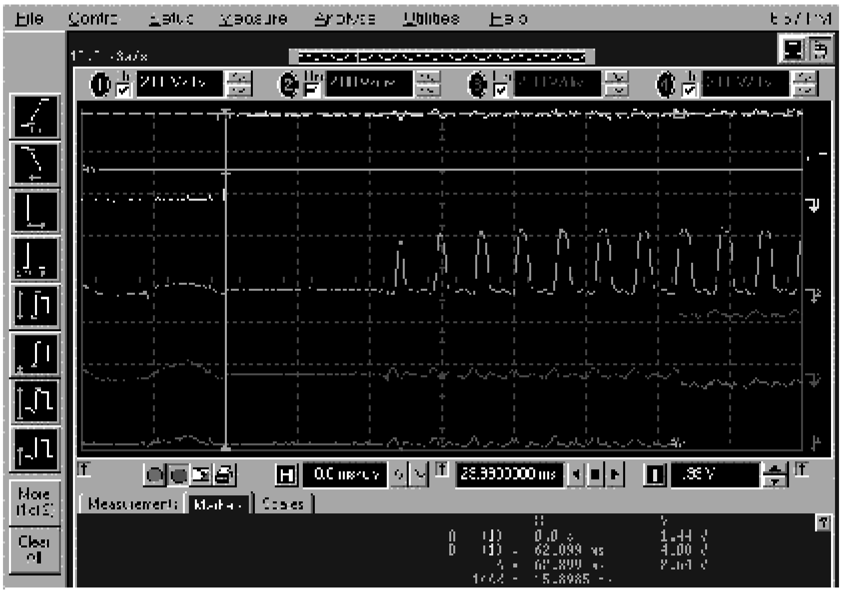
Although solder joints may be adequate to pass manufacturing requirements, they may not withstand mechanical stress or heat cycling. Cracked or broken solder may cause failures to occur as the result of simple use. Reflowing some of the major components may fix problems where the phone exhibits strange behavior (some buttons may not work, the phone doesn't ring, or the phone doesn't power on).

Power Supplies

Measure the power supplies. Test points are illustrated in the baseband test points table and the layout diagram.

Power up sequence test:

CCONT digital parts keep MAD4 in reset by keeping PURX down for a delay of 62ms.



Here is the start-up sequence picture:

Ch1 = PWRONX
Ch2 = SLEEPCLK
Ch3 = PURX
Ch4 = RESETX

Phone is Totally Dead

The phone doesn't take current at all when the power switch is pressed or when the watchdog disable pin (TPD331) is grounded.

Make sure that the battery voltage you use is within specification (i.e., 3.2 - 4.2V). If the voltage is lower than that, CCONT hardware (N302) prevents power on.

If the battery voltage is within the specification, change the CCONT (N302).

High current: This indicates that the problem is likely the result of a shorted component. Check the orientation of major components (including RF) and check for shorts. Likely components are those that are powered directly from Vbat such as CCONT, the PAs, and various capacitors.

Low current: This indicates that CCONT is now powering on. Verify CCONT circuitry.

Phone Won't Power Up

Do a visual inspection. Verify that all parts are on the board correctly, and that none is missing. Phone won't power up often is related to VCTCXO solder joints cracking and no 19.2MHz to the BB.

Check that the 32kHz clock turns on when attempting to power up.

Check the power circuitry. This includes Vbat, Vref, and all of the linear regulators.

Power Doesn't Stay on or Phone is Jammed

If this type of fault occurs after flash programming, there are most likely open joints in ICs. Solder the IC joints. Normally, the power will be switched off by CCONT(N302) after 30 seconds if the CCONT watchdog cannot be served by software. This updating can be seen with an oscilloscope at CCONTCSX(TPD334). In normal cases, there is a short pulse from "1" to "0" every 8 seconds.

Because of underfill, check the supply voltages, clock signals, and power sequence. If the power sequence fails, there are some open connections under MAD4 or compomemory. If everything appears to be correct, it is best to erase the flash memory and try to reput the software to the phone again.

Flash Programming Fails

The flash programming can be done via flash connector X052 or via dedicated PCB pads (J56,J57). In production, the first programming is done via flash connector. After this, the flash connector is cut away; as a result, the programming must be done via PCB pads visible through the shield under the battery. The fault-finding diagrams for flash programming are shown in the start-up sequence diagram.

In the case of flash programming errors, the flash prommer may provide some information about a fault. The fault information messages could be:

- MCU doesn't boot
- Serial clock line failure
- Serial data line failure
- External RAM fault
- Algorithm file or alias ID not found
- MCU flash Vpp error

Flash: Failure to flash is the main baseband failure. Check all the CCONT regulators, especially Vbb, VR1, and VR6 for shorts. Check clocks and reset circuitry. Check for shorts on the address, data, and chip enable lines on the memories and MAD4. If a short is detected, it may be that it is beneath the BGA flash and may have to be replaced.

Note: Unfortunately there is no ROM software that can be run when the phone does not flash. Typically, this software would be used to test all of the interfaces between MAD4 and its peripherals. Therefore, it must be visually (or by ohmeter) determined whether there is a possible short between two or more of the address or data lines.

Audio failures

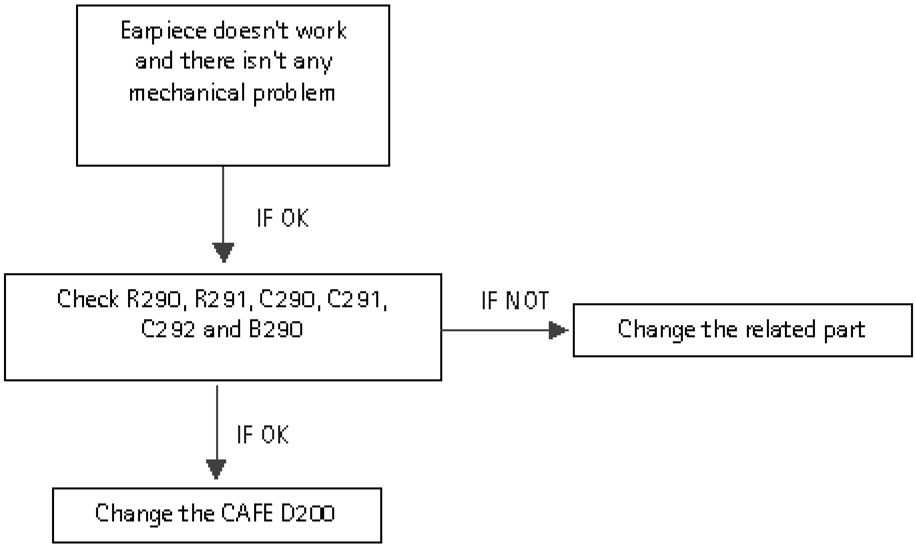
If audio fails to be heard from the earpiece (or XEAR), check the following:

Check earpiece contacts.

Verify that the CAFÉ EARP and EARN bias is on. If necessary, check the entire receive path—Rx voice data comes from the RF through the RXIQ bus (CDMA), then to MAD4 through RXD (11:0) (Refer to schematic).

The Rx voice data then goes back to CAFE on CAFESIO (0), and then to the earpiece or XEAR. CAFESIO (2) must also be active.

Conversely, if the transmit audio is not working, the fault could be anywhere in the transmit path. Check the following:

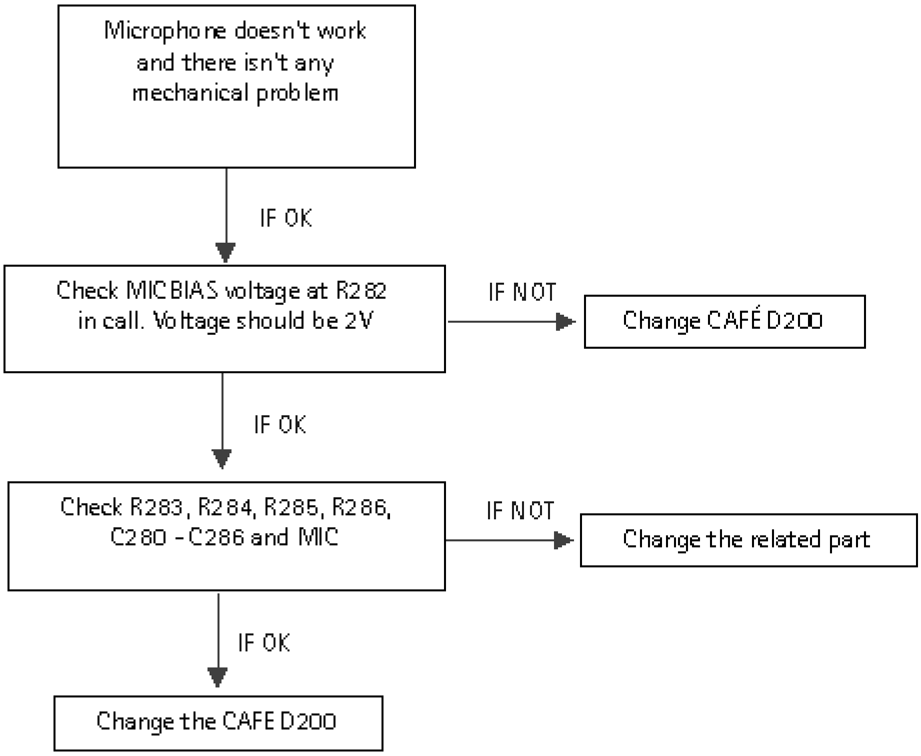


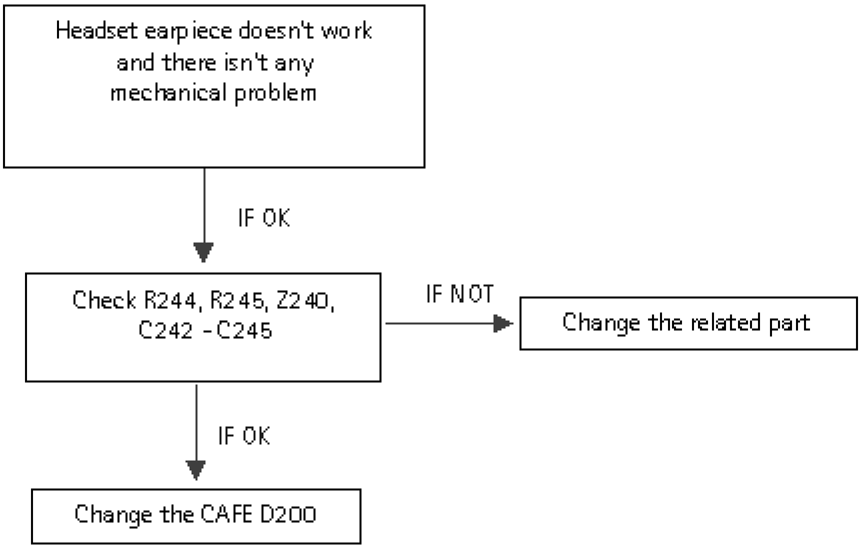
Check microphone contacts.

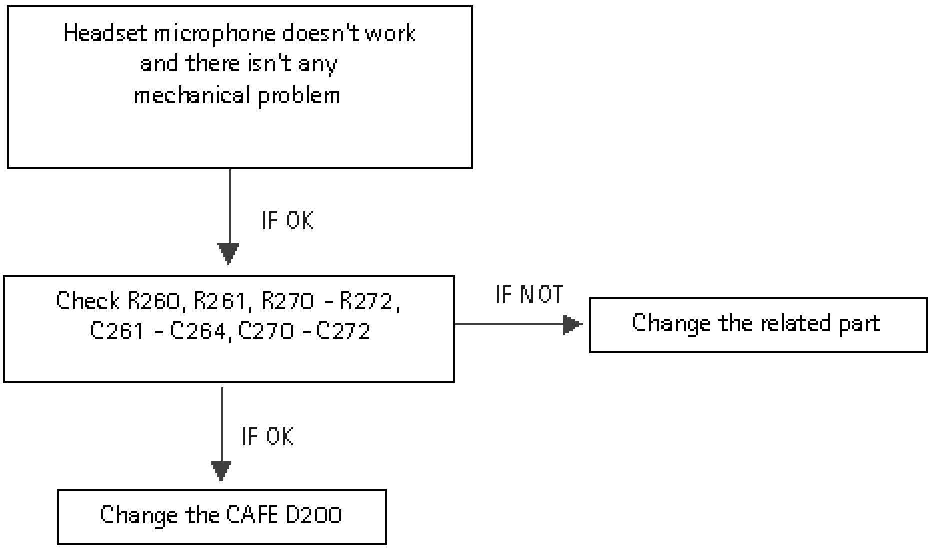
Microphone bias.

Tx voice data is transferred from CAFÉ to MAD4 on CAFESIO (1). CAFE-SIO (2) must also be active. Tx voice data is then sent back to CAFÉ on the TXD bus (See schematic).

Tx voice data is then sent to RF on the TXIQ bus.

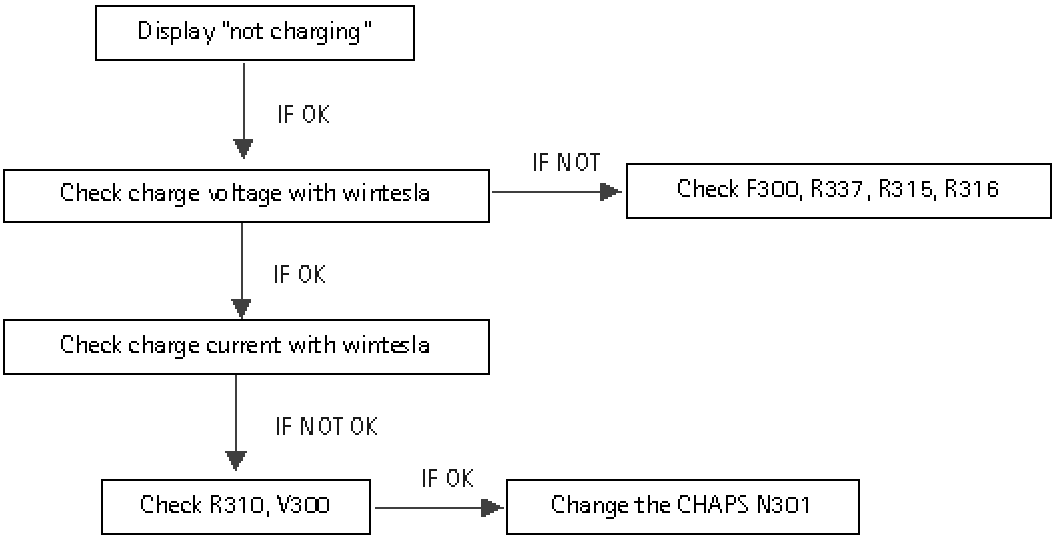

Microphone doesn't work
and there isn't any
mechanical problem
IF OK
Check MICBIAS voltage at R282
in call. Voltage should be 2V
IF NOT
Change CAFÉ D200
IF OK
Check R283, R284, R285, R286,
C280 - C286 and MIC
IF NOT
Change the related part
IF OK
Change the CAFE D200


Headset earpiece doesn't work and there isn't any mechanical problem
IF OK
Check R244, R245, Z240, C242 - C245
IF NOT
Change the related part
IF OK
Change the CAFE D200


Headset microphone doesn't work and there isn't any mechanical problem
IF OK
Check R260, R261, R270 - R272, C261 - C264, C270 - C272
IF NOT
Change the related part
IF OK
Change the CAFE D200

Battery Will Not Charge

If the battery won't charge (phone doesn't allow the battery to charge), check CHAPS and the charging circuit. It may also be necessary to verify the A/D functionality of CCONT since this is the method of detecting battery type, charger type, etc.

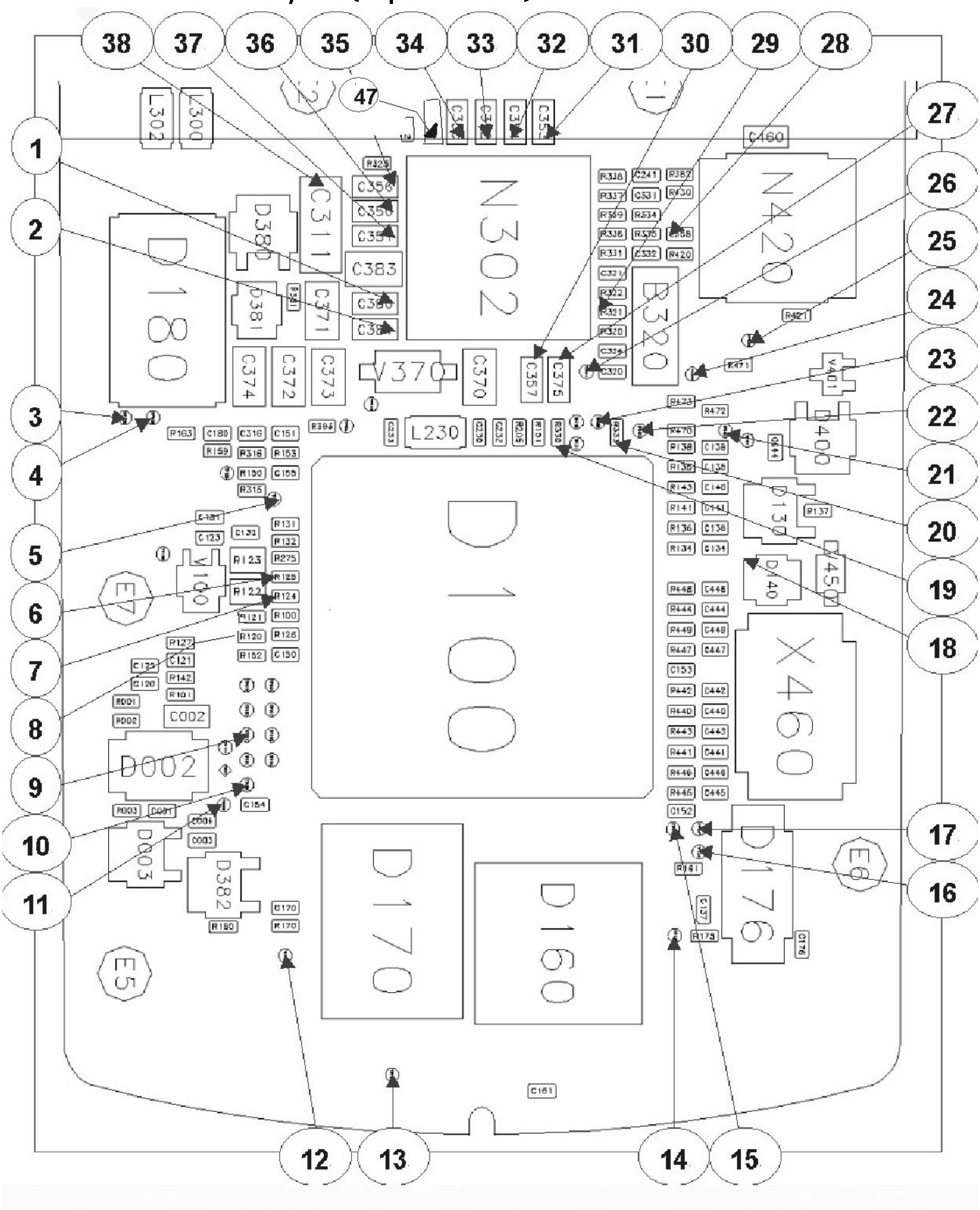


Baseband Test Points

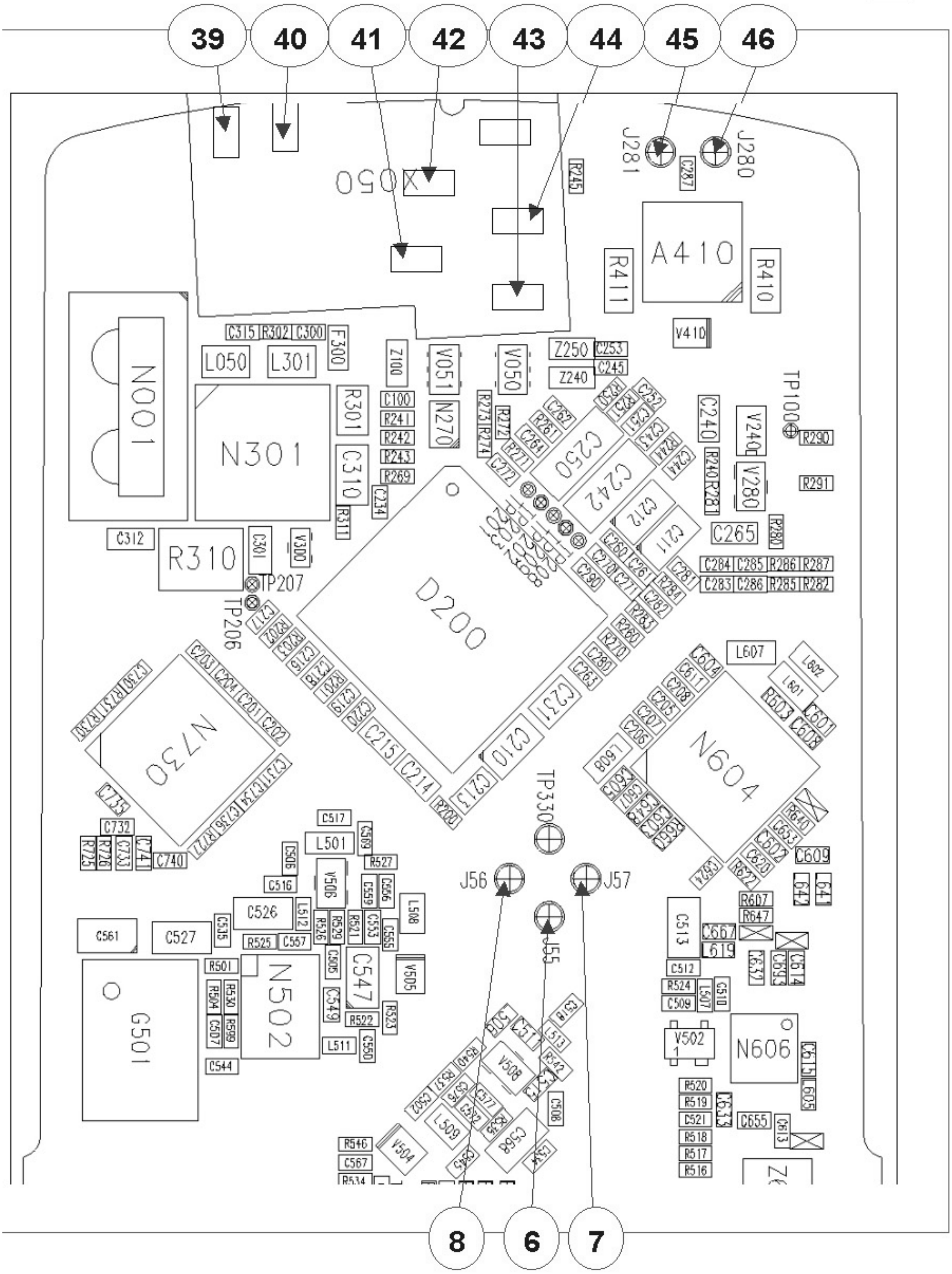
Test point	Signal name	General characteristics	General signal destination
1	VSIM	CCONT regulator output (2.8V-3.2V)	From CCONT to FLASH
2	V5V	CCONT regulator output (typical 5V)	From CCONT to RF transmitter
3	EEPROMSDA	EEPROM access serial data	From MAD4 to EEPROM
4	EEPROMSCLK	EEPROM access serial clock	From MAD4 to EEPROM
5	CCONT_INT	CCONT interrupt	From CCONT to MAD4
6	MBUS	Maintenance bus serial signal	Bi-directional serial bus to MAD4 and the bottom connector
7	FBUS_TX	Flash bus Tx signal	Serial bus from MAD4 to the bottom connector
8	FBUS_RX	Flash bus Rx signal	Serial bus from the bottom connector to MAD4
9	PWM	PWM	From CCONT to CHAPS
10	CLK9M83	9.83MHz square waveform	From CAFE to MAD4
11	CLK19M20	19.2MHz square waveform	From CAFE to MAD4
12	DATA(0)	Data bus(0)	From MAD4 to FLASH and SRAM
13	ADD(0)	Address bus(0)	From MAD4 to FLASH and SRAM
14	MEM(2)	Write enable signal (active low)	From MAD4 to FLASH, SRAM
15	MEM(1)	SRAM select signal	From MAD4 to SRAM
16	MEM(0)	FLASH ROM select signal	From MAD4 to FLASH
17	MEM(3)	Read enable signal (active low)	From MAD4 to FLASH, SRAM
18	RESETX	Reset signal (active low)	From MAD4 to CAFE
19	PWRONX	Power ON (active low)	From UI power key to MAD4 and CCONT
20	CLK_EN	VCTCXO enable signal	From MAD4 to FLASH, CCONT, and CAFE
21	UIF_CCONT_SCLK	LCD and CCONT serial bus clock	From MAD4 to LCD and CCONT
22	PURX	Power up reset signal (active low)	From CCONT to MAD4
23	SLEEPCLK	32.768KHz typical square waveform	From CCONT to MAD4
24	CCONTCSX	CCONT chip select signal	From MAD4 to CCONT
25	UIF_CCONT_SDIO	LCD and CCONT serial bus data	From MAD4 to LCD and CCONT
26	WD_DIS	Watchdog disable (active low)	CCONT test point for phone diagnosis mode
27	Vmad	MAD4 supply voltage	From CCONT to MAD4

Test point	Signal name	General characteristics	General signal destination
28	Vref	CCONT regulator output (typical 1.244V)	From CCONT to CAFE and battery I/F
29	CRB	32.768KHz	From 32K crystal to CCONT
30	Vbb	Baseband supply voltage (2.8V typical)	From CCONT to MAD4 and memories
31	VR3	CCONT regulator output 2(typical 2.8V)	From CCONT to RF receiver
32	VR4	CCONT regulator output 2(typical 2.8V)	From CCONT to RF transmitter
33	VR2	CCONT regulator output 2(typical 2.8V)	From CCONT to RF receiver
34	VR5	CCONT regulator output 2(typical 2.8V)	From CCONT to RF transmitter
35	VR6	CCONT regulator output 2(typical 2.8V)	From CCONT to CAFE
36	VR1	CCONT regulator output 2(typical 2.8V)	From CCONT to 19.2MHz VCTCXO
37	VR1_SW	2.75V (MIC bias)	From CCONT to V201 to CAFE
38	Vbat	Battery voltage (3.2-4.2V) (3.1-5.2V with charger connected)	From battery to CCONT and other various parts of the phone
39	L_GND	0V	From bottom connector through an inductor to phone ground
40	V_IN	Charger input (ACP-8:6V, LCH-9:8.3V typical)	From bottom connector to CHAPS
41	MICP	Mic differential positive signal	From bottom connector to CAFE internal microphone input
42	MICN	Mic differential negative signal	From bottom connector to CAFE internal microphone input
43	EAD_HEADINT	Headset interrupt signal	From bottom connector to MAD4
44	XEAR	External ear output	From CAFE to bottom connector
45	XMICN	Mic external signal	From bottom connector to CAFE external microphone input
46	XMICP	Mic external signal	From bottom connector to CAFE external microphone input
47	VR7	CCONT regulator output 2(typical 2.8V)	From CCONT to RF transmitter

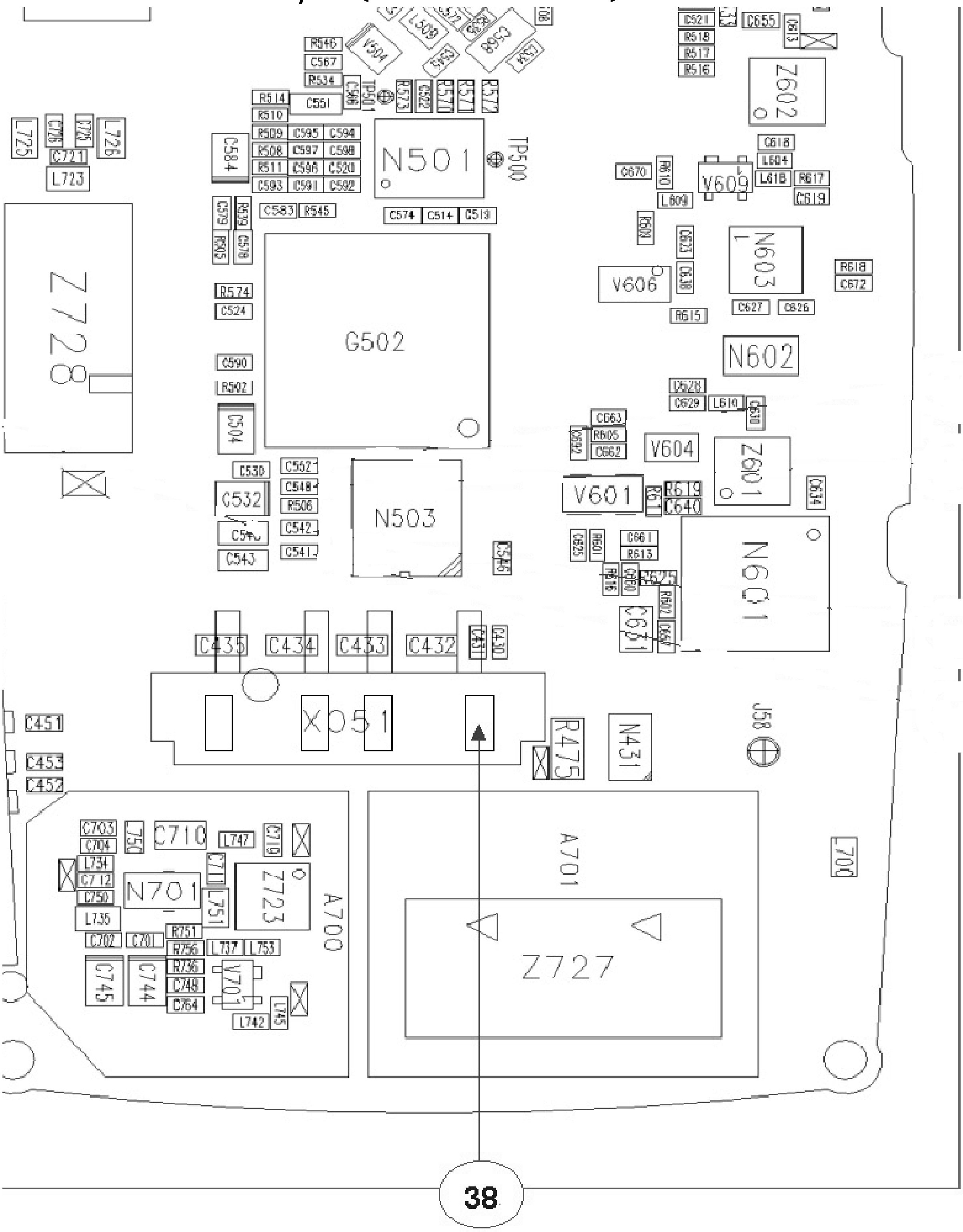
Baseband Test Point Layout (Top side view)



Baseband Test Points Layout (Bottom side View A)



Baseband Test Points Layout (Bottom side View B)



RF Troubleshooting

Purpose

This section is intended to help the troubleshooter quickly determine and fix problems with NSD-5 phones that have failed in the field.

Introduction

This document is written for use in conjunction with the WinTesla Tuning and Testing software. Screen shots of the menu structures are shown throughout the document. This document should be used in conjunction with the phone's schematics which are referred to in detail throughout.

WinTesla has three key menus:

Configure — Basic set up covered in WinTesla General Set Up

Testing — This menu allows switching on the phone in different modes

Tuning — This menu allows tuning and storing of data to eeprom

Tuning is described in four parts:

A description of the tuning: Describes the tuning process
Definition of result: What tuning is storing to eeprom
Manual Verification: How to use WinTesla to tune the phone
Troubleshooting: Outlines key components to be checked

Reference Documents

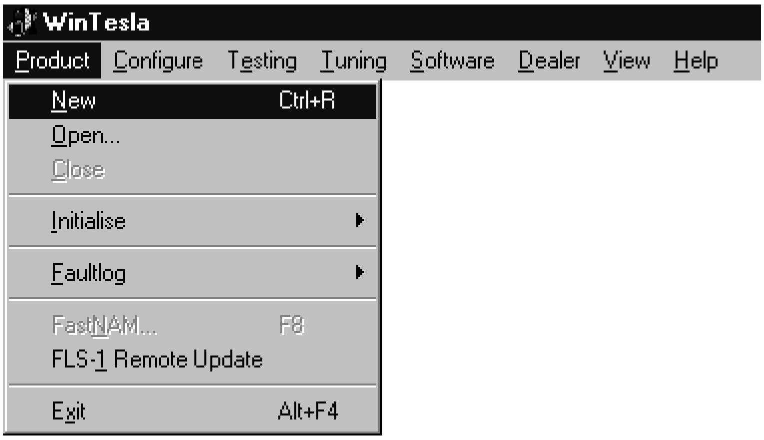
The phone's schematics are essential for troubleshooting and are referred to in detail throughout the document.

The following document may also be useful as a reference:

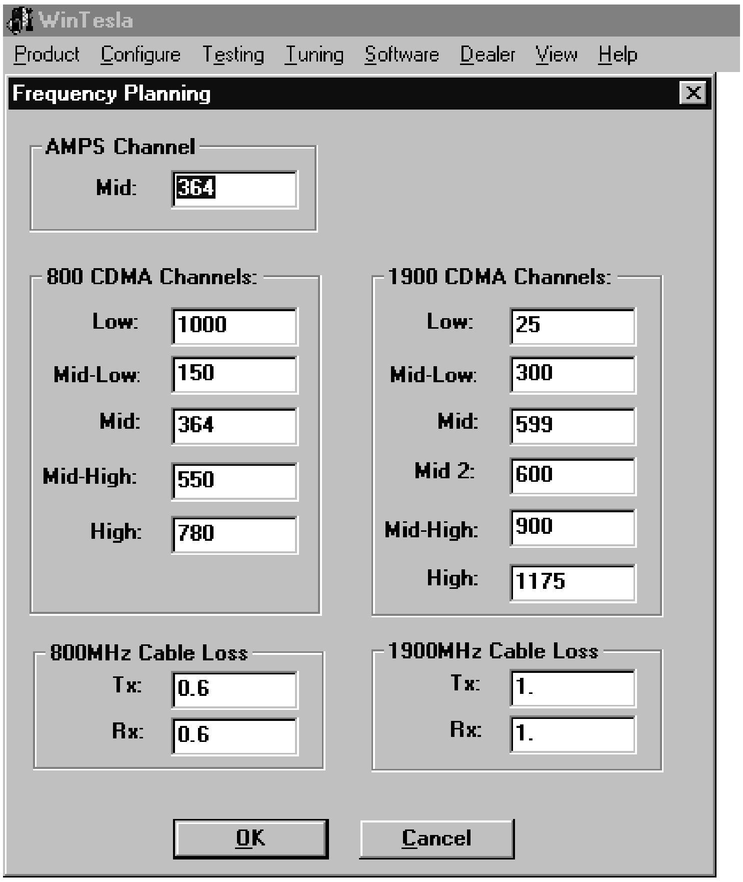
DRK00009-EN: *Diagnostic Technicians Guide to Zim Flash/Alignment and Final/UI Tuning and Testing*

WinTesla General Set Up

Following connection of the phone to the PC COM port and starting WinTesla, select **Product** from the main WinTesla menu and **New** from the drop-down menu. The ZIM configuration will automatically be selected.



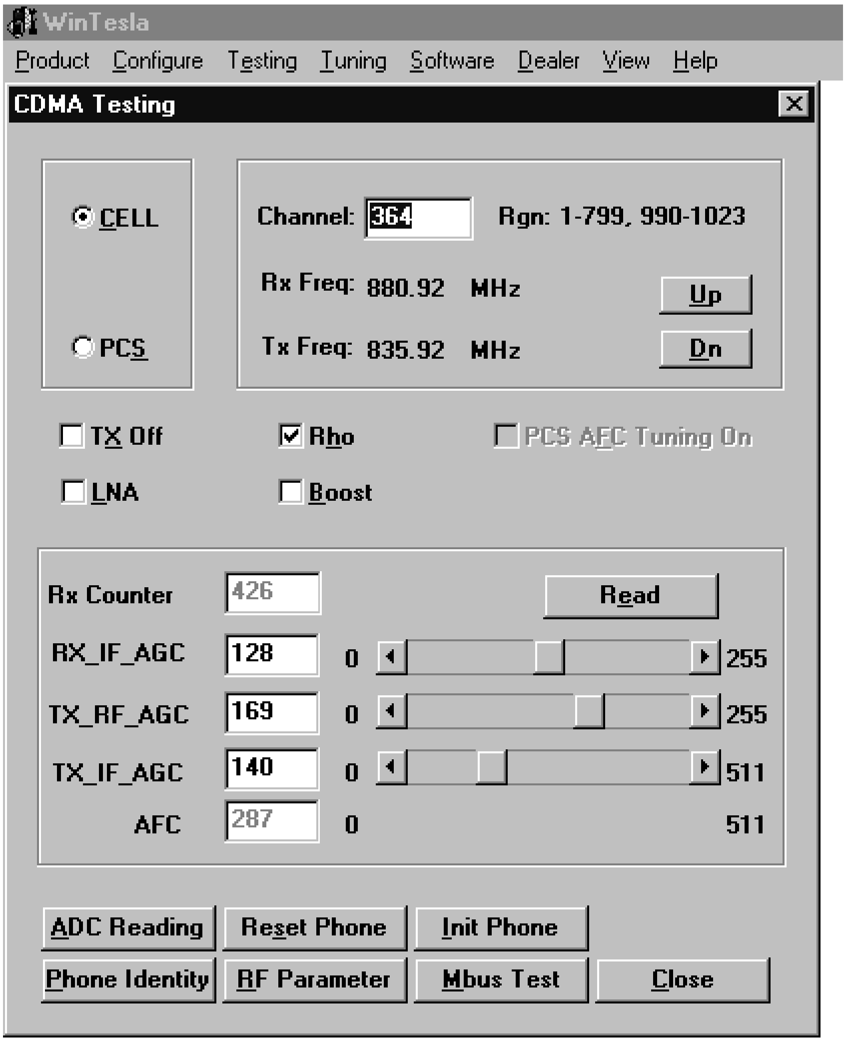
Select **Configure** from the main WinTesla menu and then choose **Frequency Planning** from the drop-down menu. You then will be able to set up the default CDMA Channels. The cable loss also should be entered. It is possible to enter a Tx and Rx cable loss separately; however, if a single cable is being used, then both losses should be the same.



CDMA Fault-finding Set Up

CDMA testing is started by selecting **Testing** from the main WinTesla menu and then selecting **CDMA Tests** from the drop-down menu. The “CDMA Testing” dialog box default switches on both the transmitter in Rho mode (Tx with CDMA modulation) and the receiver ON, with the channel defined as “Mid” in the “Frequency Planning” dialog box.

PDMs may be adjusted on the “CDMA Testing” dialog box with the slider bars or by entering a value in the appropriate boxes. The transmitter is switched off by inserting a checkmark in the TX Off box. The Rho box switches on the CDMA IQ modulation. The RX_IF_AGC is read by clicking the **Read** button. The LNA defaults to ON and can be switched off by inserting a checkmark in the LNA box.



Synthesizer Tuning Menu

WinTesla prompts you with equipment settings for all the tunings. At the end of the tuning sequence, WinTesla gives you the option of saving the new tuning values to EEPROM or of exiting without saving the new values to EEPROM.

Tuning AFC

Description of Test

This test tunes the VCTCXO to exactly 19.2MHz using a DC voltage (C519 or TPD205) controlled by the AFC PDM. The resulting PDM is stored to EEPROM. The CDMA IQ modulation is switched off. The output carrier is monitored with a spectrum analyzer. Click on WinTesla Help for equipment set-up. The AFC PDM is tuned until the RF CW carrier frequency is within +/-250Hz of 2073.1MHz (i.e., Channel 300).

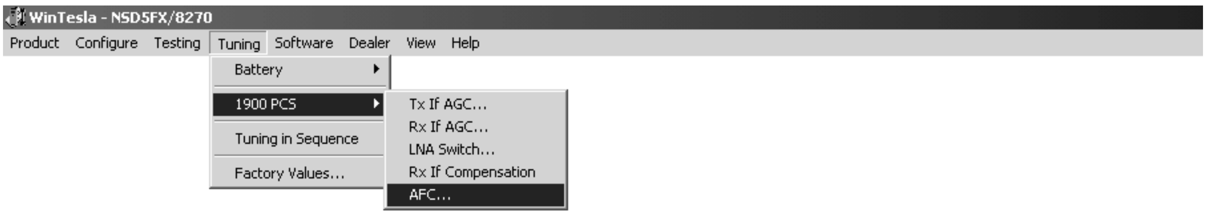
Note: The Spectrum Analyzer must be connected to a high-stability, 10MHz reference at the rear of the instrument. If this is not done, then the tuning will not be accurate.

Definition of Result

As a result of this tuning, the AFC PDM is stored to EEPROM, which puts the VCTCXO at the correct frequency.

Manual Verification

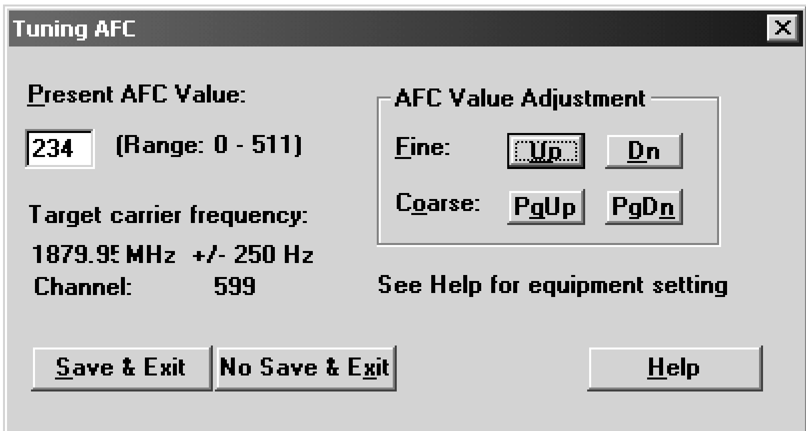
Use WinTesla as follows:



1. Select **Tuning** from the WinTesla main menu and choose **1900 PCS** and **AFC...** from the drop-down menus.

2. The “Tuning AFC” dialog box is displayed. Use this box to adjust the Present AFC values, using the **Up** and **Dn** buttons or the **PgUp** or **PgDn** buttons.

3. Select either the **Save & Exit** button or the **No Save & Exit** button when through.

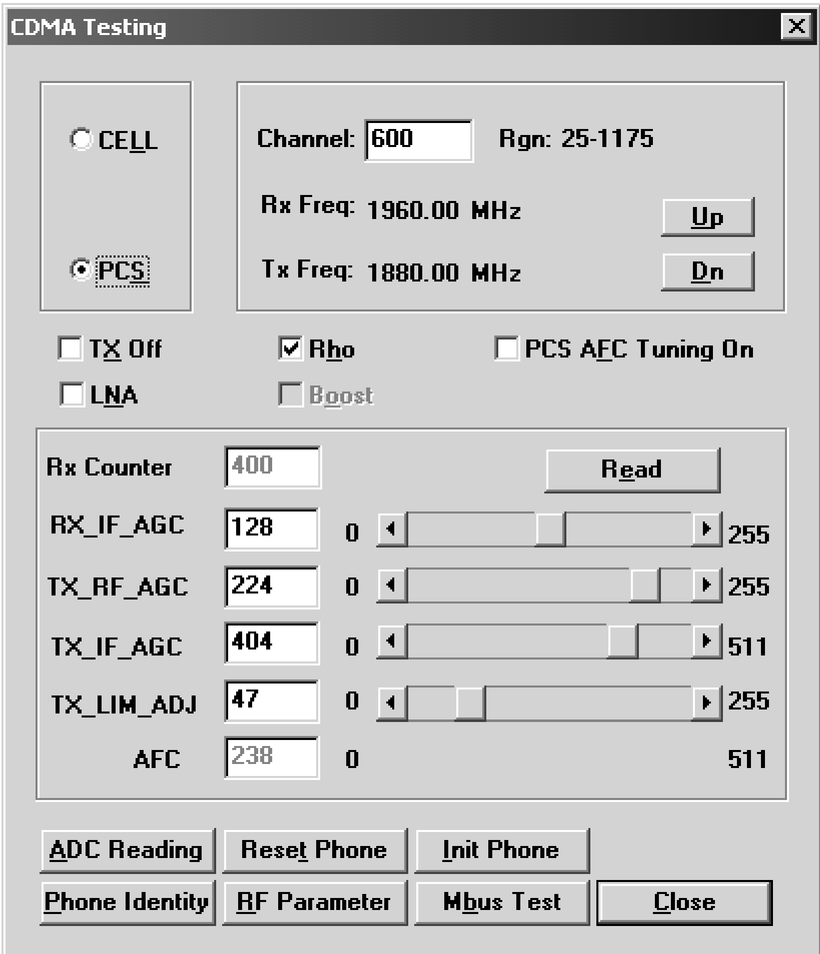


Synthesizer Troubleshooting

The VCTCXO reference designator is G501. VR1 supplies 2.7V to the VCTCXO through R501, decoupled with C561. The VCTCXO is controlled by a DC level from the AFC PDM in MAD, connected to Pin1. The PDM is filtered by R141 and C141 in the baseband section and by R504 and C507 in the RF section. Typically, a correctly tuned VCTCXO should have approximately 1.5 volts on Pin 1.

Adjustment of the AFC PDM from 0 to 511 should result in a voltage change on G501 Pin 1 of between 0.77 and 2.09 volts with approximately 45kHz change in the transmitter output frequency in the PCS band.

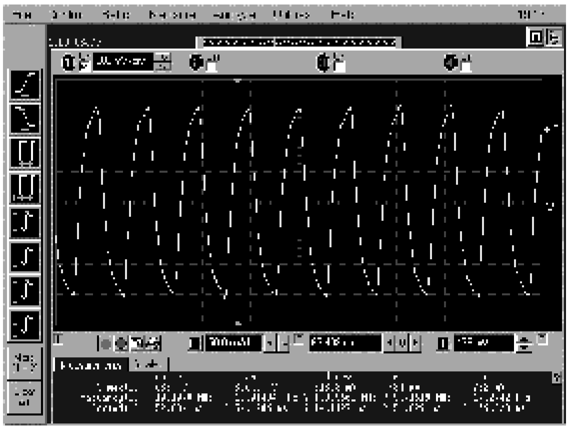
Selecting the “PCS AFC Tuning On” box disables the CDMA modulation, allowing AFC tuning to be performed on the RF carrier feed through.



Test Points

Test Point	Signal Name	General Characteristics	General Signal Destination
C507-R504	AFC	VCTCXO control voltage	PDM from MAD4
R530-R501	VR1	2.7V supply to VCTCXO	CCONT to VCTCXO
C519-C544	19.2MHz	19.2MHz from VCTCXO output	VCTCXO output to CAFE and PLL IC's
C518	Tx VHFLO	VHF LO to TIF CELL CDMA 346.2MHz	LO from PLL to TIF IC
C517	Rx VHFLO	256.2MHz VHF LO to RIF	LO from PLL to RIF

19.2MHz measured at the output of the VCTCXO with a 10 Mohm probe. The figure below shows the 19.2MHz signals measured by oscilloscope.



Requirements

Test Point	Signal Name	Specification
C507-R504	AFC	1.5 +/- 0.5V
C519-C544	19.2MHz	19.2MHz +/- 150Hz
C518	Tx VHF LO	$\geq$ -20dBm
C517	Rx VHF LO	$\geq$ -12dBm
C510	TX UHF LO	$\geq$ -5dBm
C524	RX UHF LO	$\geq$ -5dBm

Trouble Case 1: Tx VHF LO Power $\leq$ -20dBm

Check the DC level of V508.

DC level of pin 1 $\geq$ 1V, pin2 0.7 -0.8V, pin 3 $\geq$ 2V, between Pin 1 and Pin 2 from 0.6 to 0.8V

If not, change V508.

Trouble Case 2: Rx VHF LO Power ≤ -12dBm

Check the DC level of V506.

DC level of Pin 1 ≥ 1V, Pin 2 0.7 0.8V, Pin3 ≥ 2V, between Pin 1 and Pin 2 from 0.6 to 0.8V

If not, change V506.

Trouble Case 3: UHF LO Power ≤ -5dBm

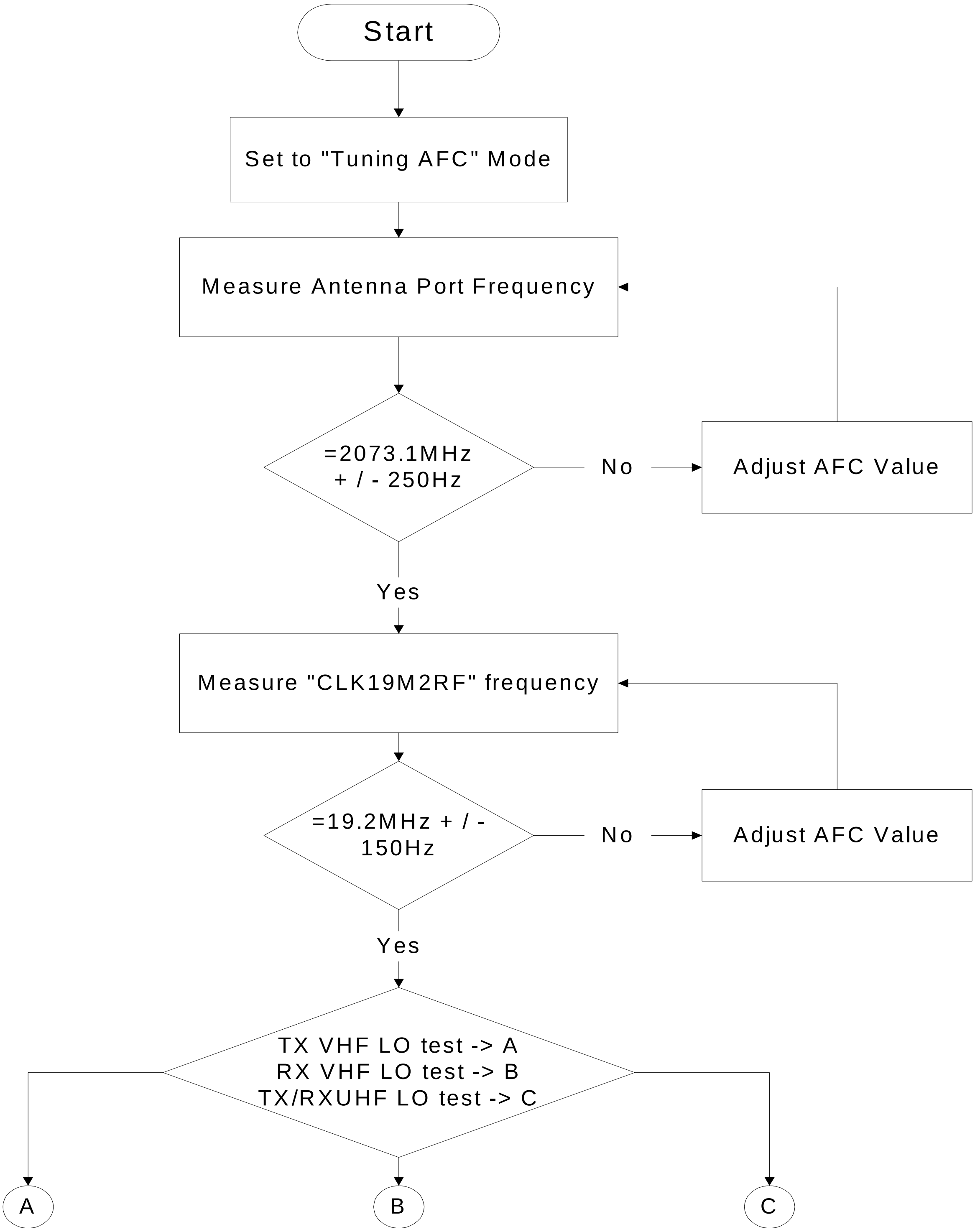
Check the DC level of V502.

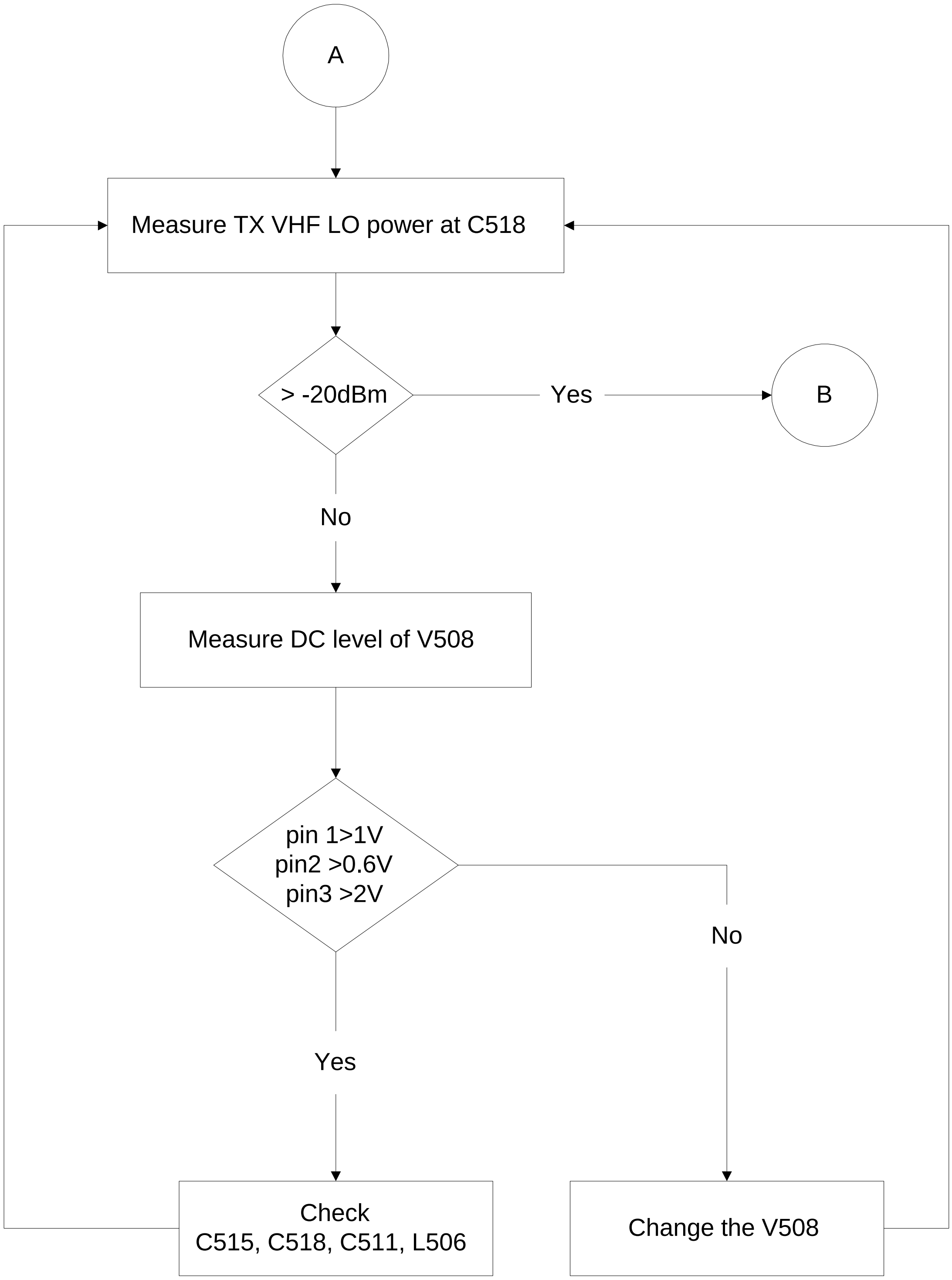
DC level of Pin 1 ≥ 0.5V, between Pin 1 and Pin 2 from 0.6 to 0.8V

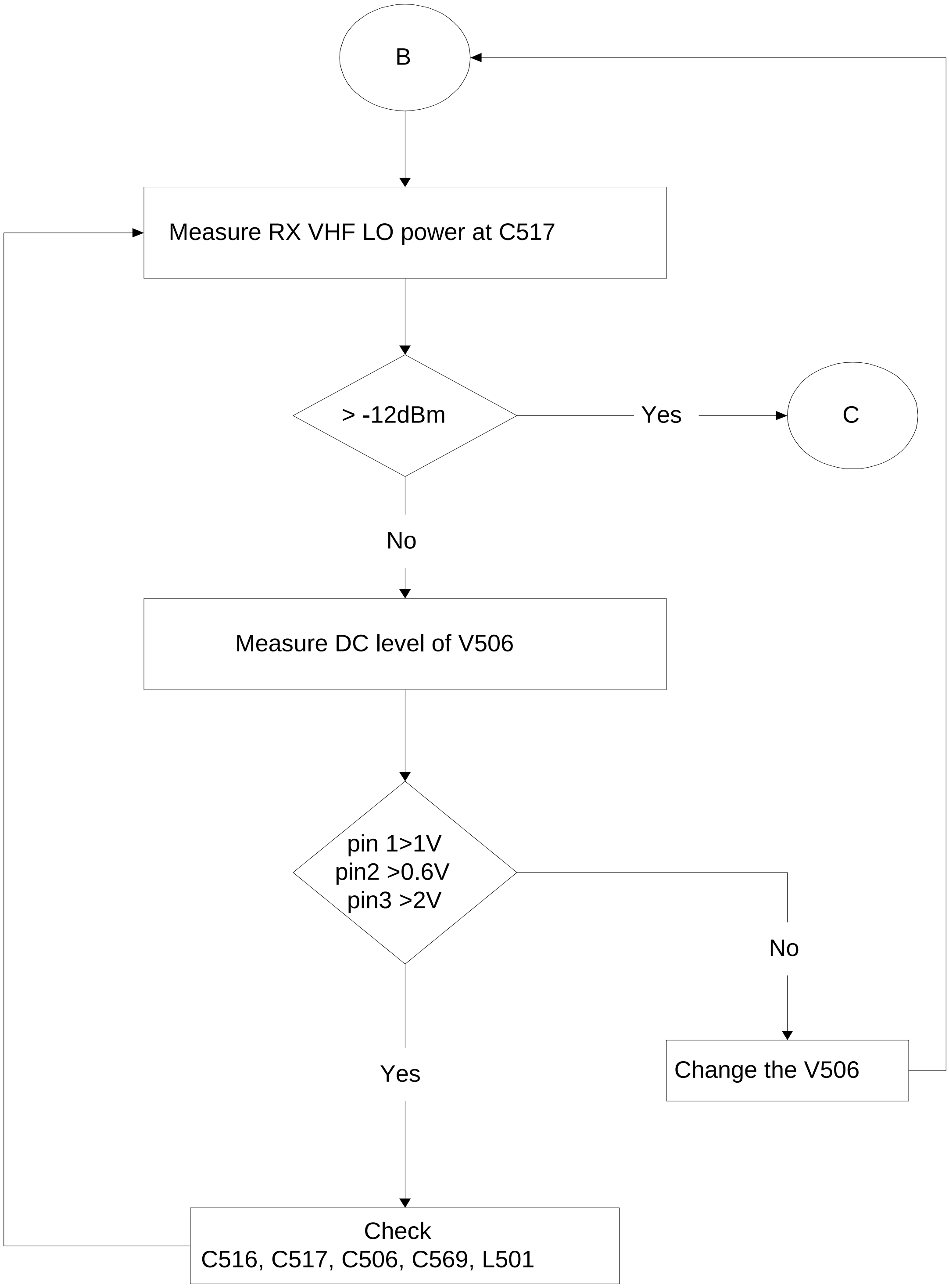
If not, change V502.

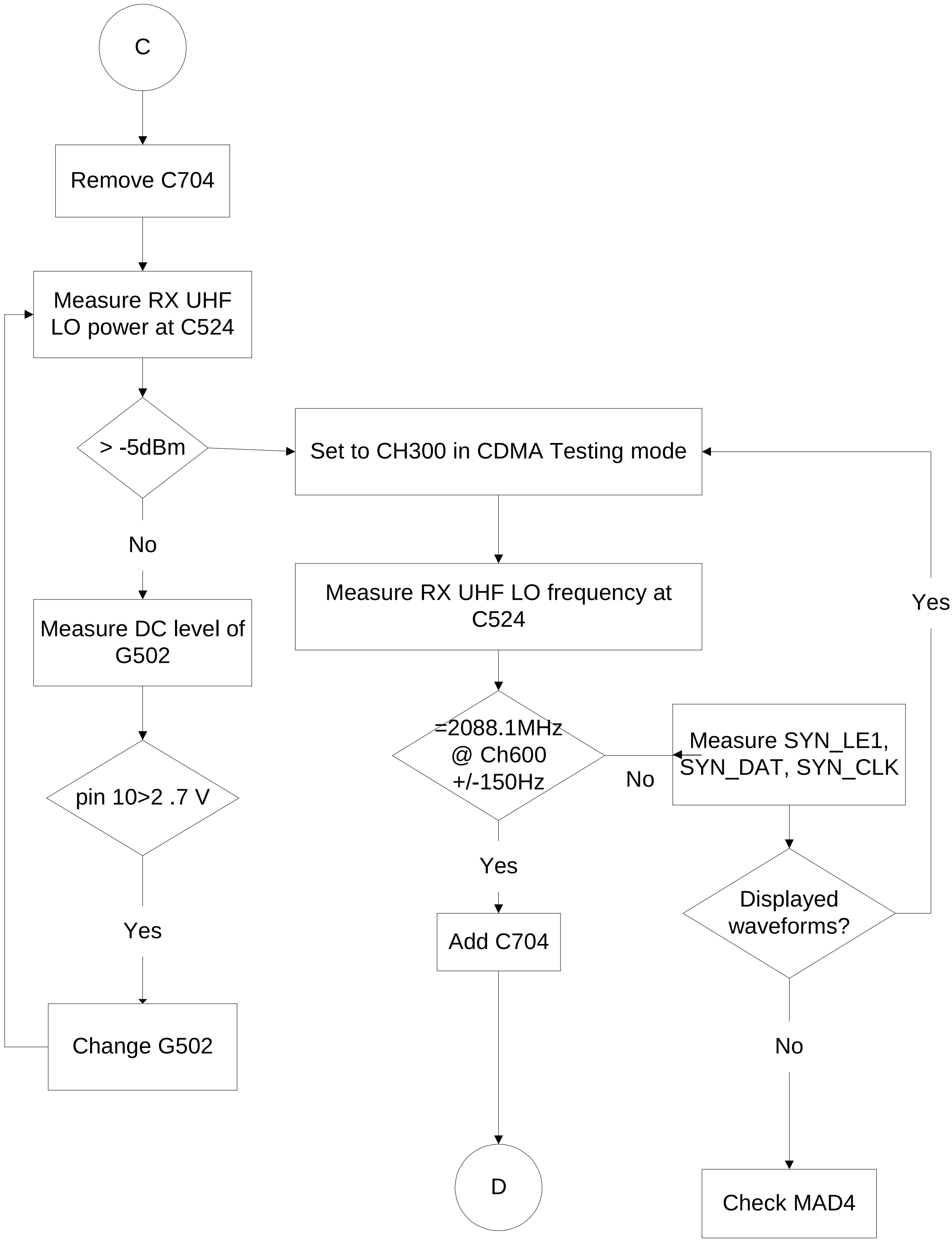
Trouble Case 3: Rx UHF LO Power ≤ -5dBm

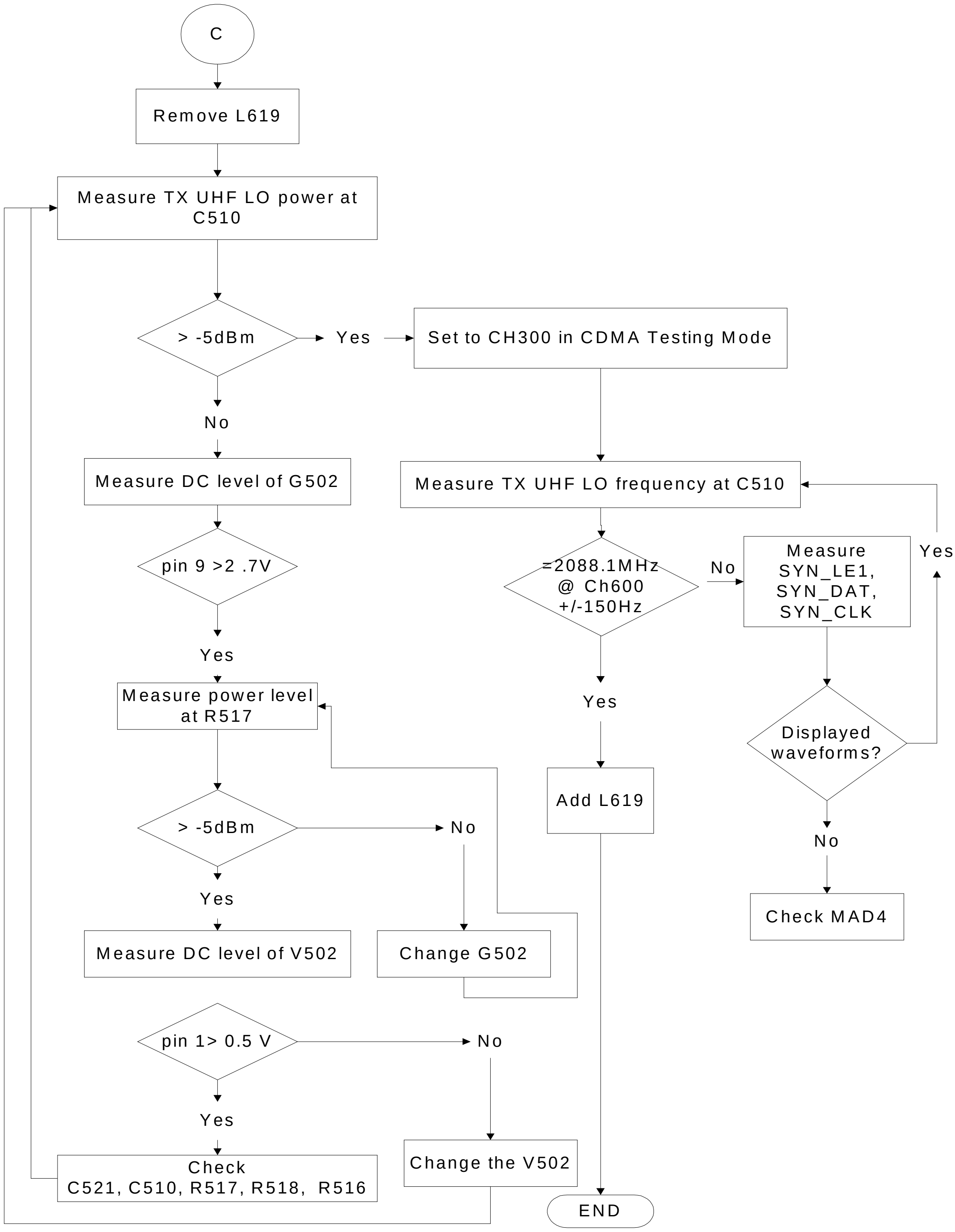
Change G502.


Start
Set to "Tuning AFC" Mode
Measure Antenna Port Frequency
=2073.1MHz
+ / - 250Hz
No
Adjust AFC Value
Yes
Measure "CLK19M2RF" frequency
=19.2MHz + / -
150Hz
No
Adjust AFC Value
Yes
TX VHF LO test -> A
RX VHF LO test -> B
TX/RXUHF LO test -> C
A
B
C


A
Measure TX VHF LO power at C518
> -20dBm
Yes
B
No
Measure DC level of V508
pin 1>1V
pin2 >0.6V
pin3 >2V
No
Yes
Check
C515, C518, C511, L506
Change the V508


B
Measure RX VHF LO power at C517
> -12dBm
Yes
C
No
Measure DC level of V506
pin 1>1V
pin2 >0.6V
pin3 >2V
No
Change the V506
Yes
Check
C516, C517, C506, C569, L501


C
Remove C704
Measure RX UHF LO power at C524
> -5dBm
No
Measure DC level of G502
pin 10>2 .7 V
Yes
Change G502
Set to CH300 in CDMA Testing mode
Measure RX UHF LO frequency at C524
=2088.1MHz @ Ch600 +/-150Hz
No
Yes
Add C704
D
Measure SYN_LE1, SYN_DAT, SYN_CLK
Displayed waveforms?
Yes
No
Check MAD4



TX Tuning

Description of Test

The RIF and TIF AGC is approximately a second-order curve; this curve is split into 16 segments for both Transmitter and Receiver. Offset and slope values are stored in EEPROM for each of these 16 segments. The offset for the segments is computed from the 3-point calibration performed in this test. Then a second-order approximation is made and the offset and slope computed.

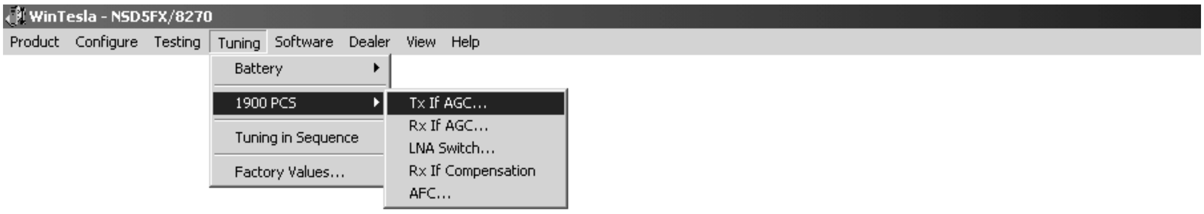
TX_IF_AGC must be adjusted to achieve the correct power level for Point 1. When this is done, the process must be repeated for Points 2 and 3.

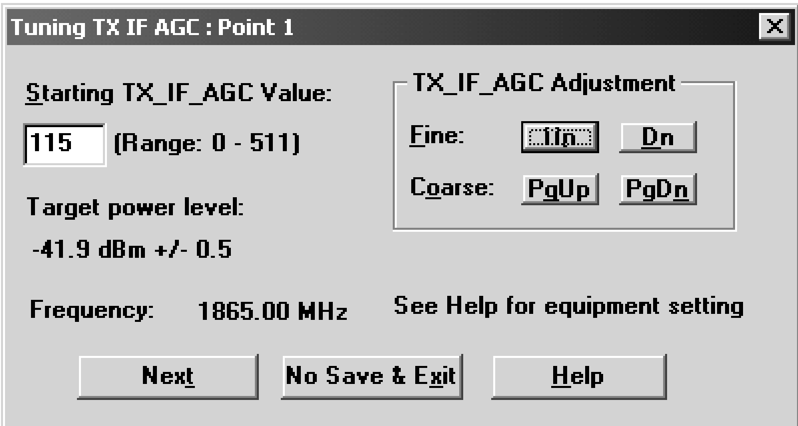
Definition of Result

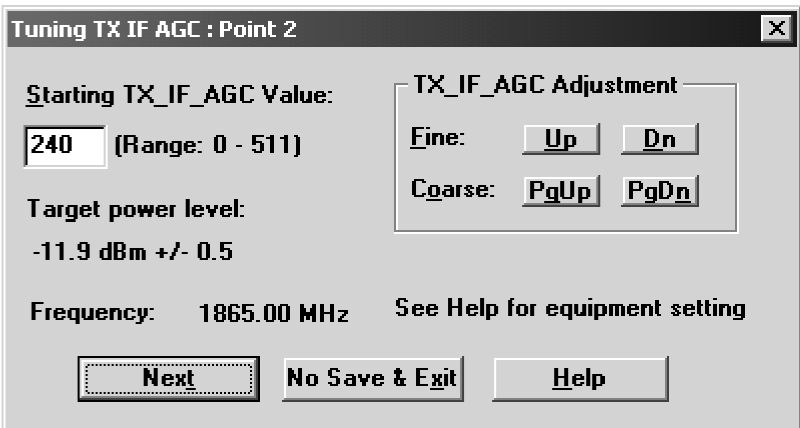
The results of the three-point tuning are the 16 slope and offset values, which are stored to EEPROM RF_TUNE_PCS_TX_AGC_OFFSET_SLOPE_HANDLE.

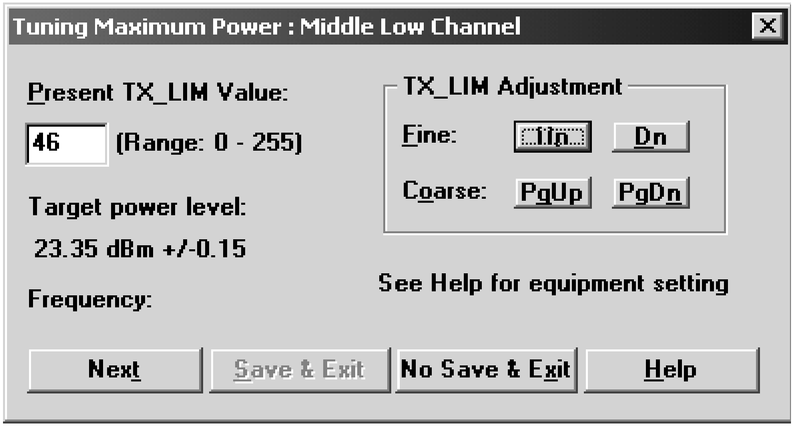
Manual Verification

Use WinTesla as follows:

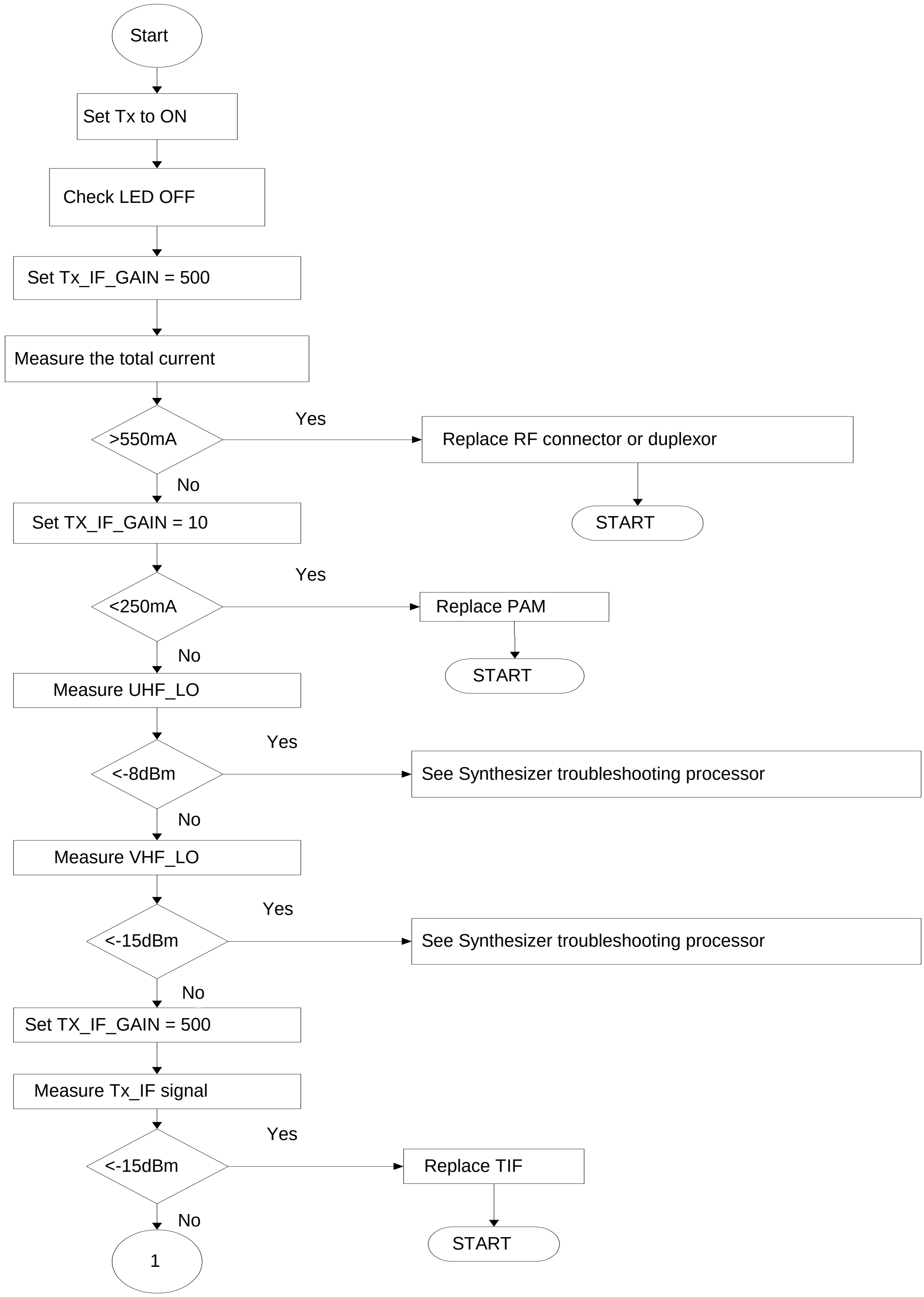


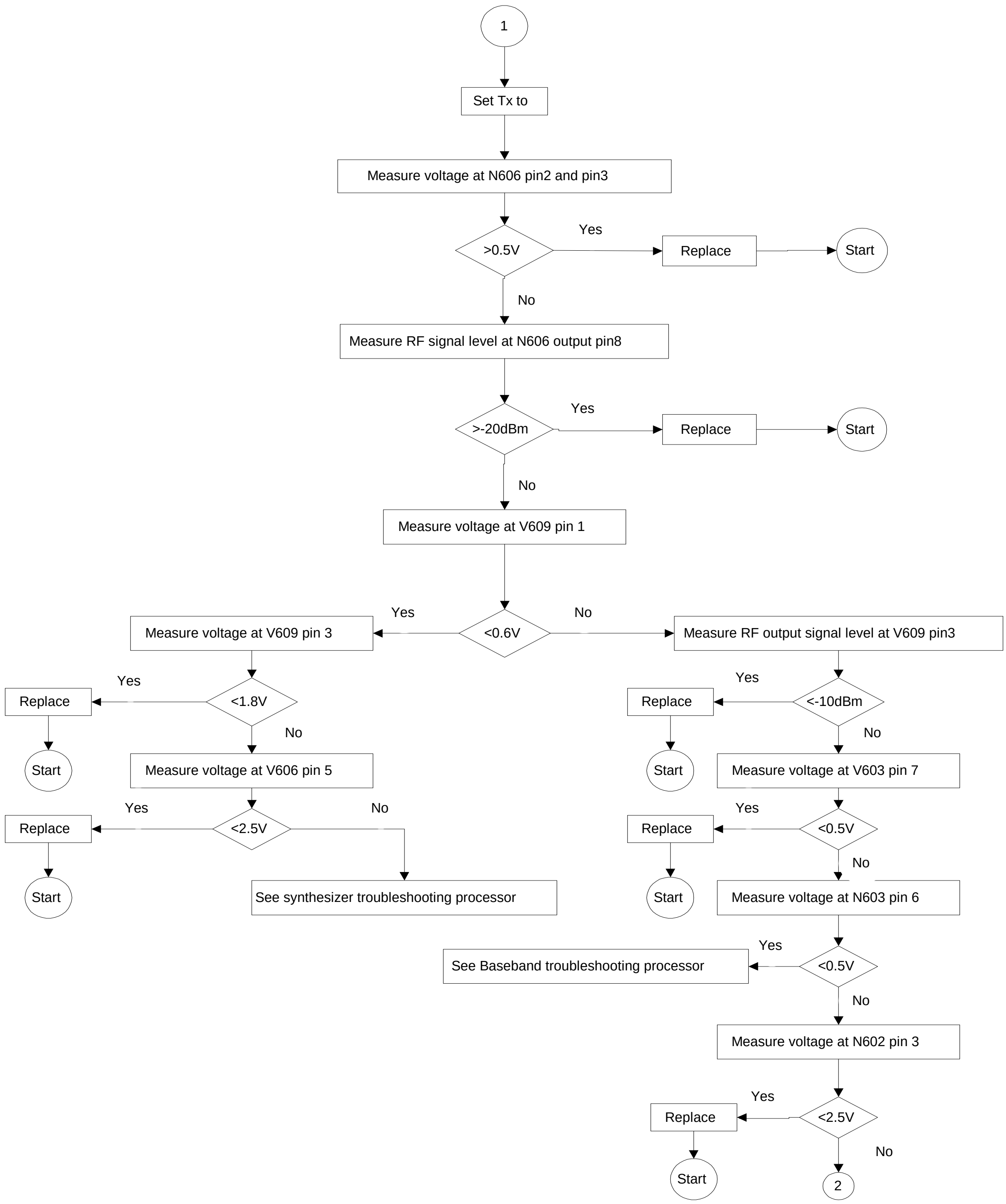


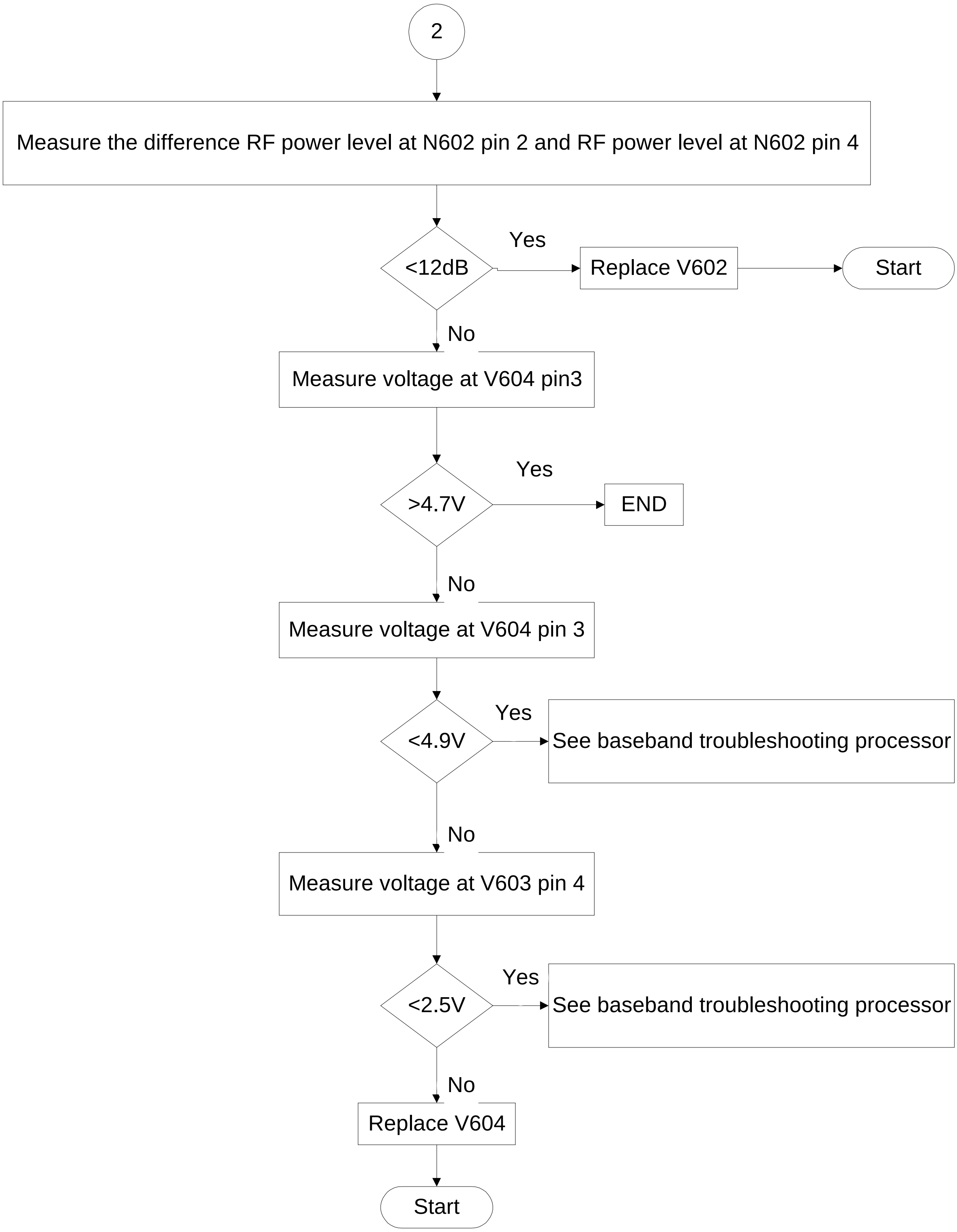



Tuning Maximum Power : Middle Low Channel
Present TX_LIM Value:
46
(Range: 0 - 255)
Target power level:
23.35 dBm +/-0.15
Frequency:
TX_LIM Adjustment
Fine:
Up
Dn
Coarse:
PgUp
PgDn
See Help for equipment setting
Next
Save & Exit
No Save & Exit
Help

TX Troubleshooting Flowchart




1
Set Tx to
Measure voltage at N606 pin2 and pin3
>0.5V
Yes
Replace
Start
No
Measure RF signal level at N606 output pin8
>-20dBm
Yes
Replace
Start
No
Measure voltage at V609 pin 1
<0.6V
Yes
Measure voltage at V609 pin 3
No
Measure RF output signal level at V609 pin3
<1.8V
Yes
Replace
Start
No
Measure voltage at V606 pin 5
<2.5V
Yes
Replace
Start
No
See synthesizer troubleshooting processor
<-10dBm
Yes
Replace
Start
No
Measure voltage at V603 pin 7
<0.5V
Yes
Replace
Start
No
Measure voltage at N603 pin 6
<0.5V
Yes
See Baseband troubleshooting processor
No
Measure voltage at N602 pin 3
<2.5V
Yes
Replace
Start
No
2



1900 PCS Tuning Rx IF AGC

Description of Test

The RIF and TIF AGC is approximately a second-order curve. This curve is split into 16 segments for both transmitter and receiver. Offset and slope values are stored in

EEPROM for each of these 16 segments. The offset for the segments is computed from the three-point calibration performed in this test. Then, a second-order approximation is made and the offset and slope computed.

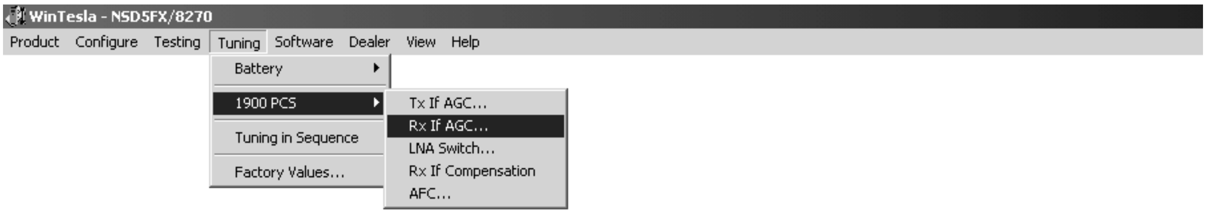
This tuning is done by putting signal level 1 into the receiver. The RX_IF_AGC will then automatically adjust for max CAFE input and the RX_IF_AGC is noted. This process is then repeated for signal levels 2 and 3.

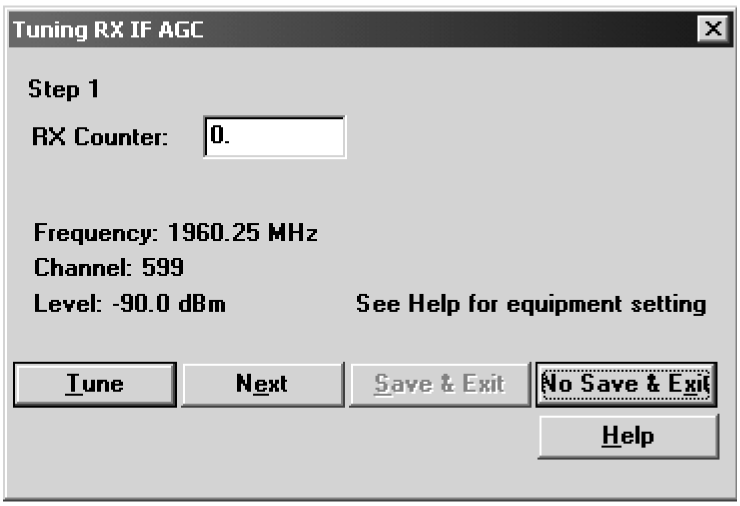
Definition of Result

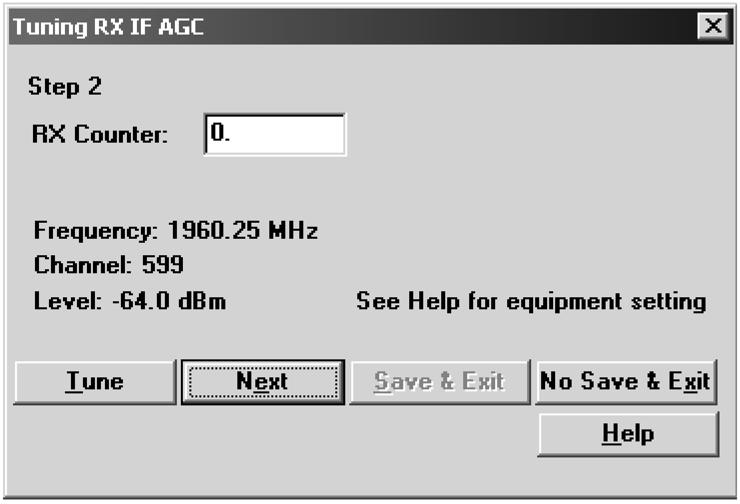
The results of the three-point tuning are the 16 slope and offset values, which are stored to EEPROM RF_TUNE_PCS_RX_AGC_OFFSET_SLOPE_HANDLE.

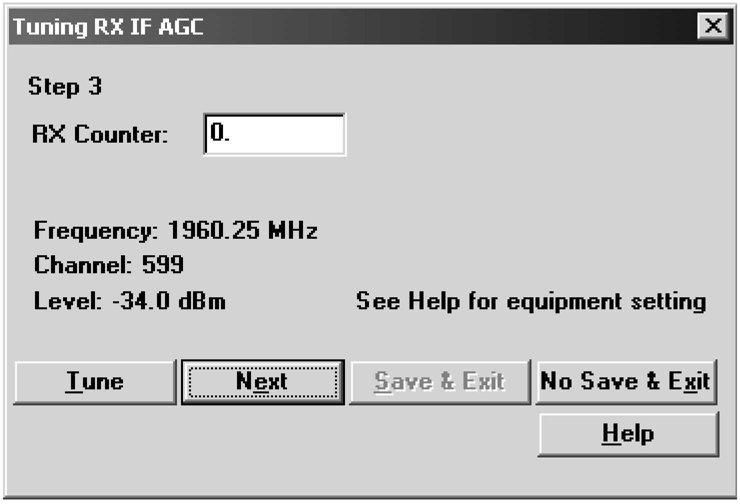
Manual Verification

Use WinTesla as follows:









1900 PCS Tuning Rx IF Compensation

Description of Test

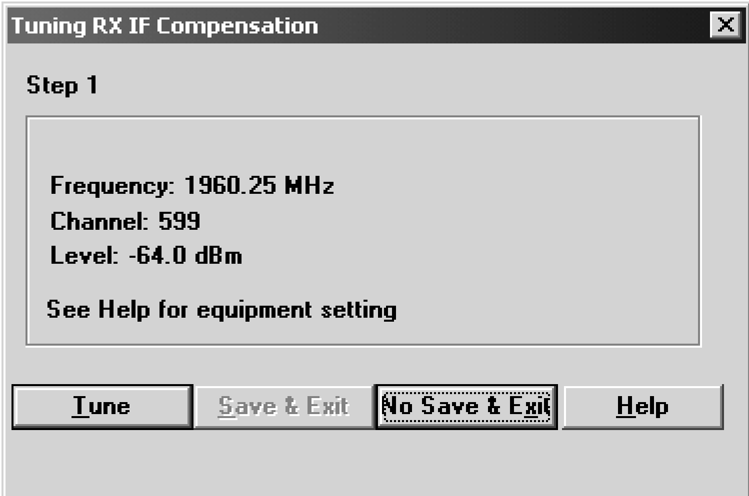
In this tuning, the receiver is calibrated at five different frequencies across the band. WinTesla instructs the signal generator to be set at five specific frequencies and a fixed amplitude. The RX_IF_AGC is adjusted by the phone's software to make the best use of the CAFE ADC. The setting of RX_IF_AGC then is read from the phone at each of the five frequencies.

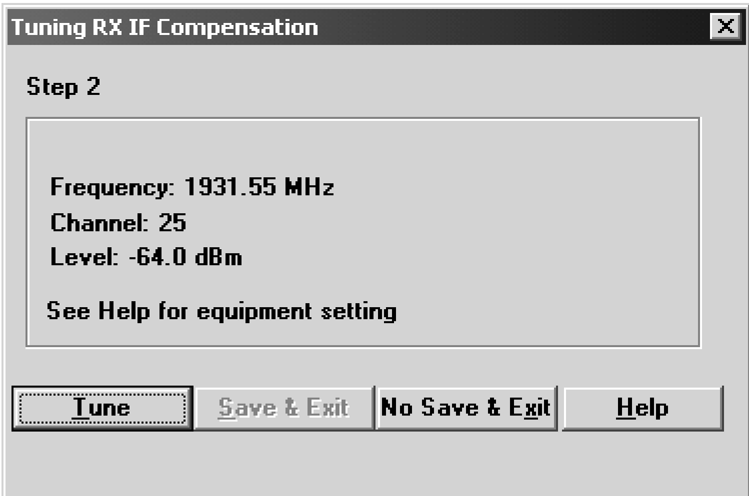
Definition of Result

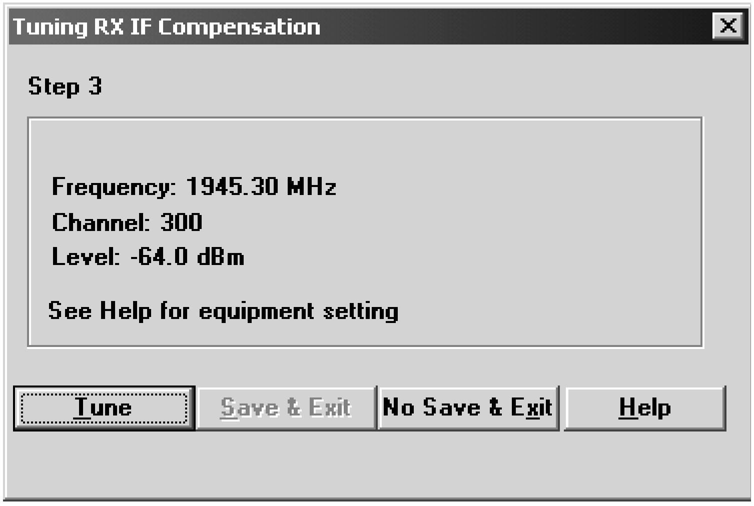
The five different values of RX_IF_AGC are stored to EEPROM.

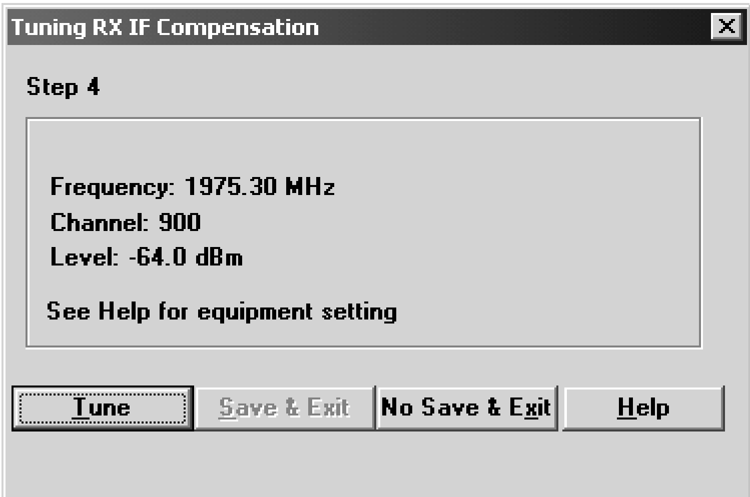
Manual Verification

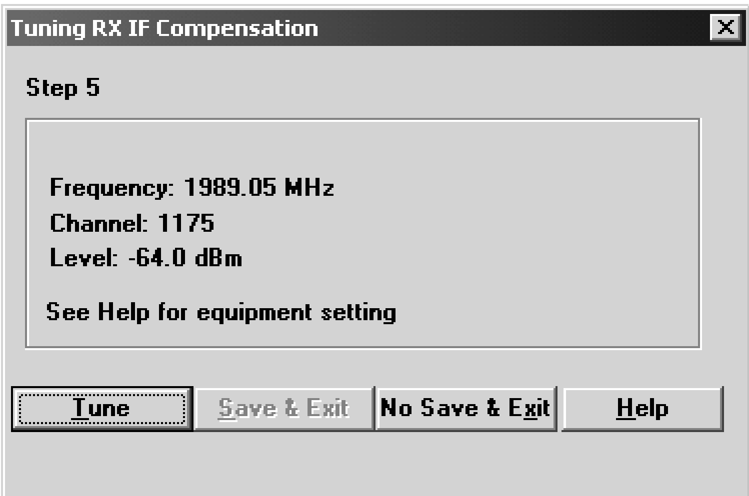
Use WinTesla as follows:






Tuning RX IF Compensation
Step 3
Frequency: 1945.30 MHz
Channel: 300
Level: -64.0 dBm
See Help for equipment setting
Tune
Save & Exit
No Save & Exit
Help


Tuning RX IF Compensation
Step 4
Frequency: 1975.30 MHz
Channel: 900
Level: -64.0 dBm
See Help for equipment setting
Tune
Save & Exit
No Save & Exit
Help


Tuning RX IF Compensation
Step 5
Frequency: 1989.05 MHz
Channel: 1175
Level: -64.0 dBm
See Help for equipment setting
Tune
Save & Exit
No Save & Exit
Help

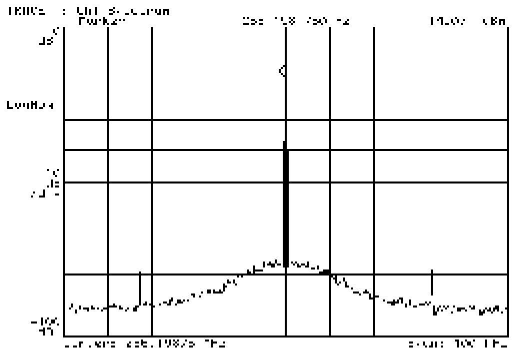
RX Troubleshooting

Troubleshooting

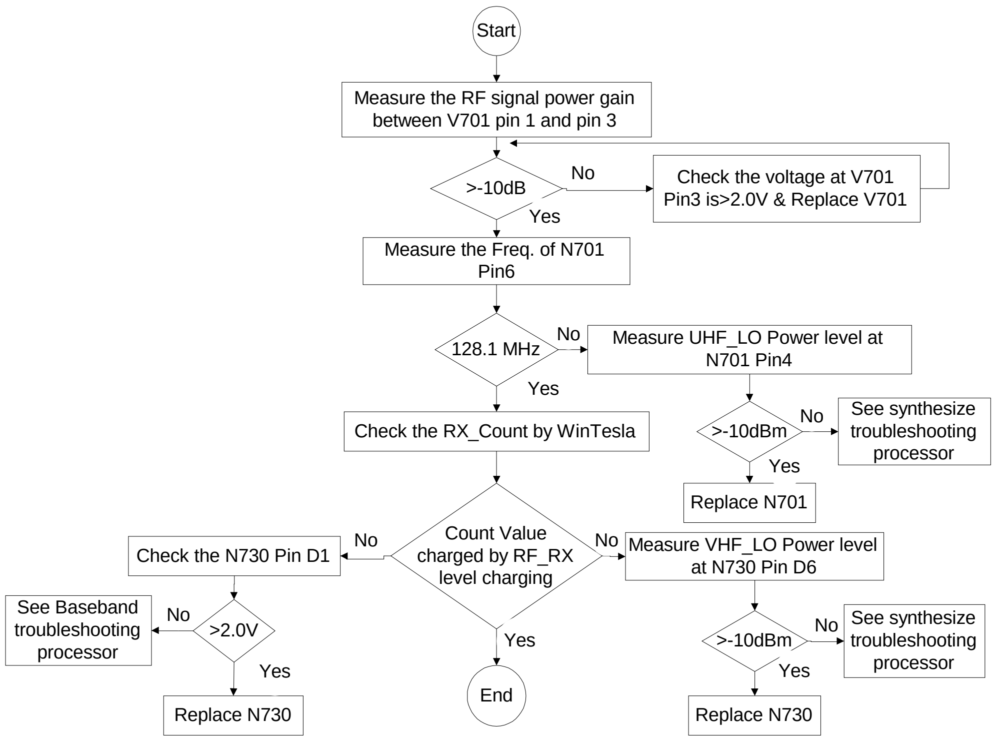
Check components in the receiver chain from Duplexer Z727, LNA V701 and Mixer N701, the 128.1MHz CDMA IF SAW filter Z728 and RIF N730. Check that the RX_IF_AGC RIF Pin D2 changes as the receiver input signal level is adjusted. Check the Rx VHF LO RIF C517. See plot diagram (following) and the Synthesizer Block.

Note: If any of these components are damaged and are replaced, then the Rx IF AGC second-order curve must be returned.

Rx VHF LO Measured at RIF Pin 20 with a Hi Z Probe



RX Troubleshooting Flowchart



Test Points

Signal Name	General Characteristics	General Signal Destination
AFC	VCTCXO control voltage	PDM from MAD4
VR1	2.7V supply to VCTCXO	CCONT to VCTCXO
19.2MHz	19.2MHz from VCTCXO buffer	VCTCXO buffer to CAFE and PLL IC's
TX_LIM_ADJ	Detector demand voltage	PDM from MAD4 Pin 128 deector circuit at RF output
1900 MHz PA Output	RF output from PA check for short with phone switched OFF	RF output from PA

Signal Name	General Characteristics	General Signal Destination
Tx VHF LO	VHF LO to TIF PCS CDMA 436.2MHz	LO from PLL to TIF IC
Tx UHF LO	UHF LO up converter IC	LO from 2GHz VCO to up converter IC
Rx VHF LO	256.2MHz VHF LO to RIF	LO from PLL to RIF
RX_IF_AGC	DC voltage proportional to signal level into receiver in CDMA mode	AGC control voltage from MAD4 Pin A16 to RIF Pin D2