Troubleshooting - RF

Contents Page

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Introduction

The following figures show the main components of the RF interface.

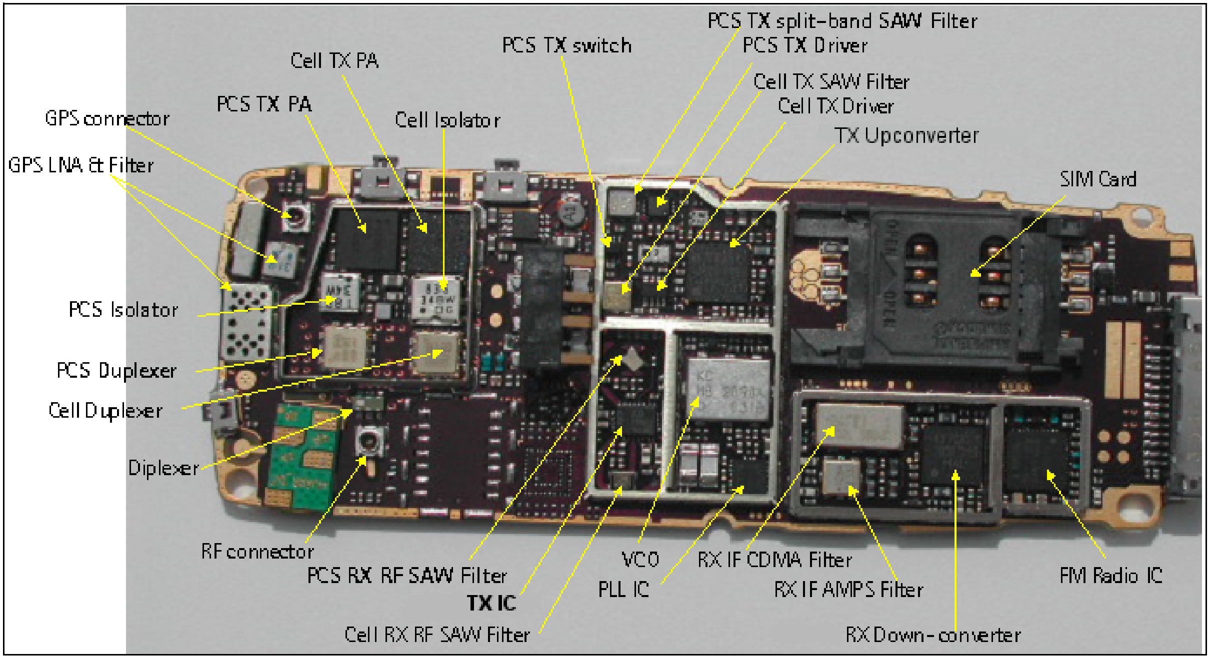


Figure 1: Baseband components – top view

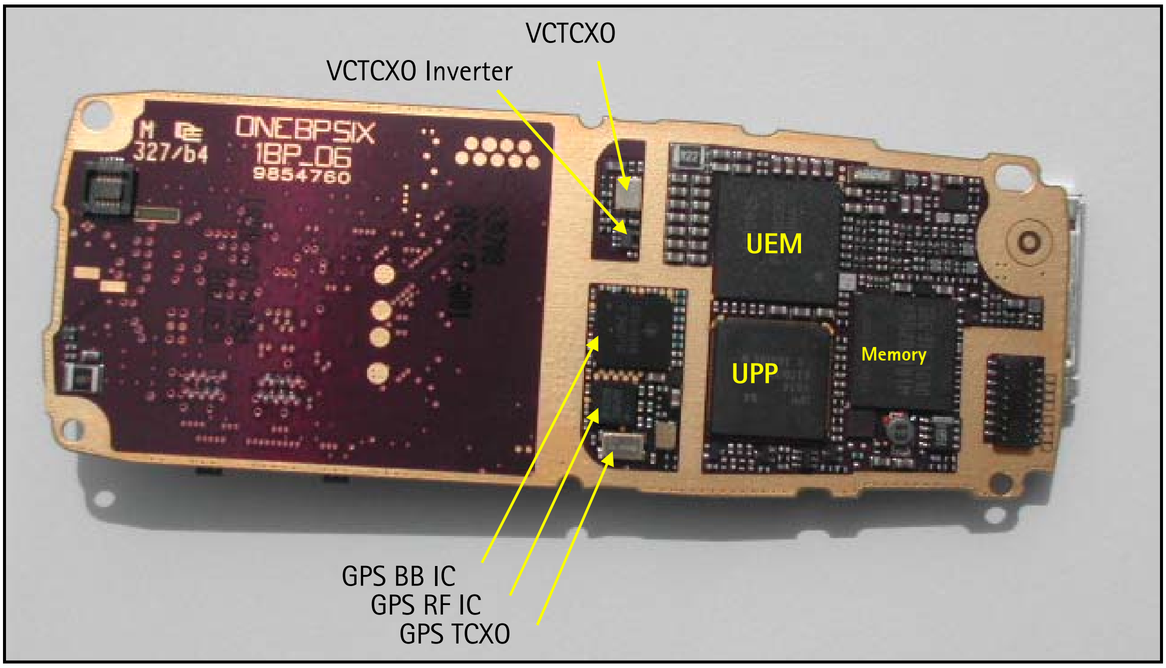


Figure 2: Baseband components – bottom view

Equipment List for RF Troubleshooting

You must have the following equipment to troubleshoot the RF using Phoenix:

- Agilent 8960 CDMA call box (if 8960 is not available, then a signal generator is needed)
- Power supply
- Diagnostic test jig
- RF connector snap cable
- Spectrum analyzer
- Active FET probe
- Pop-port® headset and Universal Headset for FM radio

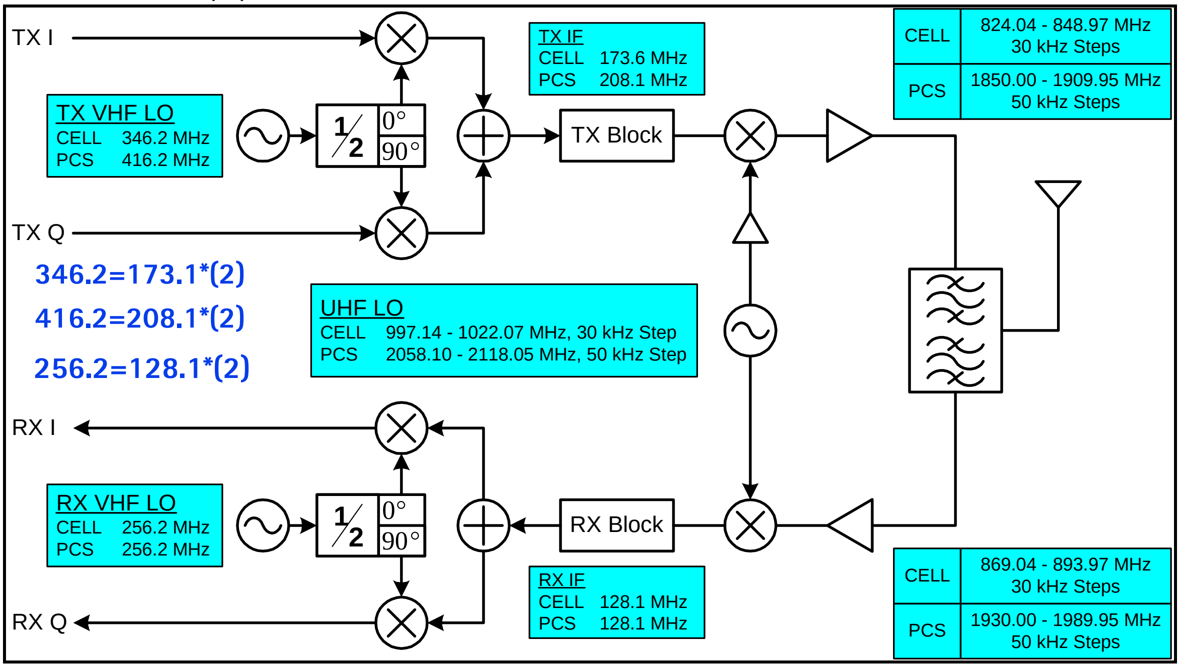
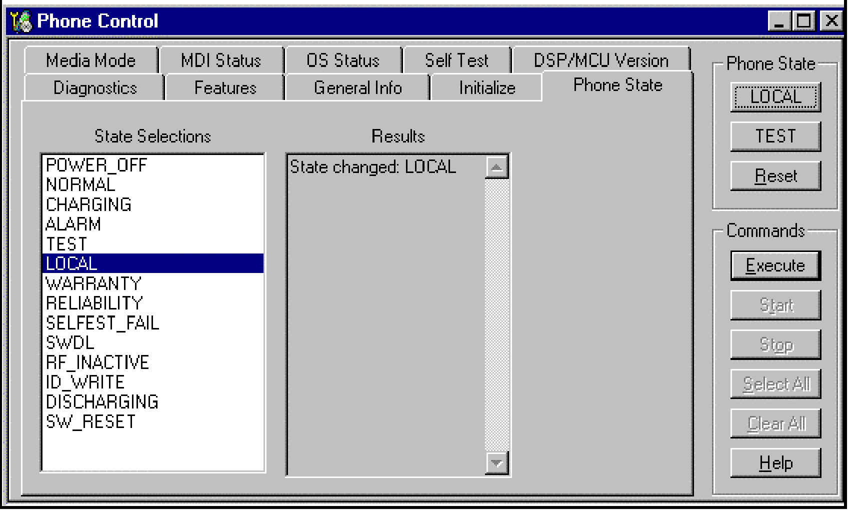


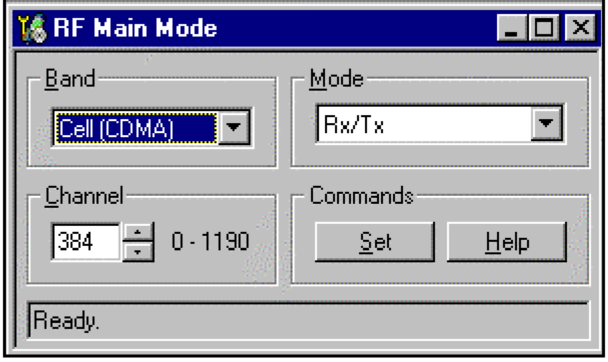
Figure 3: RF block diagram

RF (Manual Control) Components in Phoenix

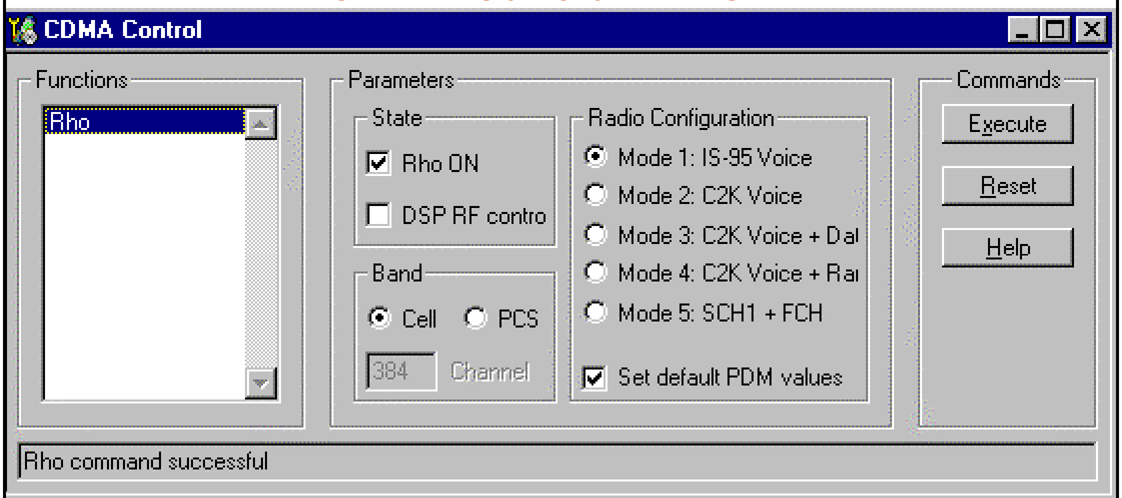
① Phone Control in DSP



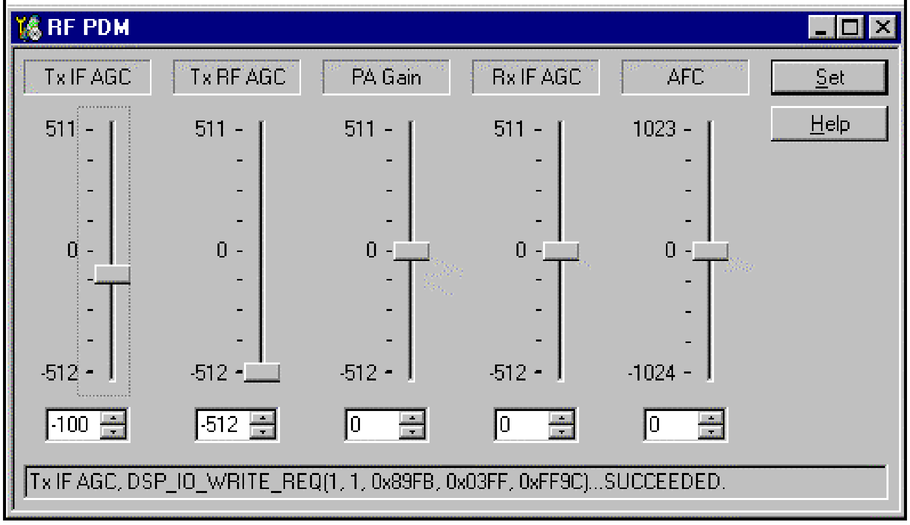
② RF Main Mode in RF



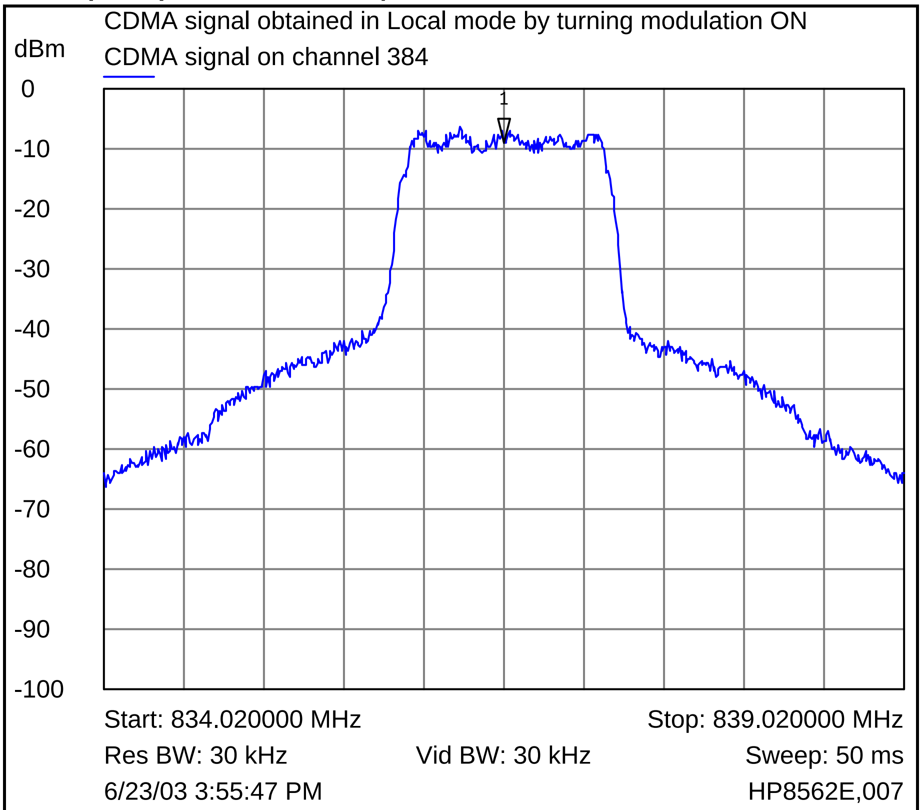
③ CDMA Control in DSP



④ RF PDM in RF

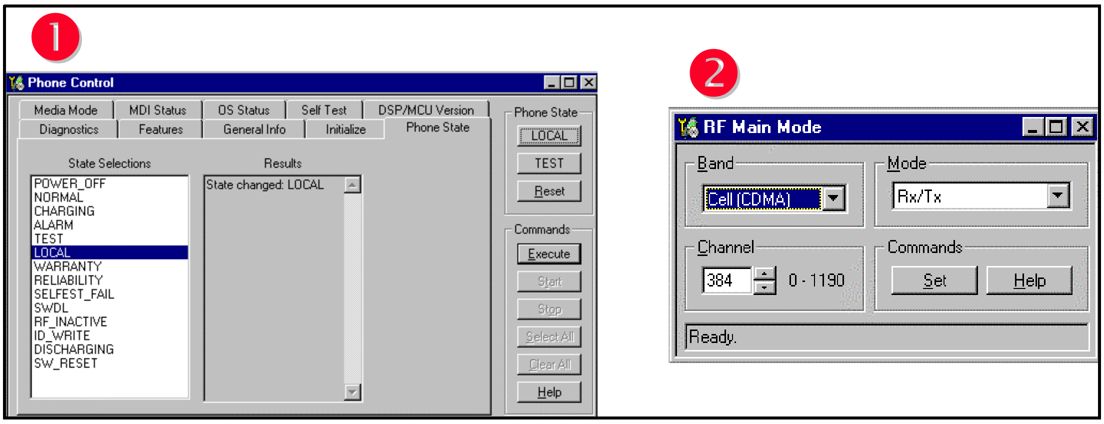

RF PDM
Tx IF AGC
Tx RF AGC
PA Gain
Rx IF AGC
AFC
Set
Help
511
0
-512
1023
-1024
-100
-512
0
0
0
Tx IF AGC, DSP_IO_WRITE_REQ(1, 1, 0x89FB, 0x03FF, 0xFF9C)...SUCCEEDED.

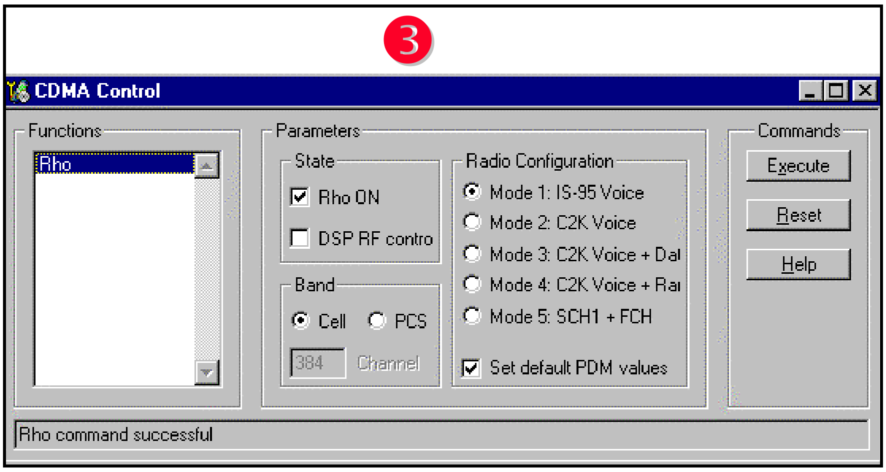
Observing Tx Output Spectrum on Analyzer

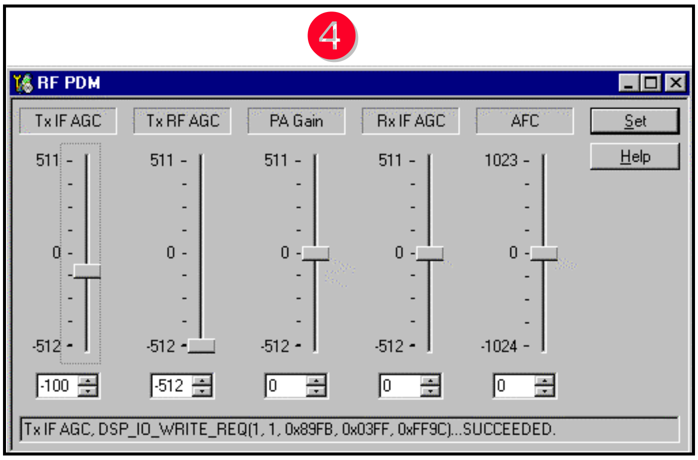


Using a spectrum analyzer to observe Tx waveform:

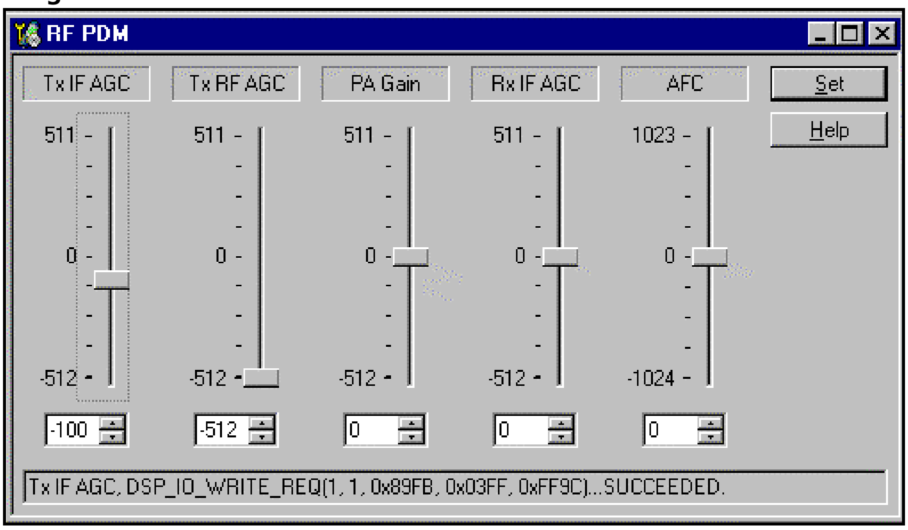
- Enable Local Mode (test jig can be set to Local)
- Select CDMA and Rx/Tx Mode (Tx path enabled)
- Select Rho ON on CDMA Control and Execute
- Adjust the 3 Tx AGC for proper output power level







RF PDM Settings



- Automatic Frequency Control (AFC):

  Control range from -1024 to +1023. Used as a control line to tune the VCTCXO. Monitor the change in frequency of the VCTCXO as the AFC is changed. Use in Local Mode only.

- Automatic Gain Control for Transmitter (Tx AGC):

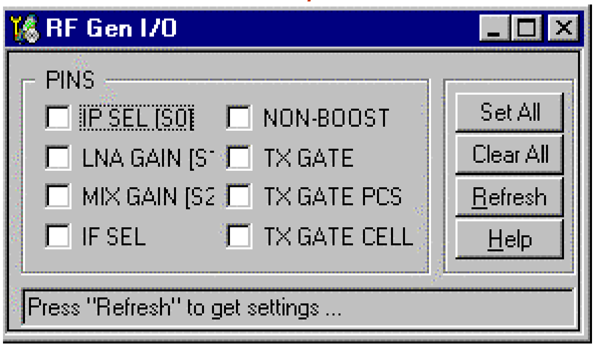
  Consists of the Tx IF AGC, the Tx RF AGC, and the PA AGC. Used as control lines to adjust the transmitter output levels. Monitor the Tx power with a call box or analyzer. Use in Local Mode only.

- Automatic Gain Control for Receiver (Rx AGC):

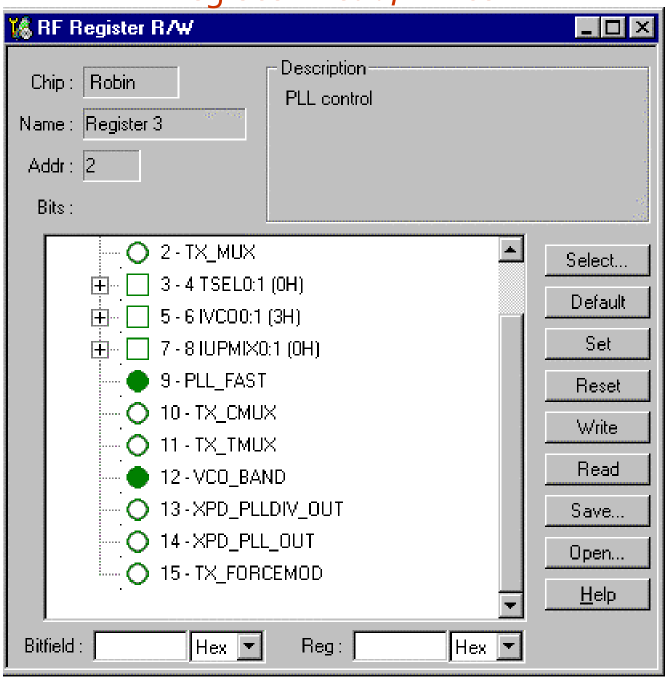
  Consists of the Rx IF AGC. Used as a control line to adjust the receiver input level. Use in Local Mode only.

Other RF Parameters in Phoenix

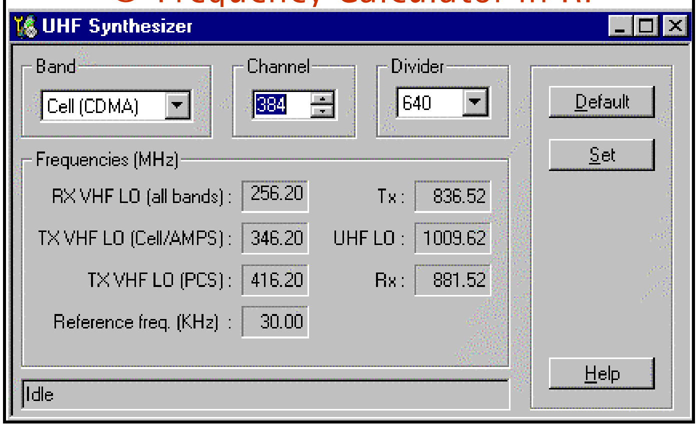
⑤ Gen I/O in RF



⑥ RF register Read/Write in RF

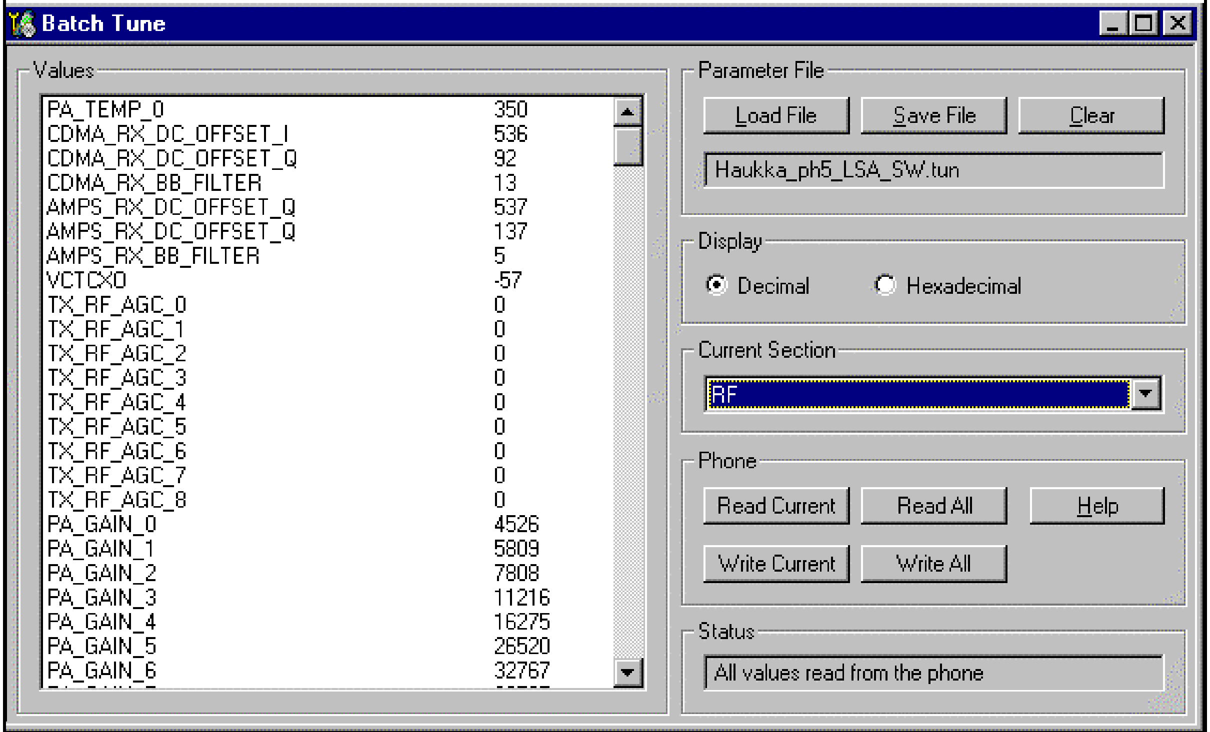


⑦ Frequency Calculator in RF

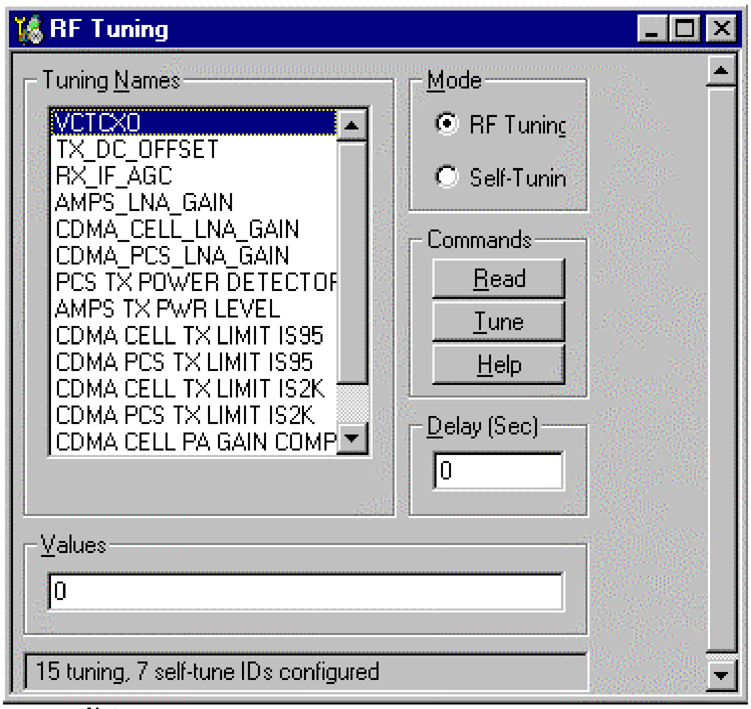


RF Tuning Parameters in Phoenix

⑧ Batch Tune in RF

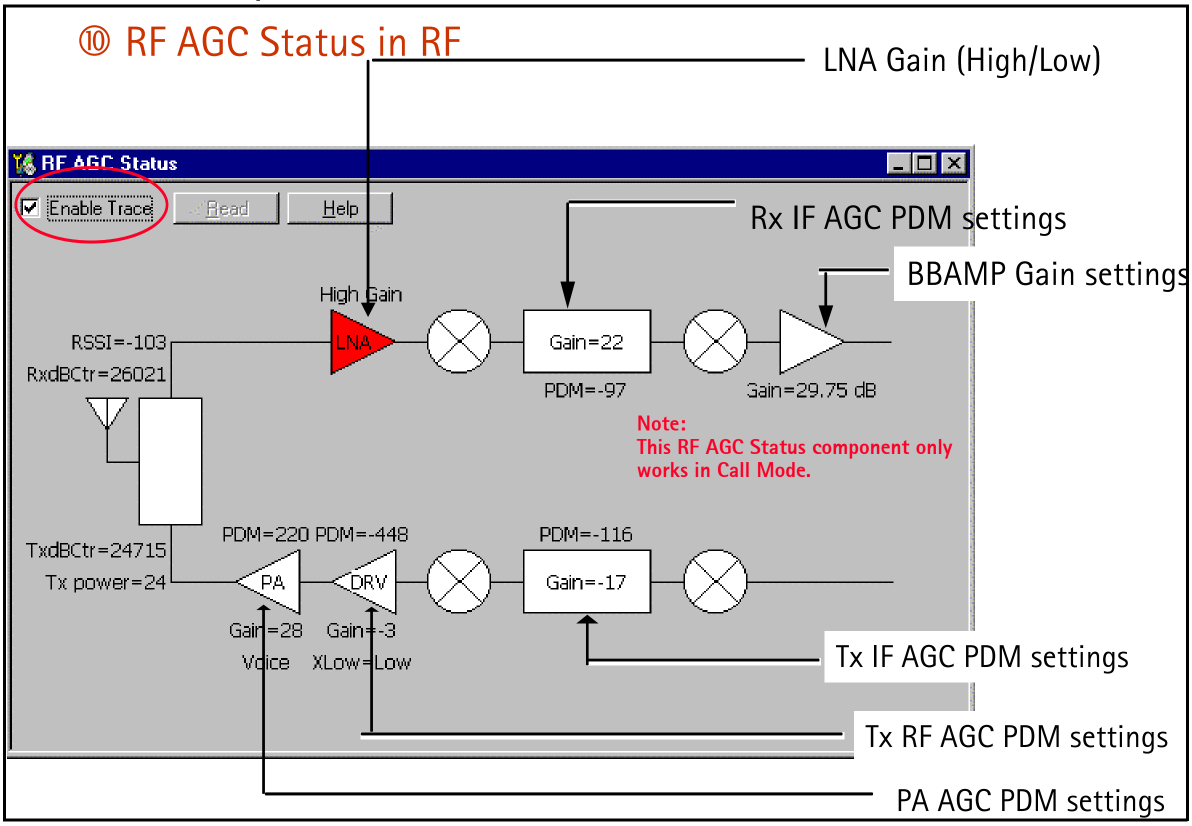


⑨ RF Tuning in RF



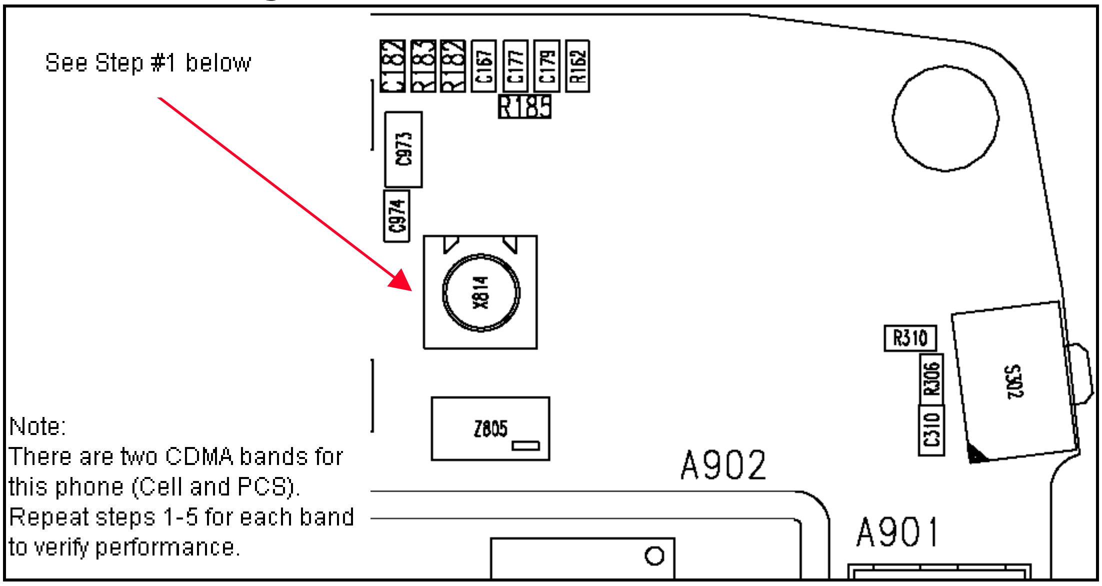
Note:
When reading the tuning parameters from the phone, always use the "Read All" button in order to read the entire set of tuning values.

RF AGC Status Components in Phoenix



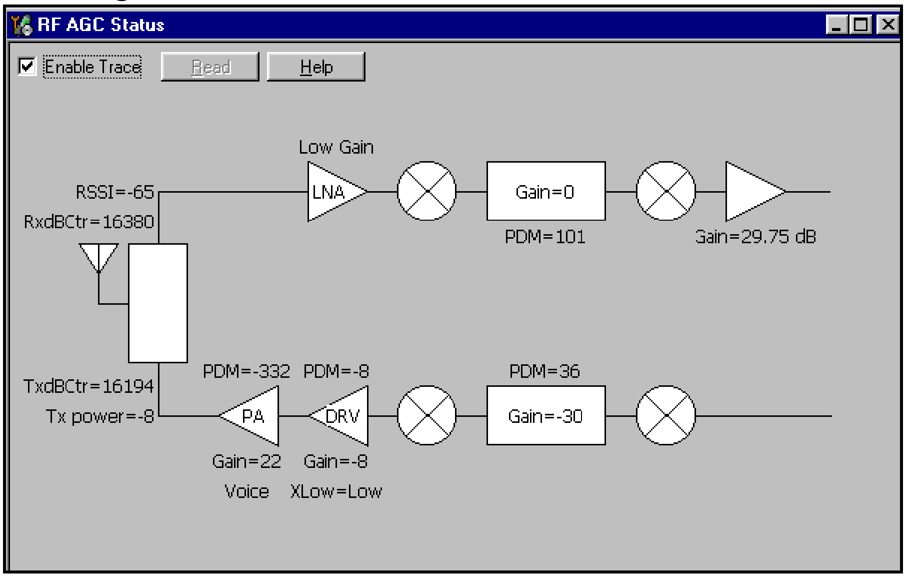
Note: Always measure resistance with the mobile terminal powered off.

CDMA In-Call Testing



1. Connect the mobile terminal to a call box via an RF port (X814). (Add RF cable loss on call box ≅0.2 dB Cell band, ≅0.4dB PCS).
2. Power up mobile terminal in Normal Mode.
3. If it is necessary, place the mobile terminal in Local Mode. Load PRL; set mobile terminal back to Normal Mode. Make sure to set the RF channel and SID according to the PRL.
4. Register the mobile terminal and establish a call at –65dBm call box sector power.
   - If you cannot register mobile terminal, set the sector power to –25dBm and try again.
   - If a call cannot be made in either PCS or Cell band, proceed with Local Mode troubleshooting.
5. If the mobile terminal call is successful, open the **RF** menu, select **AGC Status**, and click **Enable Trace** on the **AGC Status** dialog box.

CDMA In Call Testing (Low Gain)

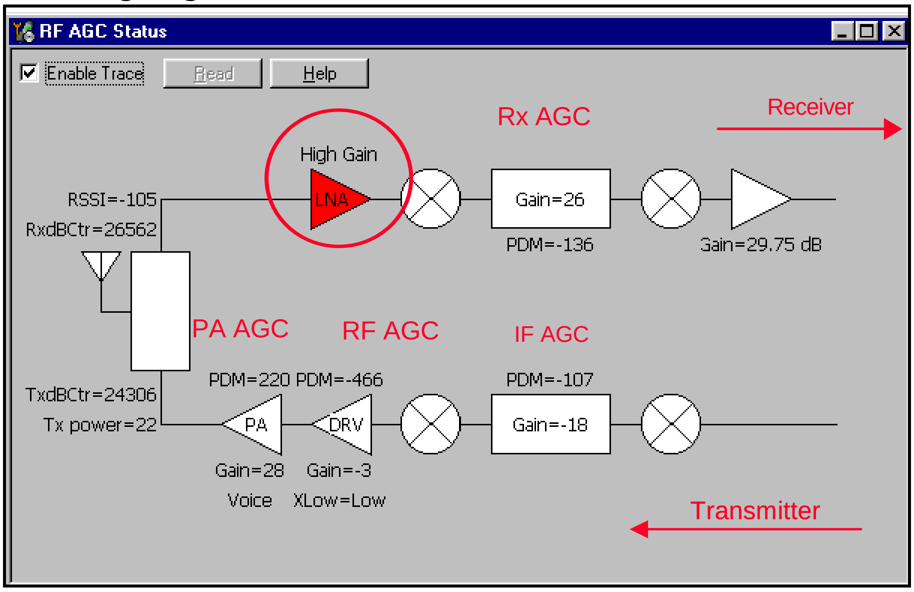


AGC Tolerances

Band	Rx AGC	IF AGC	RF AGC	PA AGC
Cell CDMA	>40	<40	125+-30	<-300
PCS CDMA	>40	<40	120+-30	<-300

1. In a call, handoff to the center channel (channel 600 for PCS, or channel 384 for Cell) and verify that the call box sector power is –65dBm. The LNA will be in Low Gain.
2. Compare the RSSI reading on the **RF AGC Status** dialog box with the sector power. Compare the Tx power to the digital average power on the call box. The value should be accurate to +3dBm.
3. Verify that Cell PDMs for Rx and Tx are within the specified tolerances:
   - Cell: Tx power (dBm) = -73 — RSSI
   - PCS: Tx power (dBm) = -76 — RSSI

CDMA In Call Testing (High Gain)

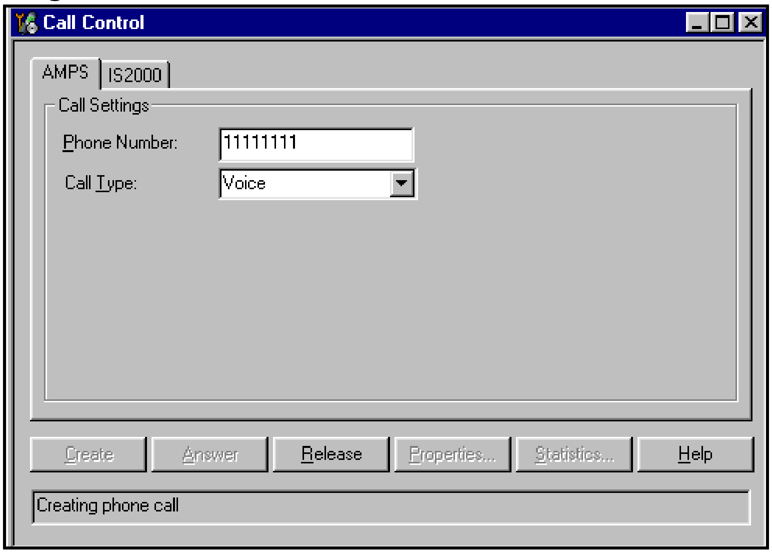


AGC Tolerances for -105dBm Input

Band	Rx AGC	IF AGC	RF AGC	PA AGC
Cell CDMA	>-150	-115+-15	<-400	=220
PCS CDMA	>-150	-100+-20	<-400	=220

1. Adjust the call box sector power to -105dBm. This turns the LNA to High Gain.
2. Compare the RSSI reading with the sector power on the call box. The value should be accurate to +3dB.
3. Compare the Tx power to the digital average power on the call box.
4. Verify that all PDMs for Rx and Tx are within tolerances specified in the above table.
   - Cell: Tx power (dBm) = -73 — RSSI
   - PCS: Tx power (dBm) = -76 — RSSI

CDMA In Call Testing (AMPS)



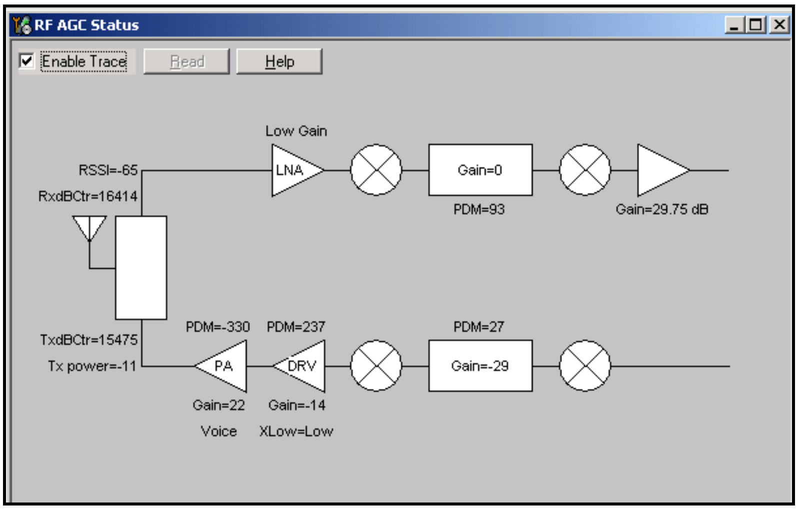
1. Connect the mobile terminal to call box via an RF port (X814). (Add cable loss on call box ≅0.2dB band.)
2. Power up the mobile terminal in Normal Mode.
3. If necessary, put the mobile terminal into Local Mode, load the PRL, and switch back to Normal Mode. Make sure to set the call box control channel and SID.
4. Open the **DSP** menu and select **Call Control**. Add the 8-digit number and create an AMPS call.

   If a call cannot be made, proceed with Local Mode troubleshooting.

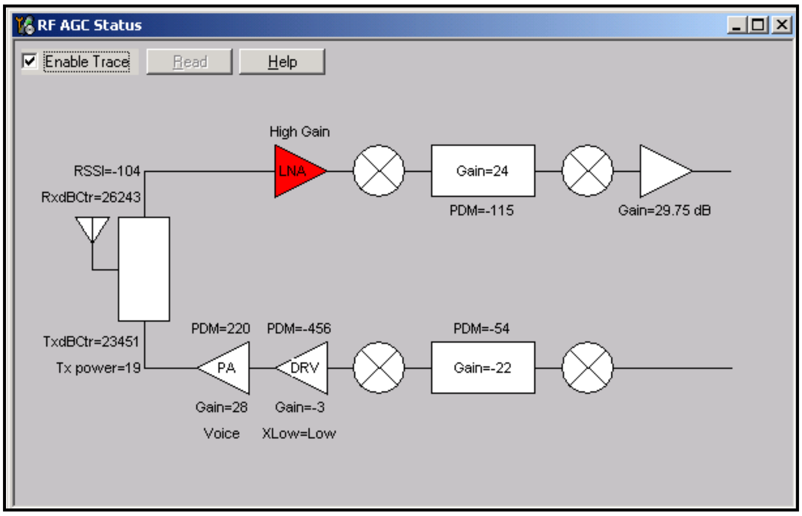
5. Switch to Channel 384, PL2, and sector power -65dBm.
6. Compare the RSSI reading from on the **RF AGC Status** dialog box to the sector power. The value should be accurate to +/-2dB.
7. Compare the Tx power to the digital average power on the call box. The value should be accurate to +/-2dBm.

Typical PDM Readings

Cell Band

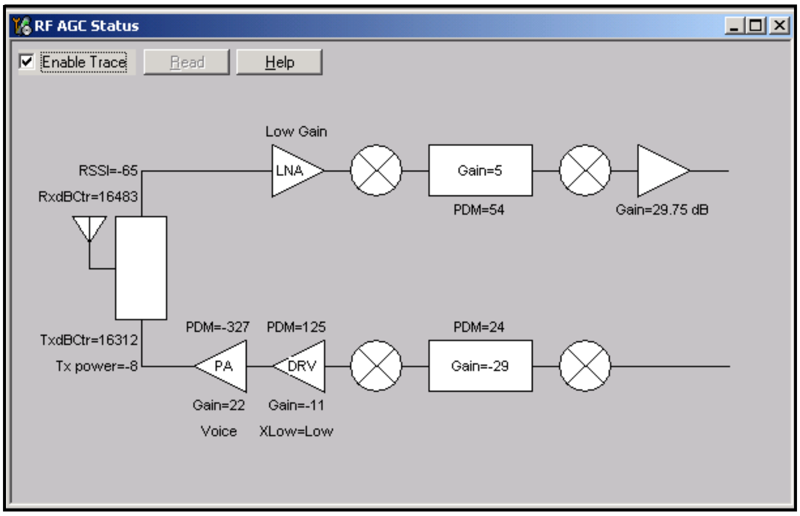


-65dBm Sector Power CDMA Channel 600	
Parameter	**Typical PDM Value**
RSSI	-65dBm
LNA	Low gain state
RxIF AGC PDM	+93
Tx IF AGC PDM	+27
Tx RF AGC PDM	+237
Tx PA gain PDM	-330
Tx Power	-11dBm

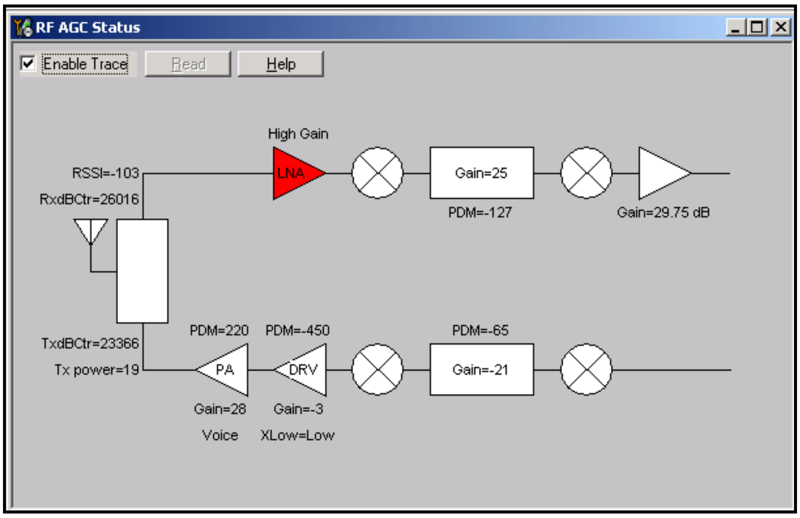


-104dBm Sector Power CDMA Channel 600	
Parameter	**Typical PDM Value**
RSSI	-104dBm
LNA	High gain state
RxIF AGC PDM	-115
Tx IF AGC PDM	-54
Tx RF AGC PDM	-456
Tx PA gain PDM	+220
Tx Power	+19dBm

PCS Band

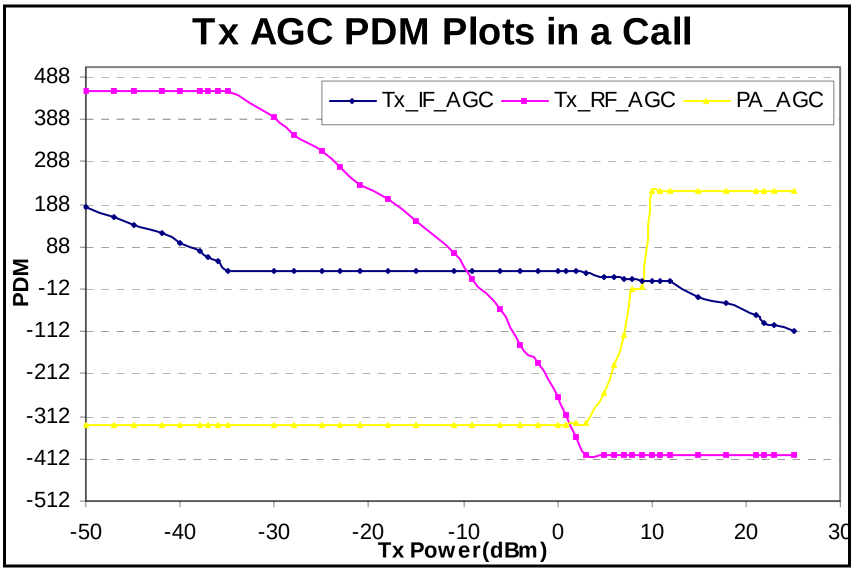


-65Bm Sector Power CDMA Channel 384	
Parameter	**Typical PDM Value**
RSSI	-65dBm
LNA	Low gain state
RxIF AGC PDM	+54
Tx IF AGC PDM	+24
Tx RF AGC PDM	+125
Tx PA gain PDM	-327
Tx Power	-8dBm

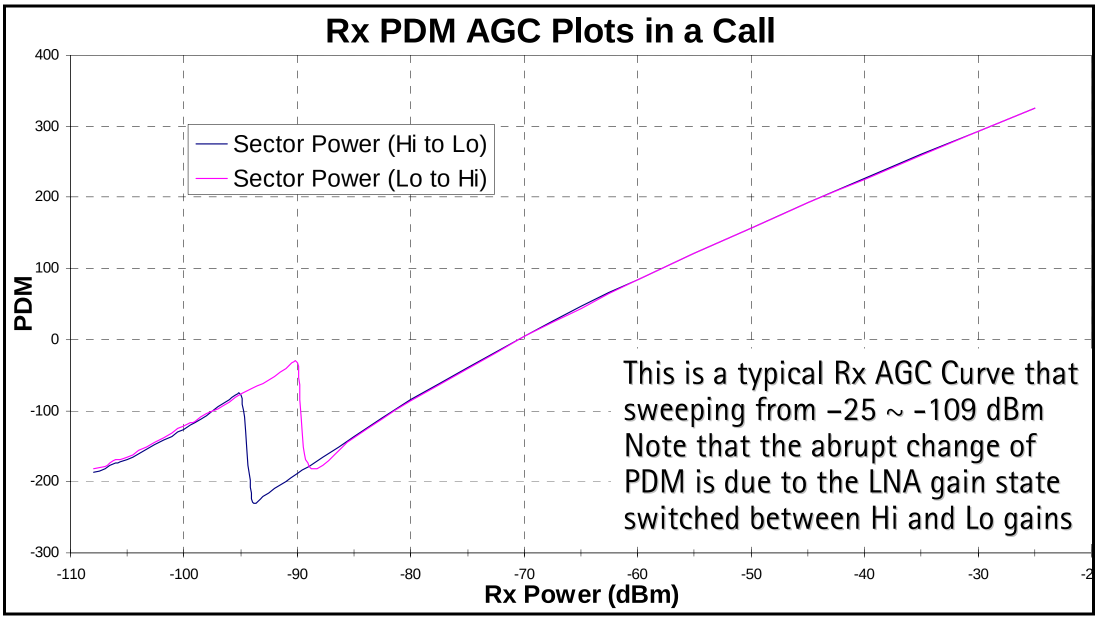


-104dBm Sector Power CDMA Channel 384	
Parameter	**Typical PDM Value**
RSSI	-103dBm
LNA	High gain state
RxIF AGC PDM	-127
Tx IF AGC PDM	-85
Tx RF AGC PDM	-450
Tx PA gain PDM	+220
Tx Power	+19dBm

Tx PDM Characteristic Curves (Call Mode)



Rx PDM Characteristic Curve (Call Mode)



Key RF Performance Tests in Call Mode

Tx Tests

Max Limiting Power

Set the sector power to -95dBm or lower and set the reverse power control bits in the 8960 to *always up*. This is the maximum limiting power that the mobile terminal can provide. Check limiting power vs. channels and see whether they are accurate to the limits. (Be sure to account for cable loss.)

Waveform Quality (RHO)

This can be measured on the 8960 call box. Always measure at maximum power. The value should be greater than 0.97. The frequency error should be within +/-150Hz.

Spurious Emissions (ACPR)

ACPR can be measured on the 8960 call box. Always measure at maximum power. Limits for +/-885kHz and 1.98MHz are lower than at least -42dBc and -54dBc.

Rx Tests

Rx Sensitivity

Measure this on the 8960 call box. Always measure at max power. Rx sensitivity is defined as the minimum sector power for 0.5% FER. Usually the result is better than -107dBm. (Be sure to account for cable loss.)

Receive Signal Strength Indicator (RSSI)

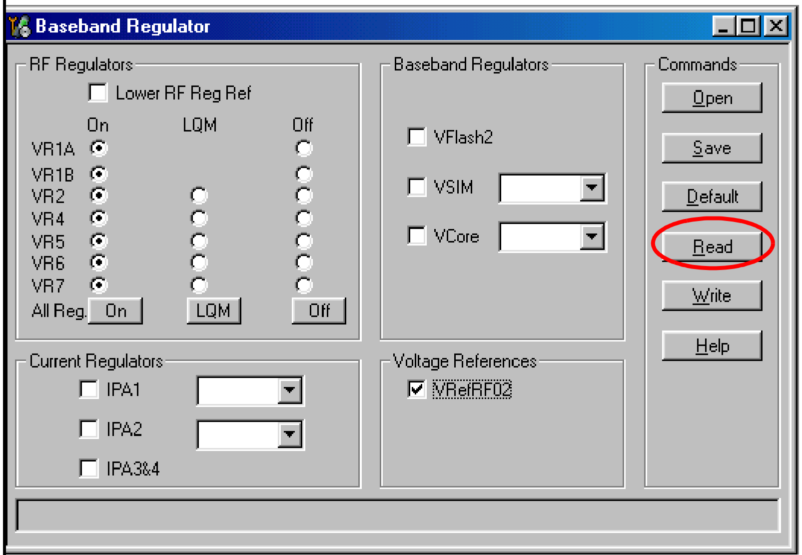
When in a call, you can verify the receiver received level by using the RF AGC component. The RSSI reading tracks with the call box sector power reading within 2dB. Vary the sector power from -25dBm to -104dBm for accuracy. If the RSSI reading is off (e.g., 20dB), start Local Mode troubleshooting.

LNA Switching (High/Low Gain State)

When in a call, you can verify at what point the LNA is turned on (High Gain State) by using the RF AGC component. The indicator for the LNA turns red when it is turned on. Usually, the LNA turns on between -93dBm and -95dBm. If the LNA does not turn off at all on the **RF AGC Status** dialog box while in a call, you have bad sensitivity.

Supply Lines Measurement Using Phoenix

Baseband Regulator component

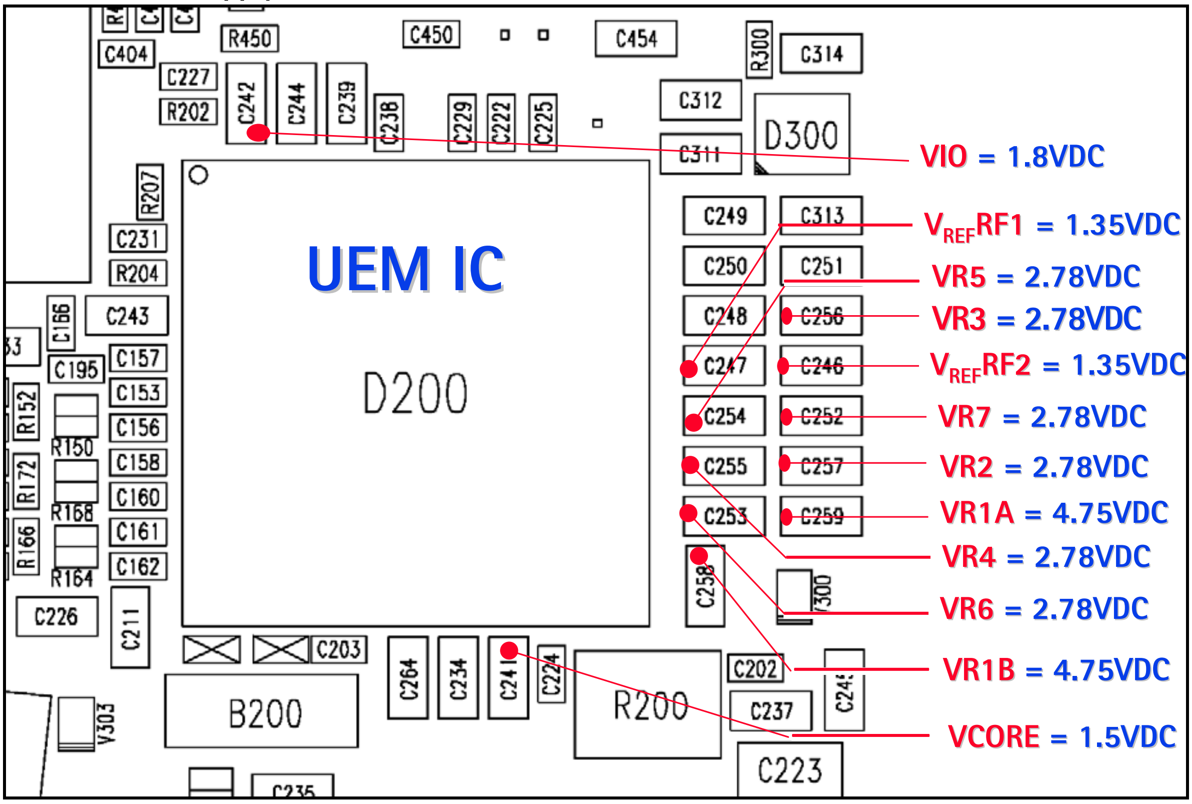


There are 12 RF-related regulators

1. VR1A
2. VR1B
3. VR2
4. VR3
5. VR4
6. VR5
7. VR6
8. VR7
9. VrefRF1
10. VrefRF2
11. VIO
12. VCORE

Before writing to the mobile terminal, click the **Read** button,

12 RF-related Supply Lines Distribution



Supply Lines Distribution by RF Components

Component	Supply Line
N705	VR5
N701	VR5, VR7, VIO, V_{REF}RF1
N601	VR2, VR3, VR6, VIO, VR1B, V_{REF}RF2
N603	VBAT
N801	VR2, VBAT
N806	VR2
G501	VR3, VR1A
N507	VIO, VR1A
G502	VR4
N502	VR6

12 Supply Lines Resistance to Ground

Supply Line	Resistance	Component
VR1A	100kΩ to GND	Synthesizer (VCTCXO, UHF PLL)
VR1B	29kΩ to GND	N601
VR2	4.4kΩ to GND	N601, PA, PA Detector
VR3	4.5kΩ go GND	N601, VCTCXO
VR4	4.7kΩ to GND	VCO
VR5	3.2~5.1Ω to GND	N750
VR6	39kΩ to GND	N601, VCO Buffer
VR7	38kΩ to GND	N701
VIO	15kΩ to GND	N701, N601, UHF PLL
V_{REF}RF1	45kΩ to GND	N701
V_{REF}RF2	46kΩ to GND	N601
VCORE	4.5kΩ to GND	UEM, UPP

Note: Always measure resistance with the mobile terminal powered off.

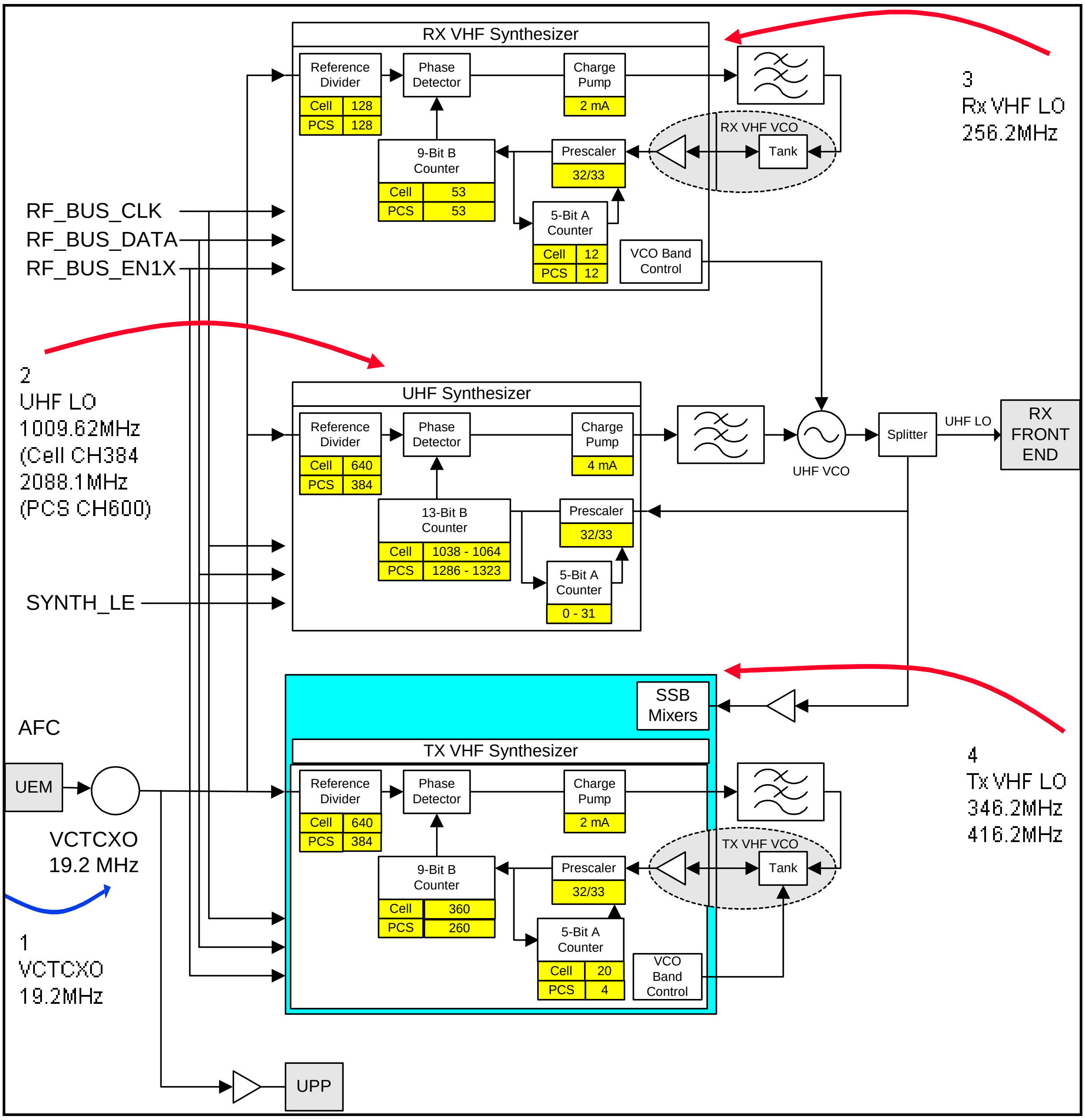
Top RF-related Failures Seen in FLALI

Test Failed	What to Check
RF EX Self-test N701 VHF PLL	Perform Local Mode testing of Rx VHF PLL on N701. Check that voltage levels at VR5 and VR7 are 2.7V. Also, check UHF LO level into N750.
RF EX Self-test N601 VHF PLL CELL	Perform Local Mode testing of the Tx VHF PLL on N601. Check DC voltage (VIO, VR2, VR3, VR6). Probe Tx chain in Local Mode.
RF MS Tx Start-up Amplitude	Check status of soldering on the balun presence of UHF LO. Check gain of PA and driver amplifier. Driver should have 12-16dB gain and PA should have 24-28dB gain.
RFTN VCTCXO Frequency	Measure VR3, VR1A voltage and probe for 19.2MHz output of VCTCXO. Next, check if Tx VHF PLL is on frequency. If previous tests are good, probe Tx chain in Local Mode.
RF TN TX IF AGC CELL or PCS Po(X) RF TN TX PA AGC CELL or PCS Po(X) RF TN TX RF AGC CELL or PCS Po(X)	Visually check soldering of the N601 (x-ray), supporting components, and PA. Also check D400, which generates the PDM signals. Troubleshoot the rest of the Tx chain in Local Mode.
RF TN TX LIM Po IS95 CELL or PCS XX	If the max Tx power cannot be reached, either a component in the transmitter has too much loss or not enough gain. Troubleshoot the corresponding Cell or PCS transmitter in Local Mode.
RF TN TX DC Offset CS	If the parameter fails, check version of FLALI software to ensure that it is the latest. Also verify that the tuning limits are correct.
RF MS RX IF AGC RXdbCtr(X)	Inject signal and probe Rx chain for gain to key out any failed parts.
RF MS LNA AMPS LowGain RF MS LNA AMPS HighGain	Inject signal and probe Rx AMPS chain for gain to key out any failed parts.
RF MS LNA CELL LO LowGain RF MS LNA CELL LM LowGain	Inject signal and probe Rx Cell chain for gain to key out any failed parts.
RF MS LNA PCS xx LowGain	Inject signal and probe Rx PCS chain for gain to key out any failed parts.
GPS MS Test Mode x (all tests)	Check VL_{NA_GPS}, V_{CORE}, V_{IO}. RF Probe GPS chain.

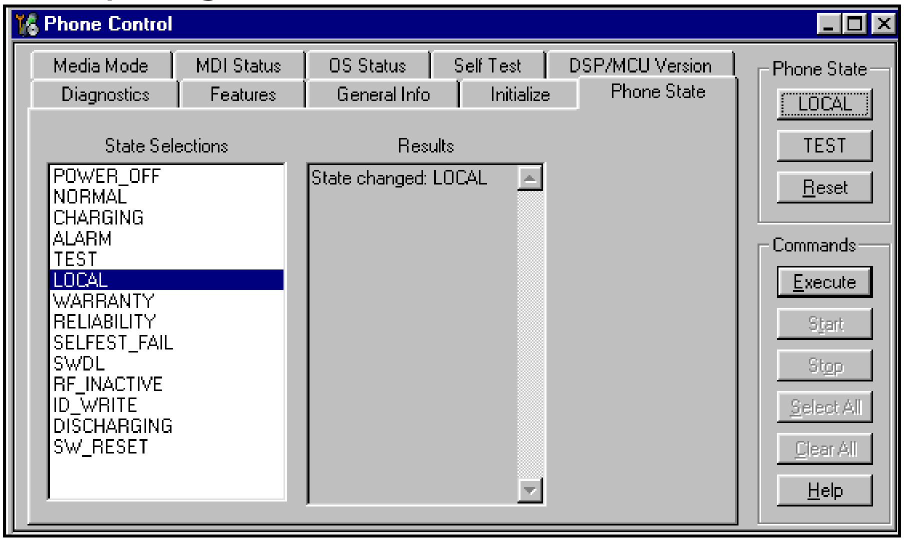
Top RF-related Failures Seen in FINUI

Test Failed	What to Check
RF MS TX Rho PCS CH600	Rho problem is very likely caused by elevated spurious levels in UHF LO and/or by VHF Tx LO in N601. Establish a call and verify the degraded Rho. Next probe the LO output for spurs.
RF MS RX FER PCS CH600	At this stage, FER is most likely caused by a poor RF connection. Perform a conductive RSSI measurement with sector power at -65dBm (low LNA gain) and -100dBm (high LNA gain).
RF MS RX FER CELL CH384	At this stage, FER is most likely caused by a poor RF connection. Perform a conductive RSSI measurement with sector power at -65dBm (low LNA gain) and -100dBm (high LNA gain).
RF MS SINAD	SINAD is measurement of a mobile terminal's audio quality in an AMPS call. Hence, a secured audio plug is needed to be checked for any connection problem. Verify this on the bench in an AMPS call.
RF GPS Test Mode 3	Inject signal and test SNR with the GPS self-test. If SNR is out-of-limits, then probe chain.
RF MS TX Limiting Po PCS CH25	Tx limiting power is most likely caused by a poor RF connection.
RF MS TX Limiting Po CELL CH1013	Tx limiting power is most likely caused by a poor RF connection.

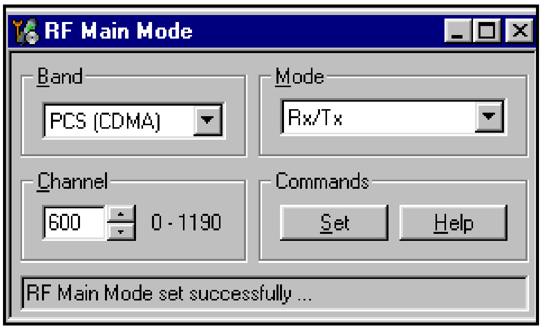
Synthesizer Troubleshooting



Synthesizer Setup Using Phoenix



1. Open the **Phone Control** dialog box and put mobile terminal into Local Mode.
   - UHF: Use Rx/Tx mode in PCS and Cell band. This allows for checking power to both Rx and Tx circuits. Typically, use channel 384 in Cell band and 600 in PCS band.
   - Rx VHF: Use Rx mode, one band is enough.
   - Tx VHF: Use Rx/Tx mode in both PCS and Cell band
2. Use **RF Main Mode** dialog box to set:
   - Band
   - Channel
   - Rx/Tx mode.



Note: Be sure the "Main Mode set successfully" message appears.

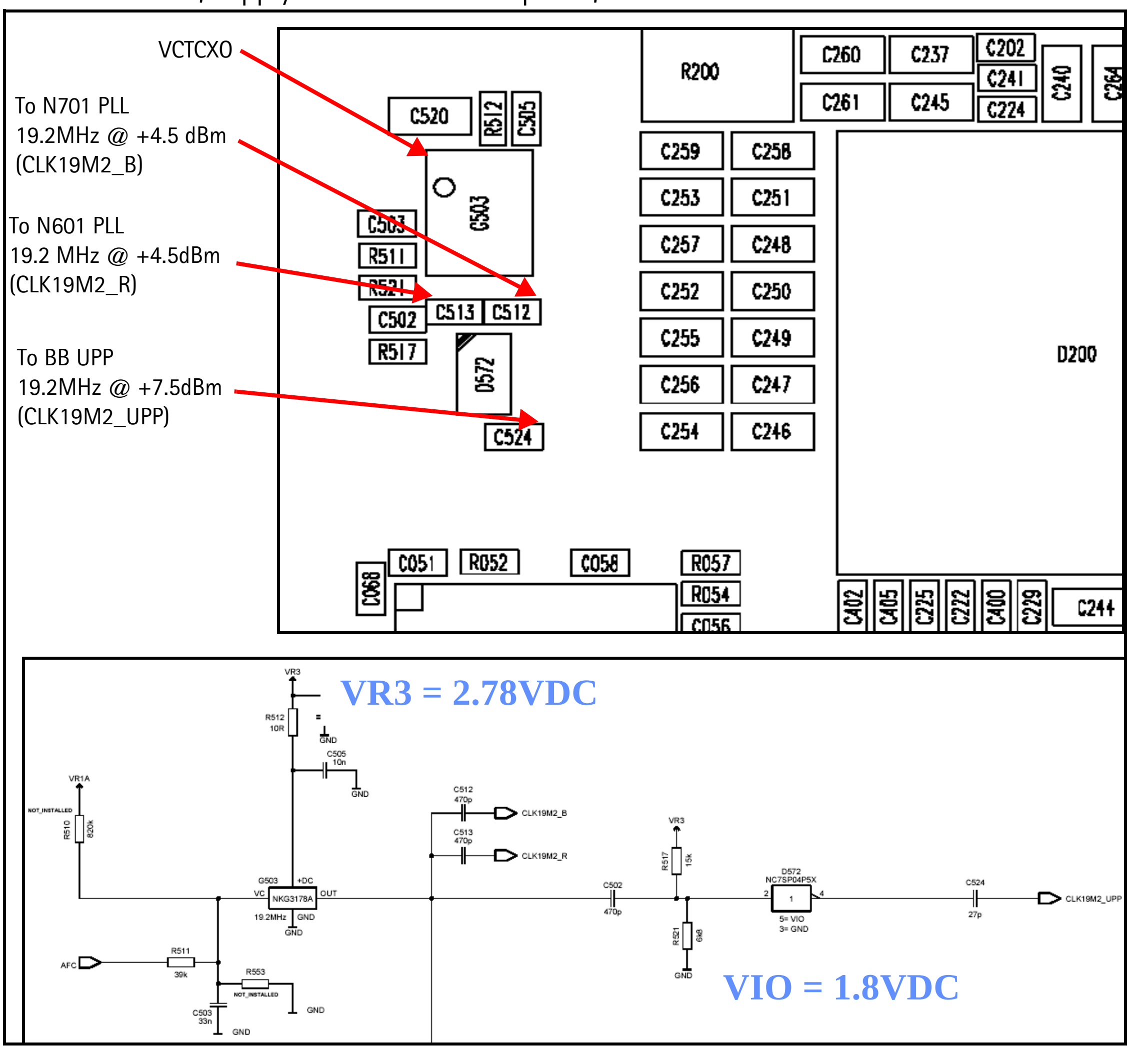
VCTCXO Troubleshooting

The VCTCXO frequency is 19.2MHz. This is the reference signal. Without 19.2MHz, the mobile terminal does not power up. This signal goes to N701, N601, UHF PLL, and also to the UPP via a buffer amplifier (D572). Check for the presence of the signal at the following points (use a high-impedance RF probe):

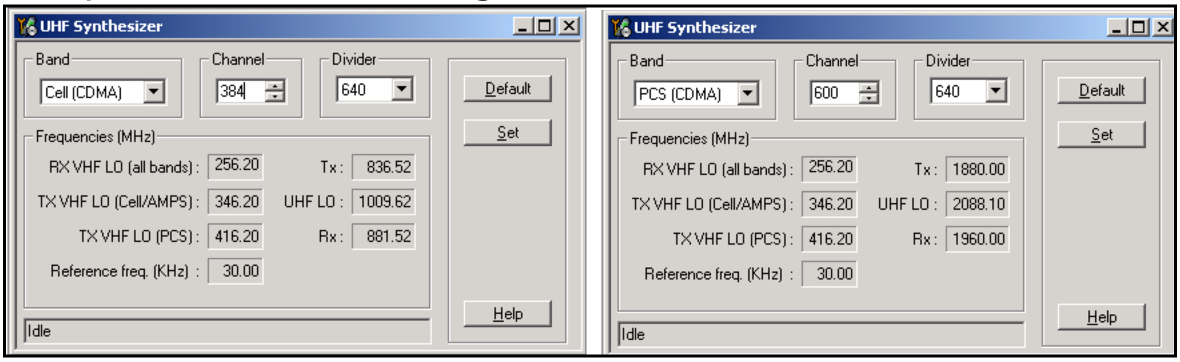
- CLK19M2_B, clock reference to N701, should be +4.5dBm
- CLK19M2_R, clock reference to N601, should be +4.5dBm
- CLK19M2_UPP, clock reference to UPP, should be +7.5dBm

If you do not see the VCTCXO signal at any of these points, check the voltages at the following supply lines:

- VR3, main supply line for VCTCXO circuitry, should be 2.78VDC
- VIO, supply line for buffer amplifier, should be 1.8VDC



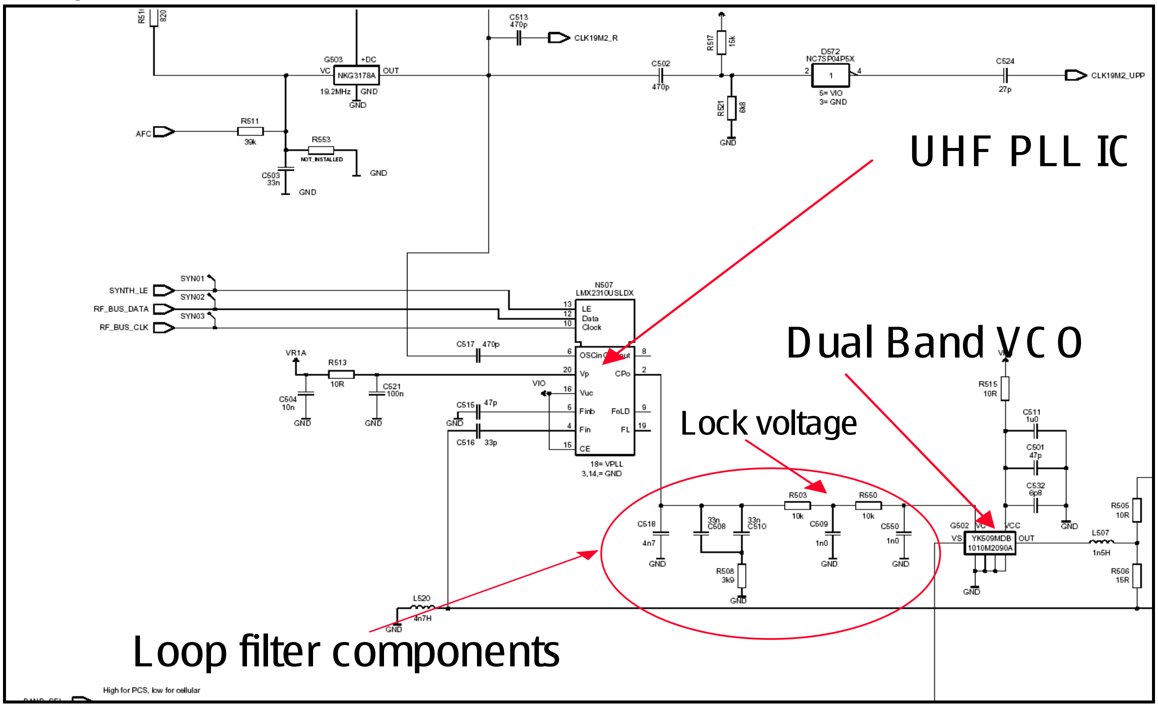
UHF Synthesizer Troubleshooting



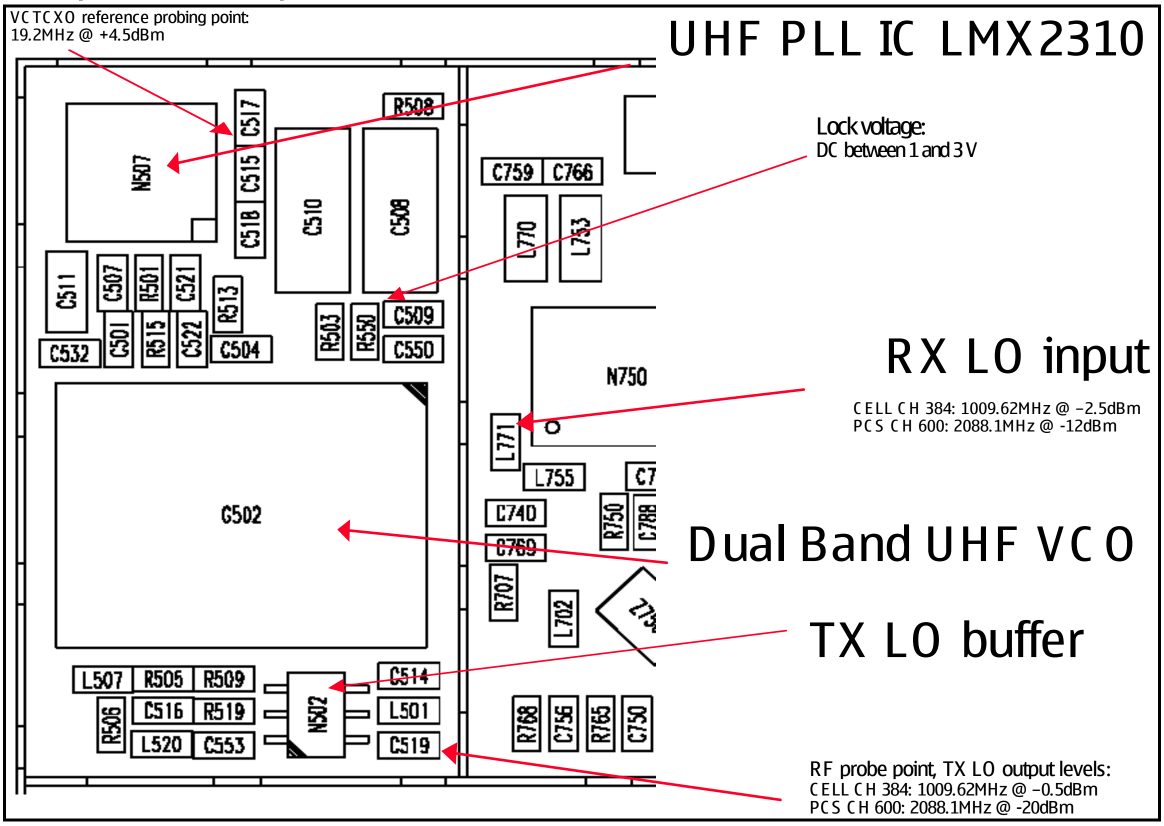
UHF LO frequency varies with channel and can be quickly calculated using the **UHF Synthesizer** in the Phoenix in **RF** menu. Check to see if the LO is actually locked. Set a channel and check the status of the UHF LO within a very narrow span of 100KHz. You should see the LO virtually immobile. Measure nominal UHF LO signal levels with an RF probe. If you do not see the presence of any LOs, check the DC voltages at the following locations:

- R513, VR1A, supply line for UHF PLL IC, should be 4.76VDC
- R515, VR4, supply line for VCO IC, should be 2.76VDC

UHF Synthesizer Schematic



UHF Synthesizer Layout



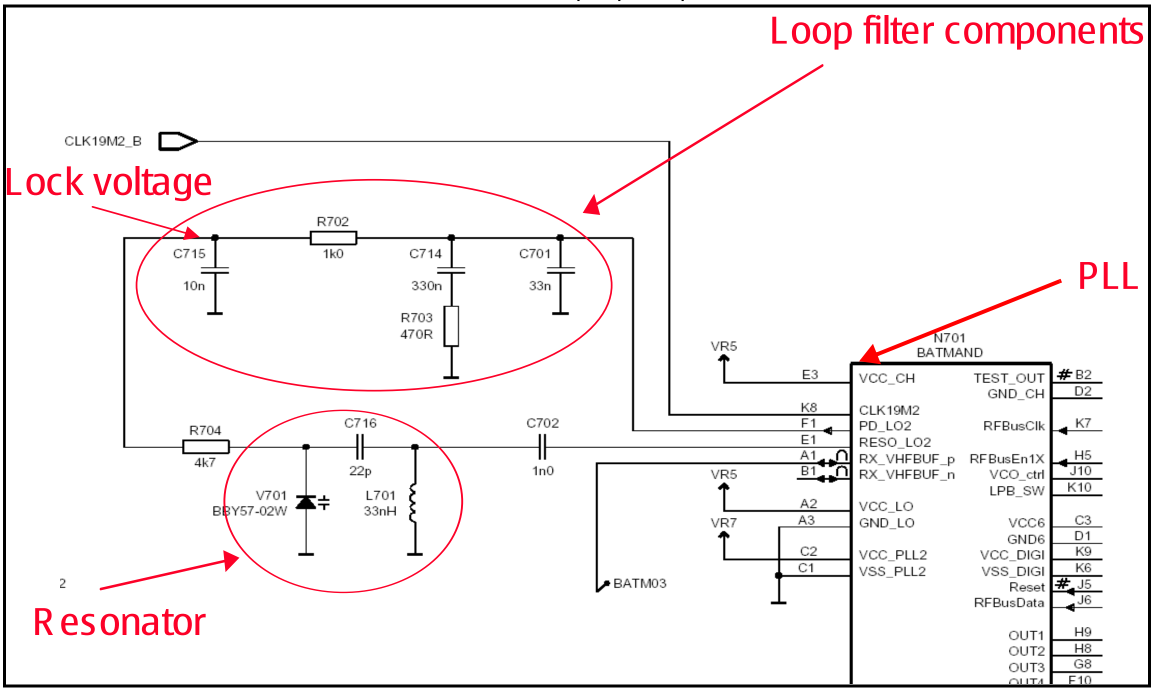
UHF Frequency is Incorrect

Possible causes:

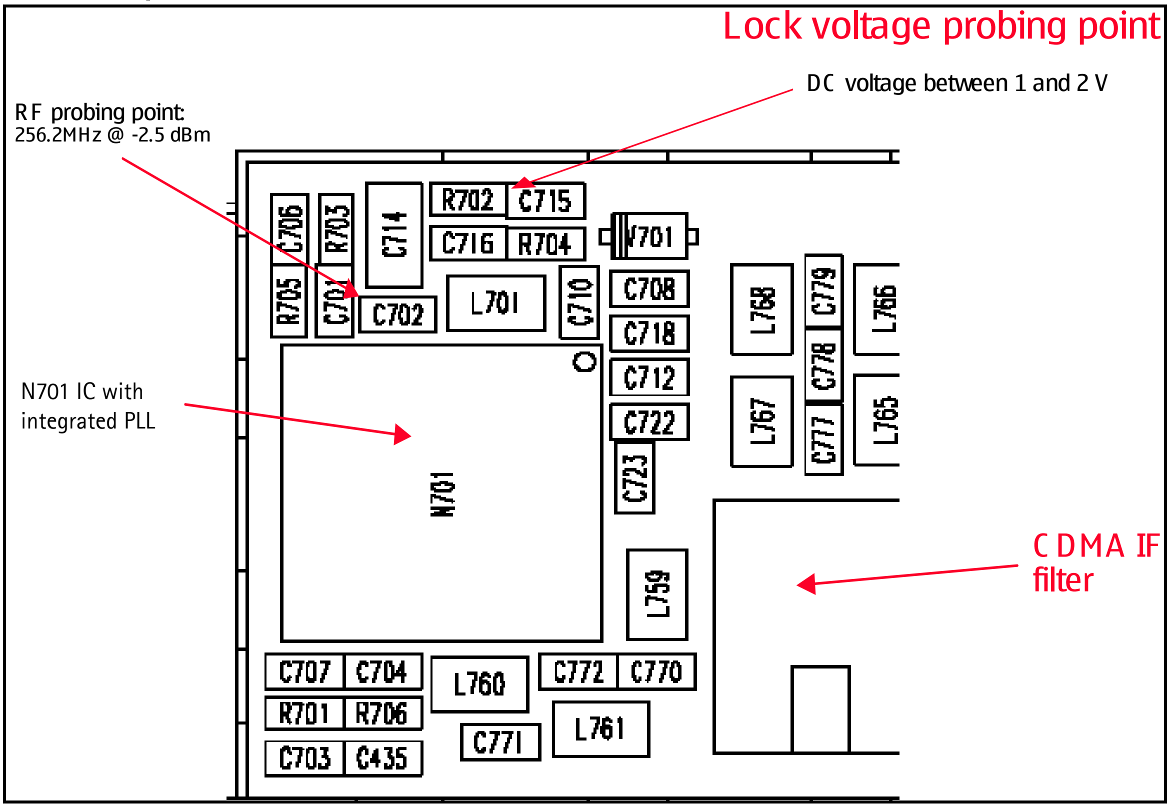
- Power supplies to PLL IC (N507) is missing or low.
- Loop filter components missing or incorrectly installed.
- 19.2MHz reference clock missing or low.
- Programming is incorrect.
- Component failure (VCO or PLL IC).

Rx VHF (N701 LO) Schematic

- Operates at a fixed frequency of 256.2MHz. It is the second LO for down-conversion to I and Q for baseband processing. Refer to the frequency plan.
- Monitor probing point at C702 for N701 LO. A locked and stable 256.2MHz with amplitude ~= -2.5dBm should be observed on the spectrum analyzer.
- Monitor control voltage at C715. The control voltage at locked state should be between 1.2 and 1.7VDV for the proper operation of N701 LO.



Rx VHF Layout



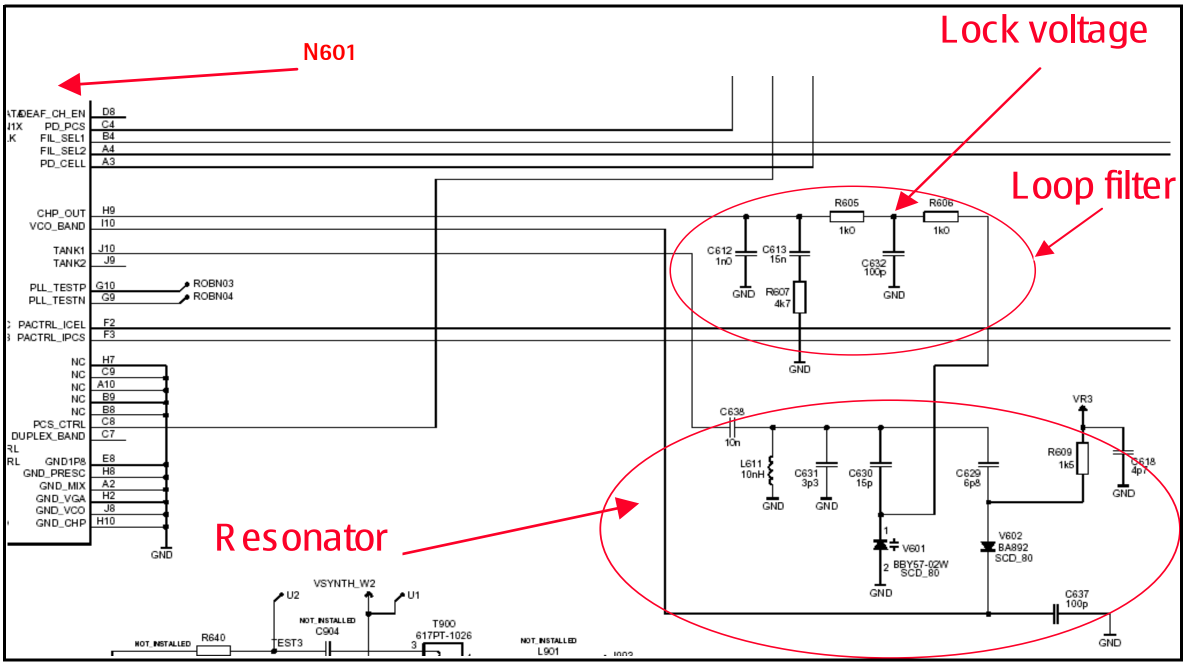
Incorrect Rx VHF Frequency

Possible causes:

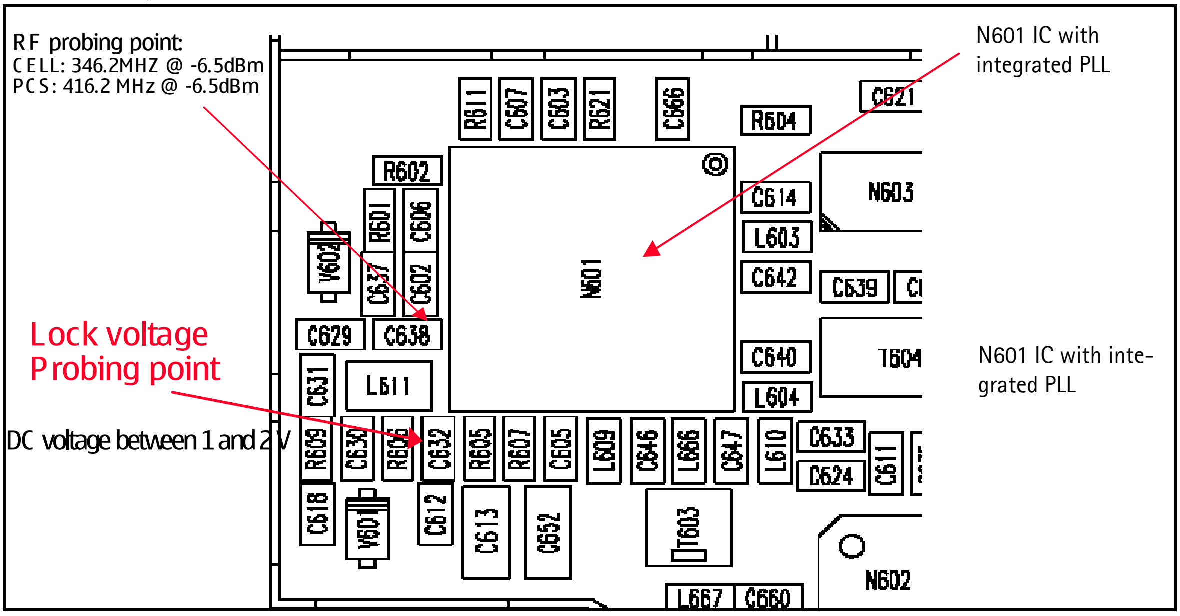
- Power supplies to PLL portion of N701 IC missing or low (VR7)
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low (C512)
- Programming is incorrect
- Component failure (PLL IC)

Tx VHF Schematic

- There are two fixed LOs – 346.2MHz for Cell band and 416.2MHz for PCS band. This is the first LO for up-conversion. Refer to frequency plan.
- Monitor probing point at C638 with a high-impedance RF probe for N601 LO. A sufficiently strong and stable signal should be observed on the spectrum analyzer.
- Monitor control voltage at C632. At this control voltage, the N601 LO is locked (it should be between 1.2 and 1.8VDC).



Tx VHF Layout



Incorrect Tx VHF Frequency

Possible causes:

- Power supplies to PLL portion of N601 IC missing or low (VR3)
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low (G513)
- Programming is incorrect
- Component failure (PLL IC)

Tx Troubleshooting

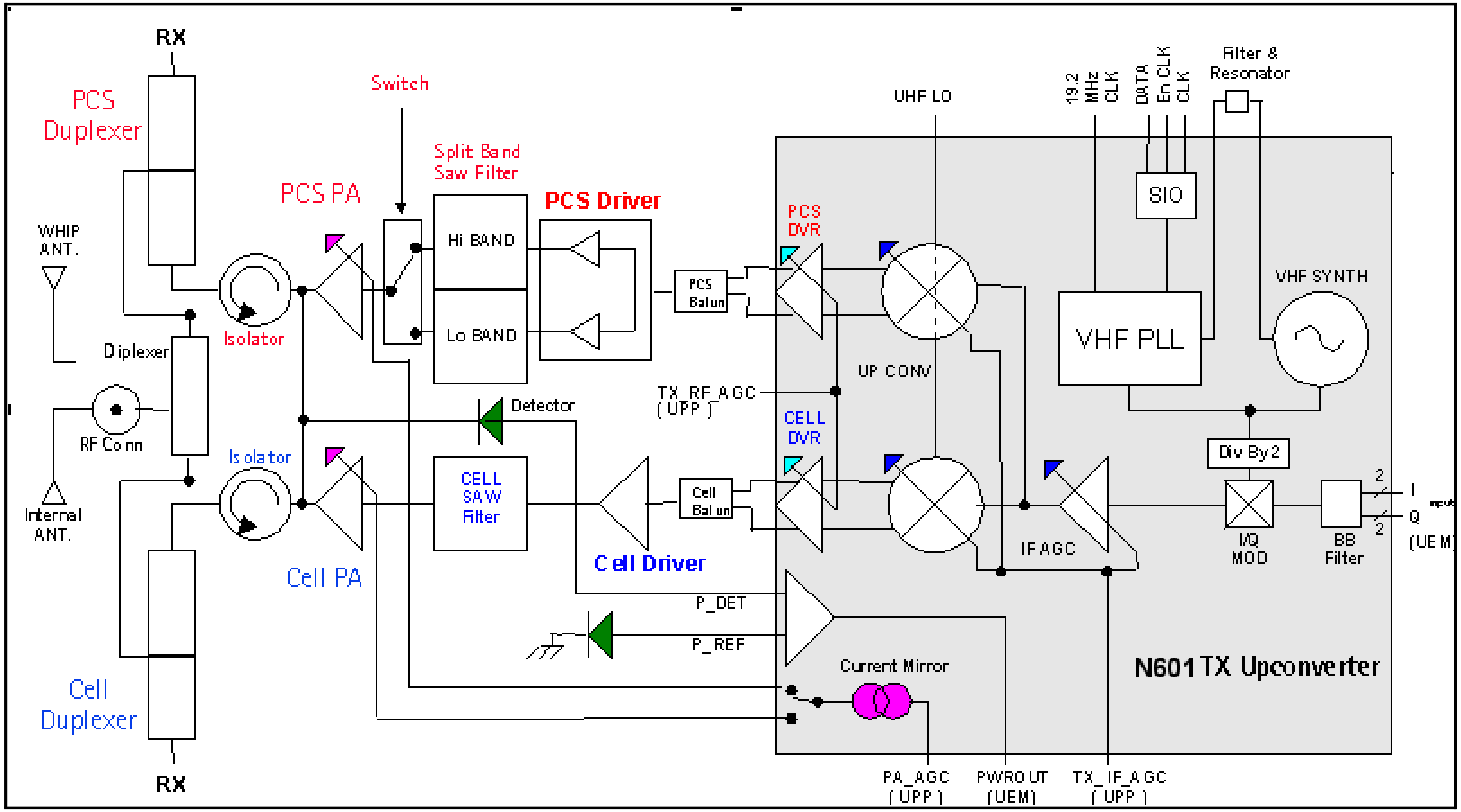
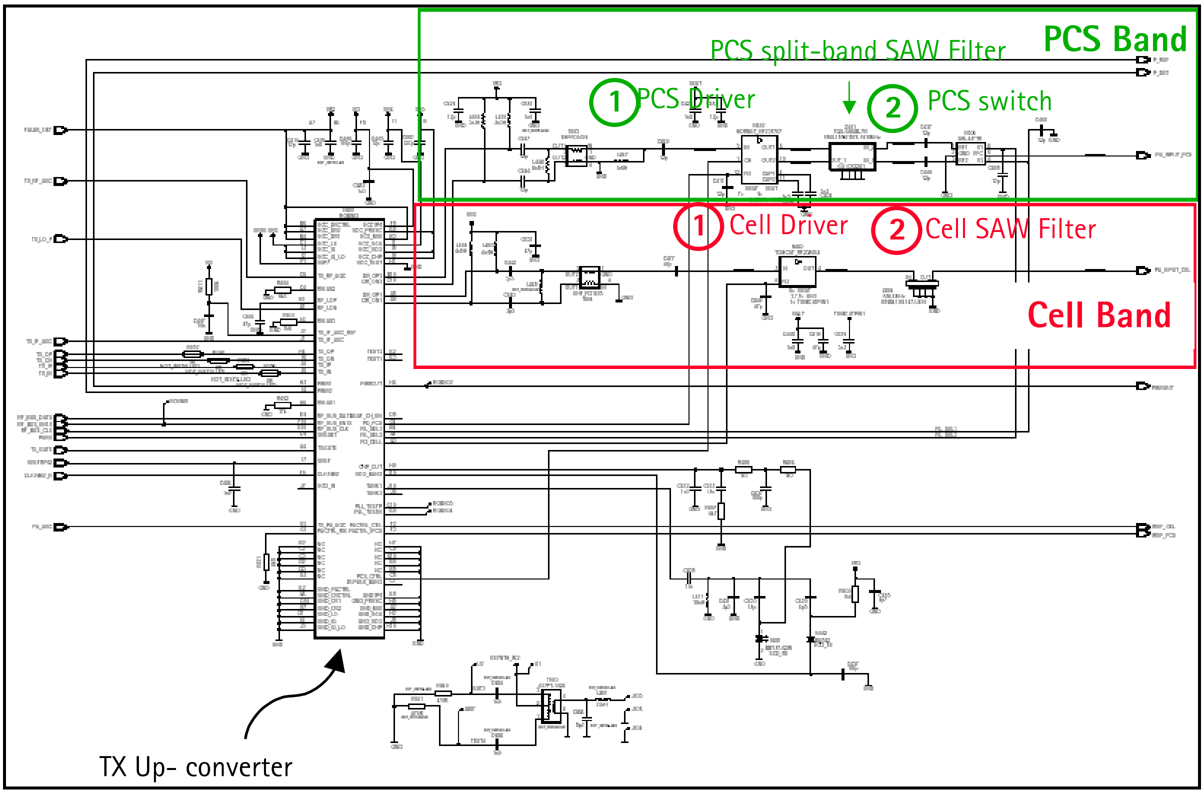


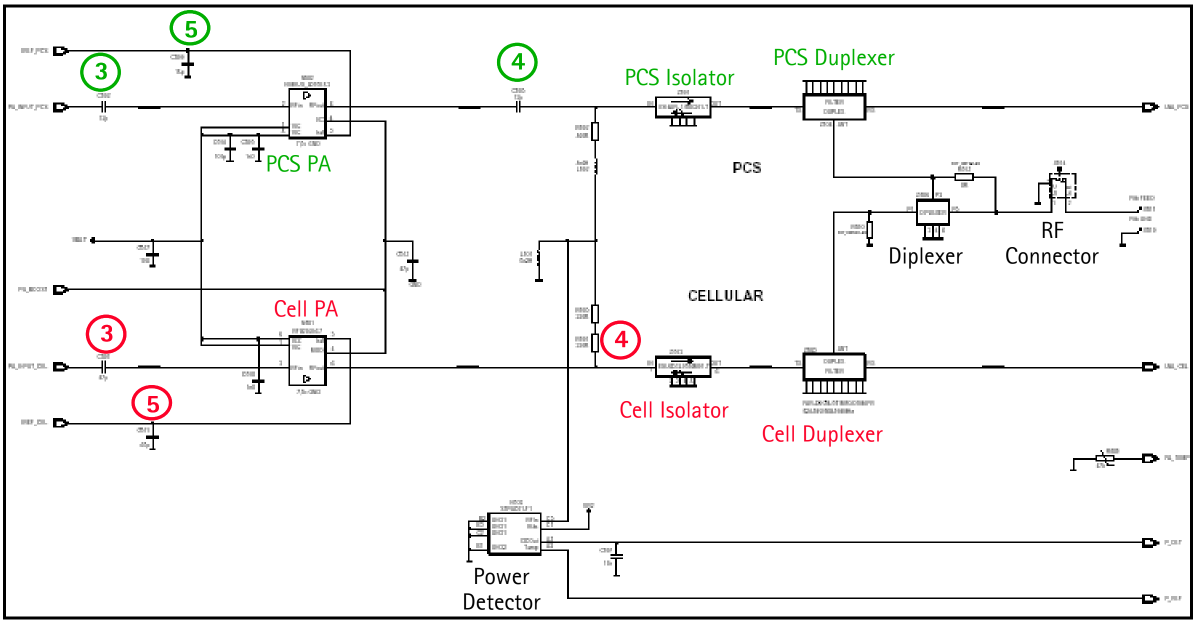
Figure 4: Tx system block diagram

- Setup mobile terminal in Local mode with appropriate band, channel, RHO, on and PDM settings.
- Agilent call box 8960 is recommended to measure Tx power at RF connector.
- The numbers in the following diagram indicate the general RF signal flow and probing locations.

Tx Schematic 1

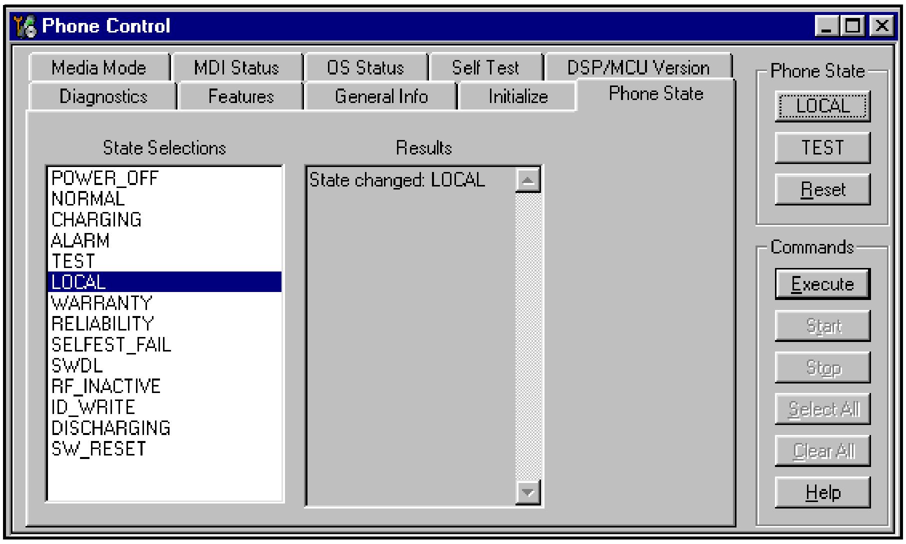


Tx Schematic 2

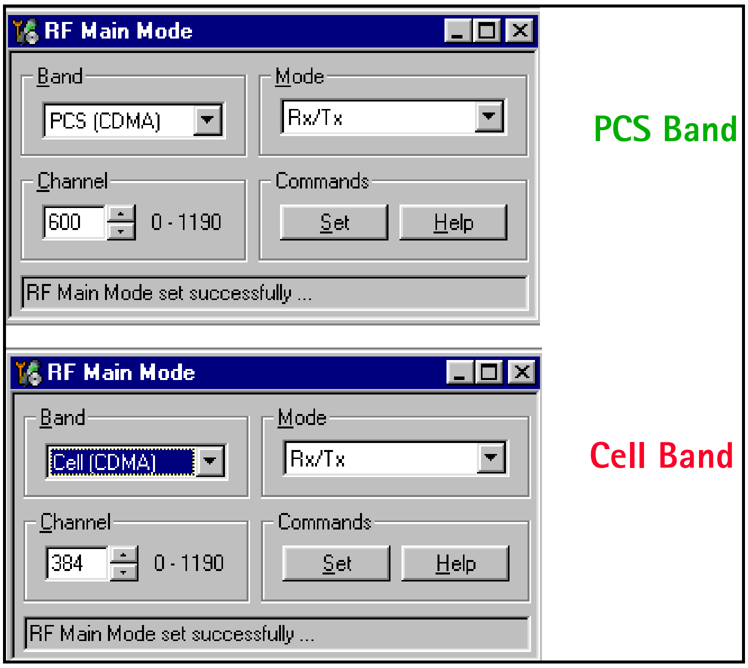


Tx Troubleshooting Using Phoenix

1. Use the **Phone Control** dialog box to turn on the mobile terminal.
2. Click the **Phone State** tab.
3. Click **Local** in the **State Selectors** list, and click **Execute**. This change the state to Local Mode.



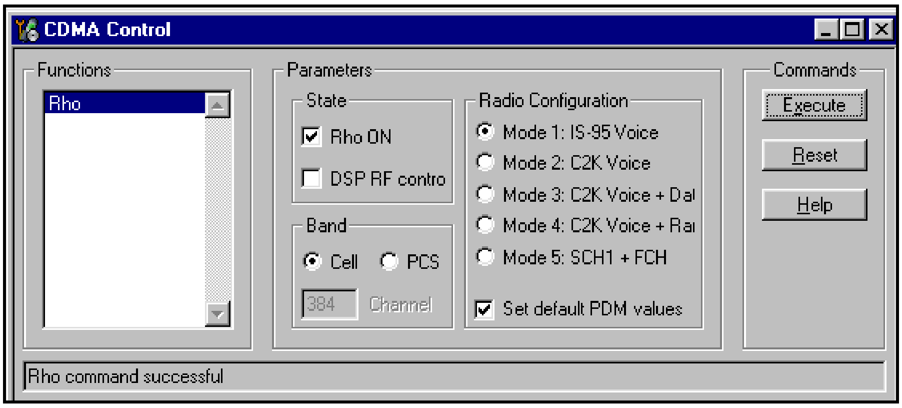
4. Use the **RF Main Mode** dialog box to set:
   - Band
   - Channel
   - Rx/Tx mode



Note: Be sure the "Main Mode set successfully" message appears.

5. Open the **DSP** menu, and click **CDMA Control**.

6. Select **Rho ON**, and click **Execute**.

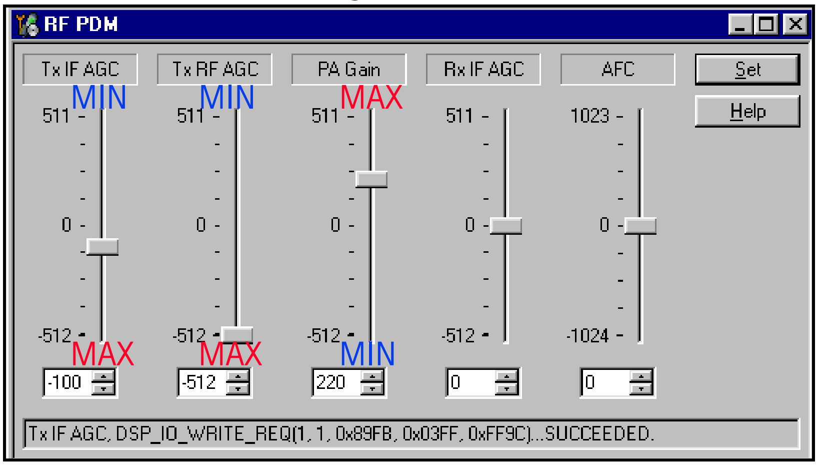


Note: Be sure the "RHO command successful" message appears.

7. Measure the Tx Pout at the RF connector using the 8960 Call Box.
   - Cell band Tx Pout = +11dBm
   - PCS band Tx Pout = +12dBm

If you do not see these powers, probe the Tx path to find out where the signal stops.

1. After Local Mode/Main Mode/and CDMA Control are activated, adjust the PDM values on the **RF PDM** dialog box.



Note: If you do not measure the correct Tx power at the RF connector, use the RF probe to determine where the failure occurs.

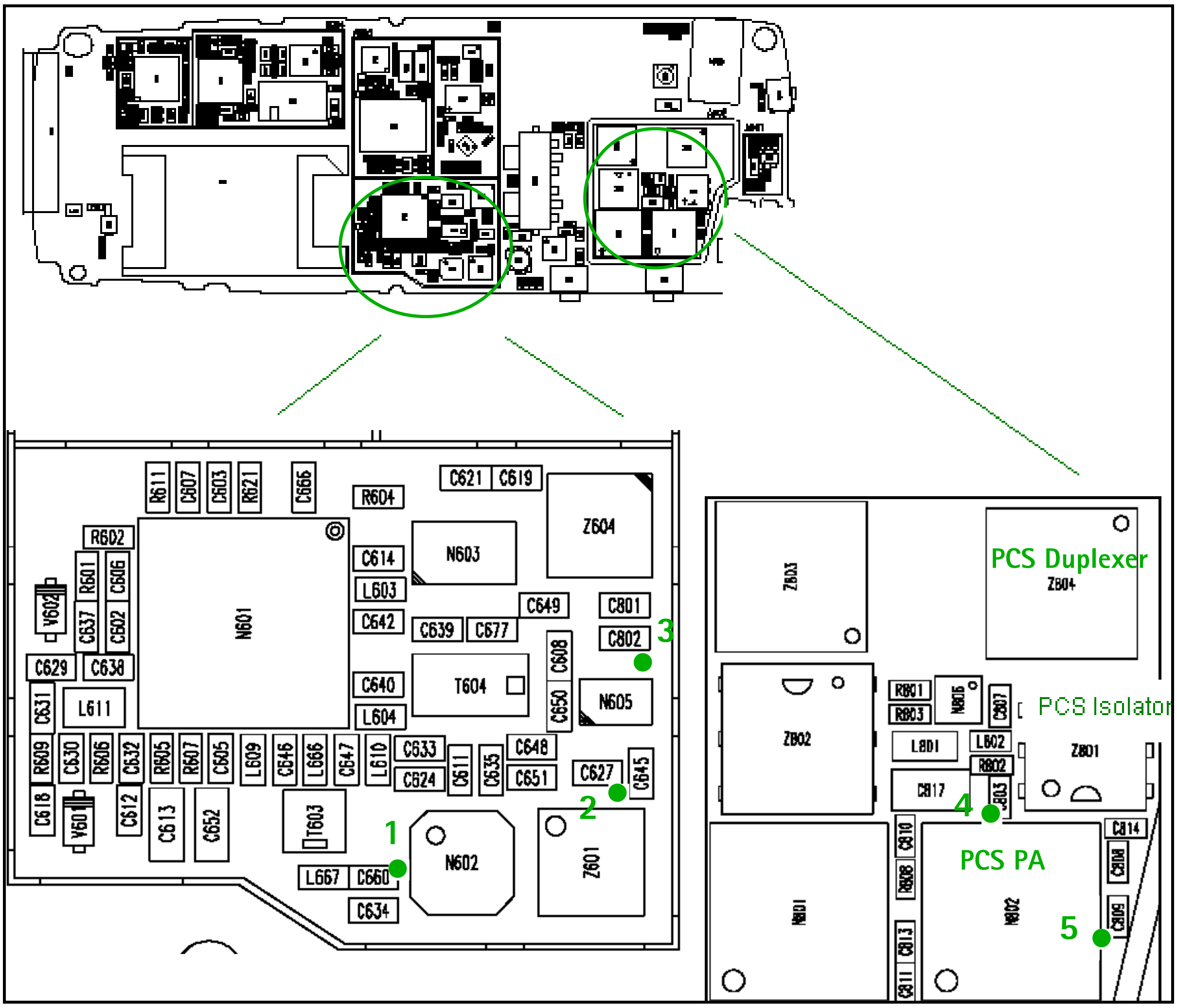
Local Mode (either PCS channel 600 or Cell chan 384):

- PA Gain PDM = +220
- RF AGC PDM = -512
- IF AGC PDM = -105 (PCS), -135 (Cell)

With PDMs set to the above values:

- Tx Pout ≅ 23dBm (PCS)
  Current ≅ 720mA (PCS)
- Tx Pout ≅ 25dBm (Cell)
  Current ≅ 880mA (Cell)

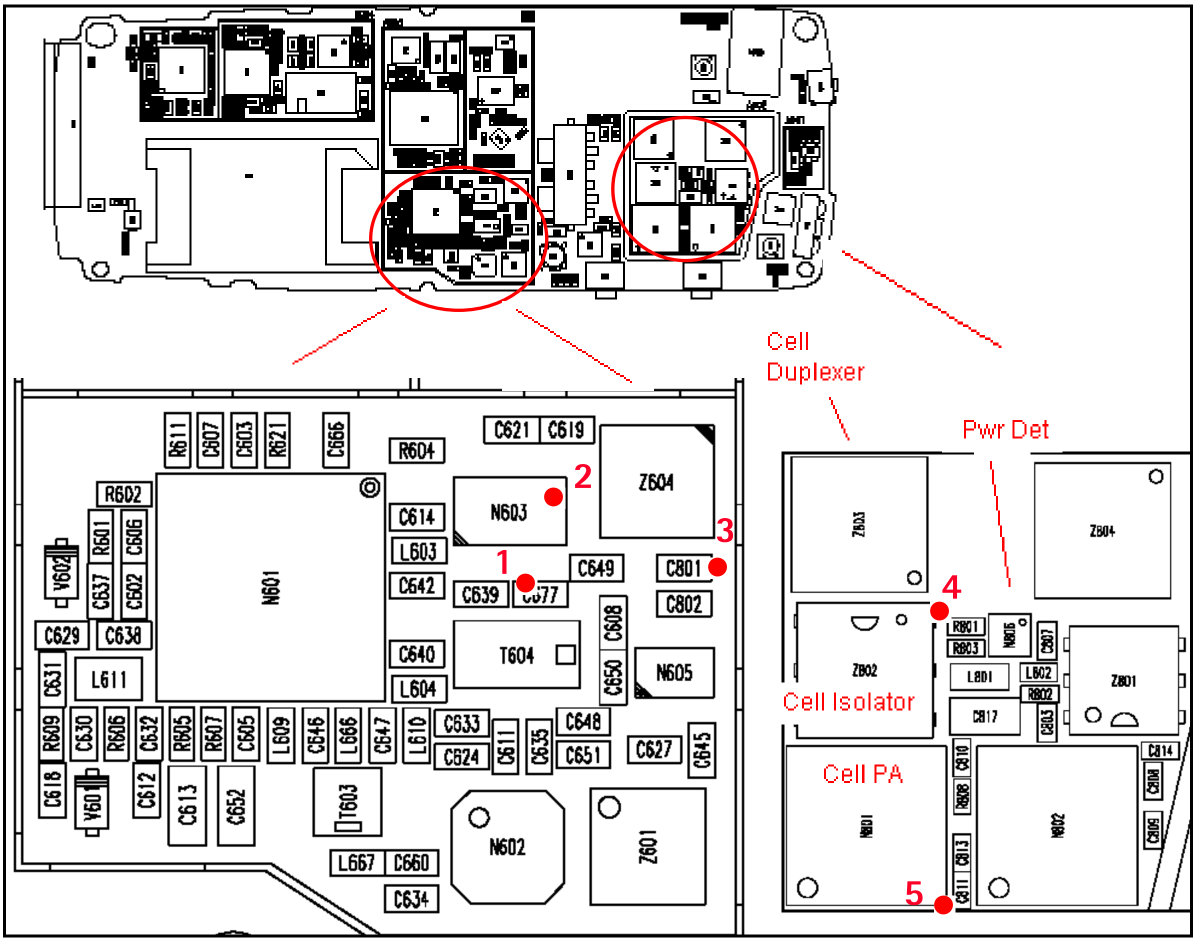
PCS Band Tx Probe Points



Use PDM settings from previous section. Following are the approximate power levels you should expect for PCS BAND (Channel 600):

1. C 660 Output of N601, input to N602
   Probed power ≅-2dBm (If not, then replace N601)
2. C 627 Output of split-band filter (Z601)
   (Gain ≅10.5dB – (filter loss 2.3dB) ≅ 8.2dB)
   Probed power ≅ 7dBm (If not, then replace N601)
3. C802 Output of the Tx Switch (Loss ≅ 1dB)
   Probed power ≅ +6dBm (If not, then replace switch)
4. C803 Output of PCS PA (use 10dB pad on probe or just sniff part)
   Probed power ≅ +18dBm (If not, then replace PCS PA)
5. C809 IREF into PCS PA should be ≅ 2.7V (If not, trace back to N601 and then to BB)

Cell and AMPS Band Tx Probe Points

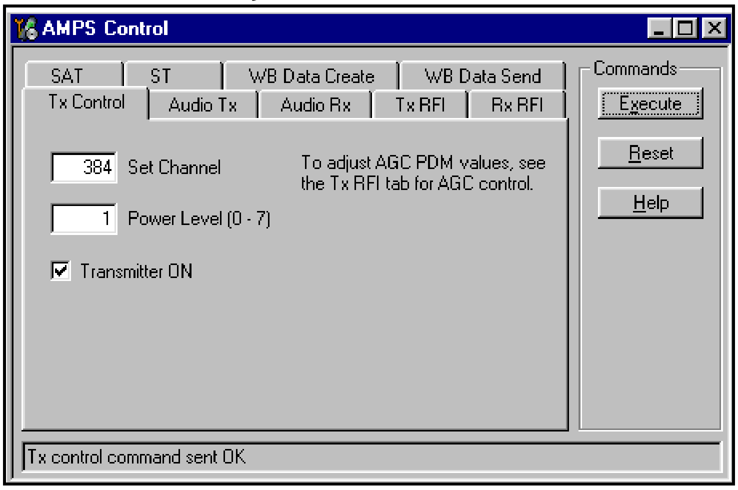


Use PDM settings from previous section. Following are the approximate power levels you should expect for Cell band (Channel 384):

1. C677 Output of N601, Input to the N603 driver
   Probed power ≅ -3dBm (If not, then replace N601)
2. Pin 6 of N603 driver is the output (Gain ≅ 14dB)
   Probed power ≅ +11dBm (If not, then replace N603)
3. C801 Output of the Tx Saw filter (Loss ≅ 1dB)
   Probed power ≅ +10dBm (If not, then replace filter)
4. R801 Output of Cell PA (use 10dB pad on probe or just sniff part)
   Probed power ≅ +21dBm (If not, then replace Cell PA)
5. C811 IREF into Cell PA should be ≅ 2.7V (If not, then trace back to N601 and then to BB)

Tx AMPS Troubleshooting Using Phoenix

1. In Local Mode/Main Mode select AMPS Band.
2. Use PDM controls to adjust the PA, RF AND IF AGC



Local Mode:

- PA Gain PDM = 229
- RF AGC PDM = -416
- IF AGC PDM = -137

With PDMs set to the above values:

- Tx Pout ≅ +26dBm
- Current ≅ 998mA

Note: If you do not measure the correct Tx power at the RF connector, repeat Cell band Local Mode troubleshooting to find where the failure occurs. AMPS and Cell band share the same Tx path.

Rx Troubleshooting

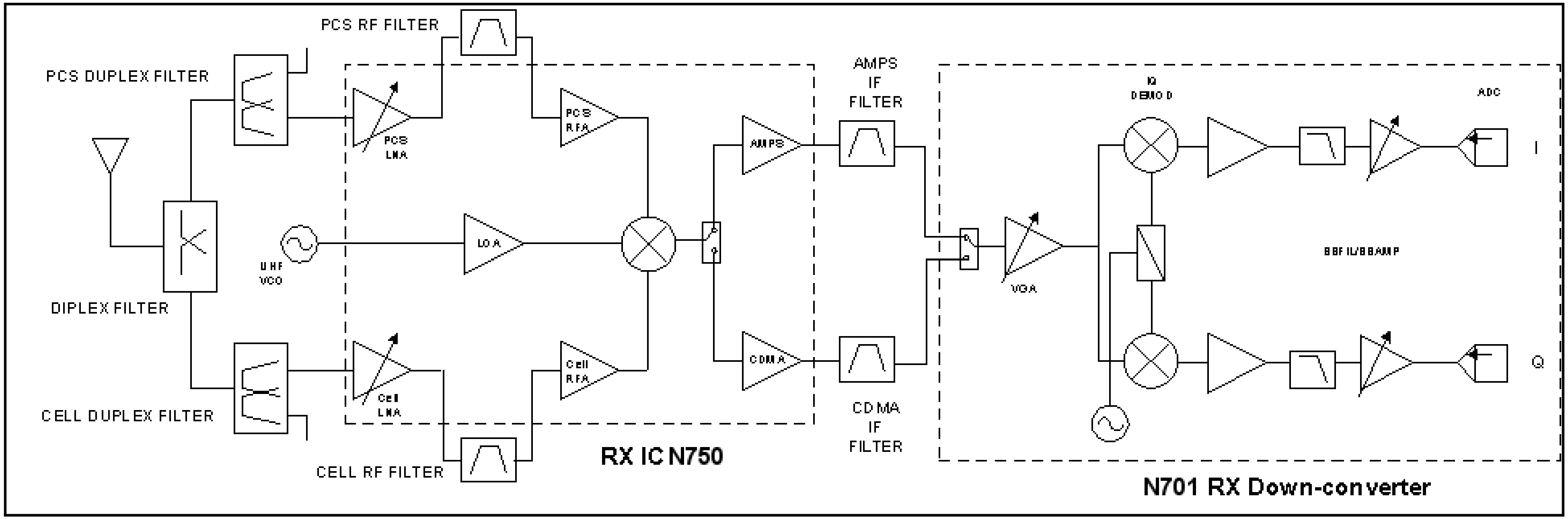
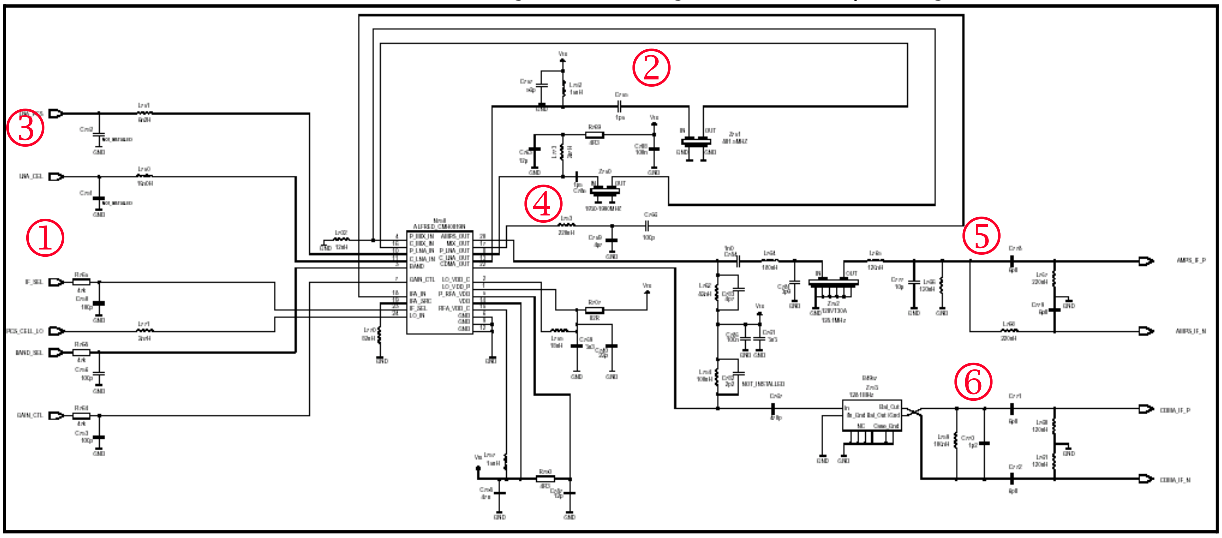


Figure 5: Rx system block diagram

Receiver Schematic

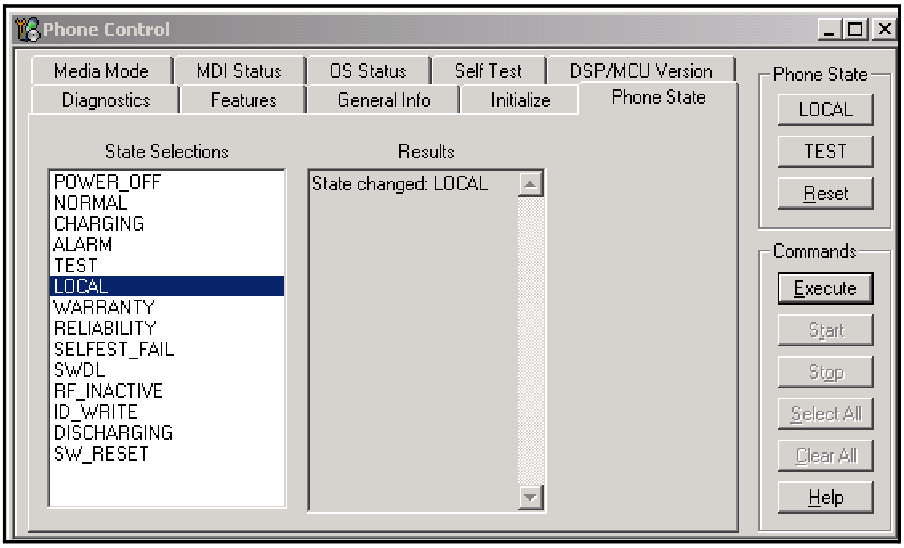
- An external signal source is injected to the RF input. The signal is then traced throughout the receiver chains.
- Agilent call box 8960 is recommended. Press the “Call Setup” soft button, “Active Cell,” then select “CW.”
- Inject a CW signal for PCS (1960MHz) or Cell/AMPS (881.52MHz) at a fixed -25dBm power level.

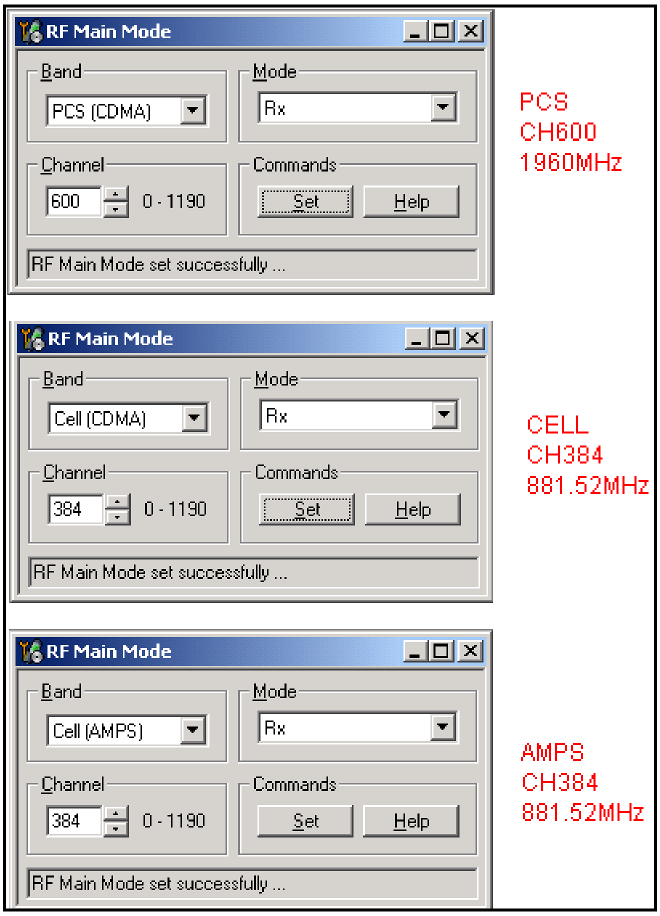
The numbers below indicate the general RF signal flow and probing locations.



Turning on Rx Path Using Phoenix

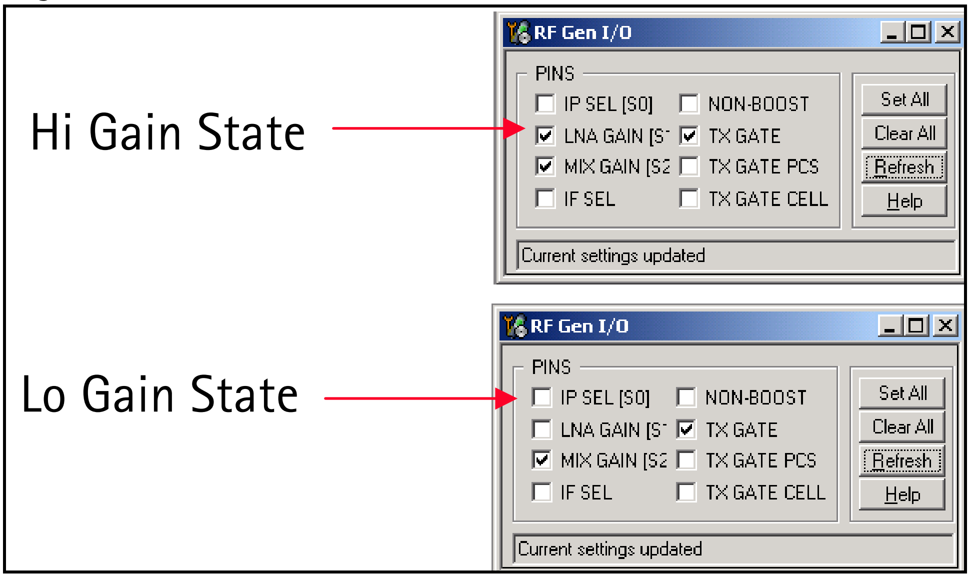
1. Turn on Receiver Only in CDMA Mode.
2. Set to Rx mode, the set the band and channel:
   - PCS channel = 600, Rx = 1960MHz
   - Cell channel = 384, Rx = 881.52MHz
   - AMPS channel = 384, Rx = 881.52MHz



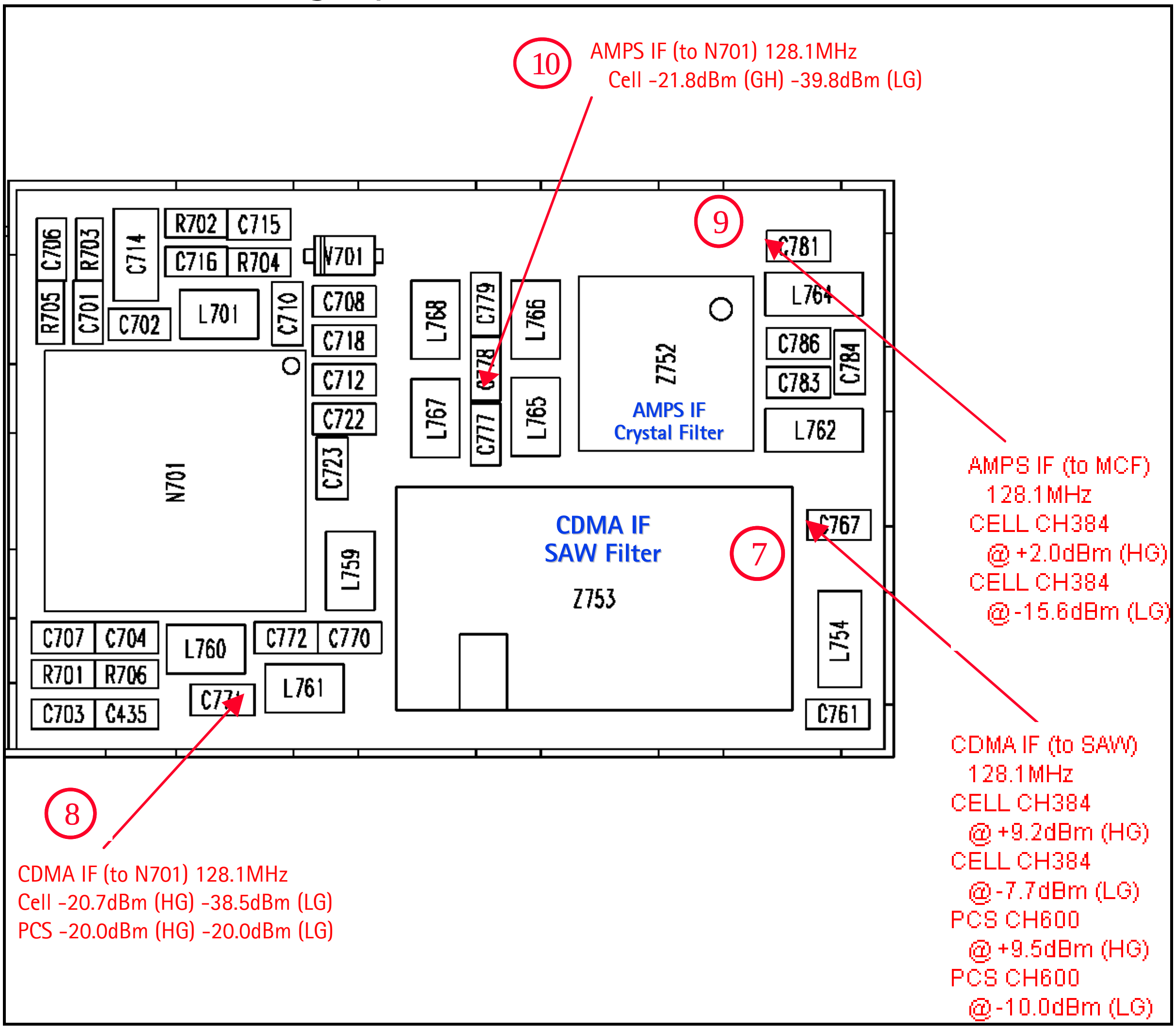


Switching Rx Gain States Using Phoenix

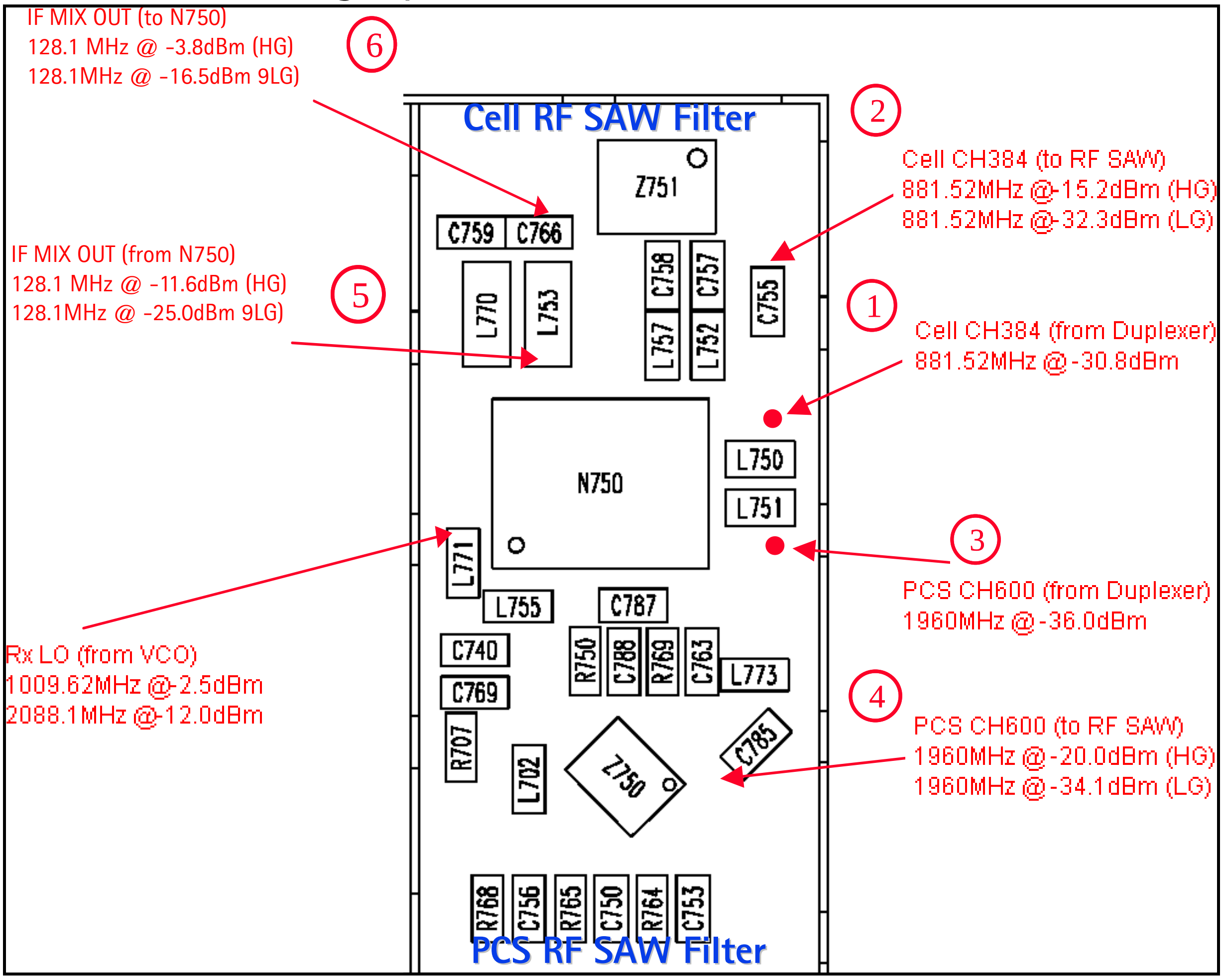
Two gain states (Hi and Lo) are available in the receiver for CDMA and AMPS modes:



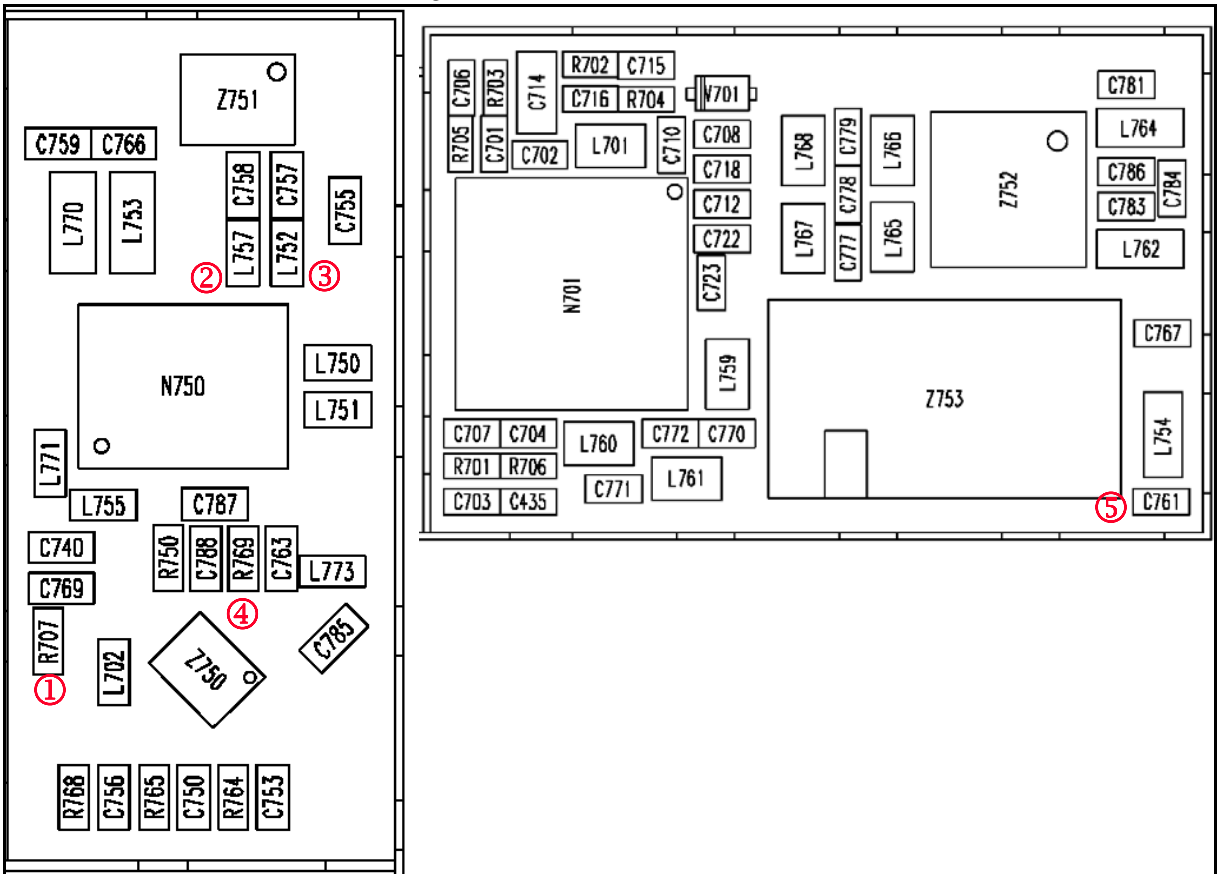
Rx IF Troubleshooting Layout



Rx RF Troubleshooting Layout



Receiver DC Troubleshooting Layout



① LO Vdd = 2.779VDC LOA Vdd supply lines for cell and PCS

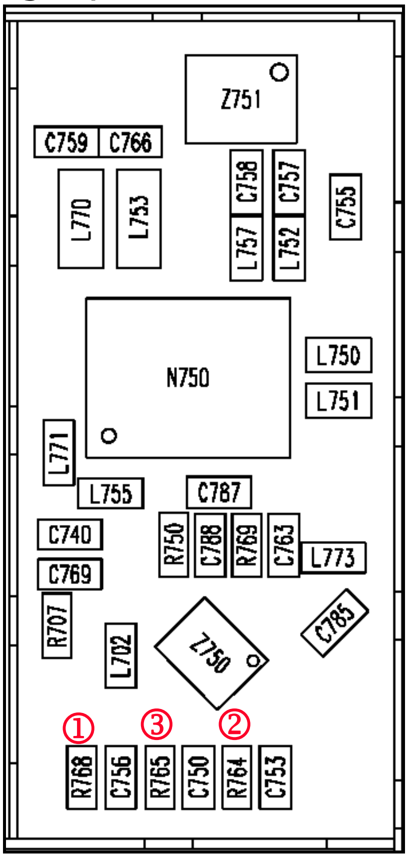
② RFA Vdd = 2.779VDC RFA Vdd supply line for cell band

③ C_LNA Vdd = 2.779VDC External Vdd supply line for Cell LNA

④ P_LNA Vdd = 2.779VDC External Vdd supply line for PCS LNA

⑤ IFA Vdd = 2.779VDC IFA Vdd supply line for CDMA and AMPS IFs

Receiver DC Troubleshooting Layout

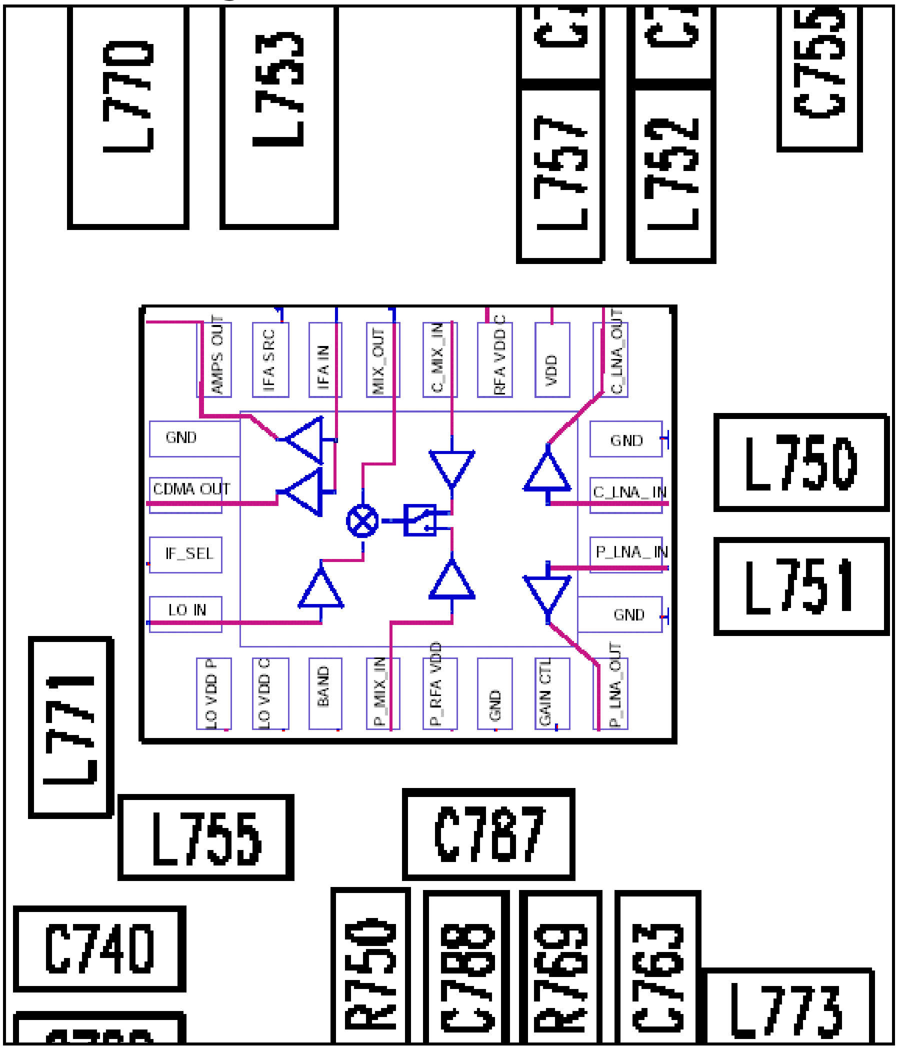


Measure Logic Levels for Rx Front End (N750)

Modes	Logic Inputs Voltages (V)		
	BAND (1)	GAIN_CTL (2)	IF_SEL (3)
CELL CDMA HI-GAIN	0.1 V	2.75 V	0 V
CELL CDMA LOW-GAIN	0.1 V	0 V	0 V
PCS CDMA HI-GAIN	2.68 V	2.75 V	0 V
PCS CDMA LOW-GAIN	2.68 V	0 V	0 V
AMPS HI-GAIN	0.1 V	2.76 V	2.76 V
AMPS LOW-GAIN	0.1 V	0 V	2.76 V

Note: If logic levels are significantly off (+/- 0.2V), replace N750 and remeasure. If voltages are still out-of-spec, see the Baseband Description and Troubleshooting *chapter of this manual.*

N750 Rx Troubleshooting



Things to Keep in Mind:

- There is a separate LNA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- Inside N750 is the RFA again. There is a separate RFA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- After RFA, there is a mixer and then the signals are separated by CDMA (Cell and PCS) and AMPS.

  For example, if there is no IF frequency (128.1MHz), check both Cell and PCS. If only one has at 128.1MHz (L753), check if IF_Sel is working. If it is, then replace N750 (bad RFA).

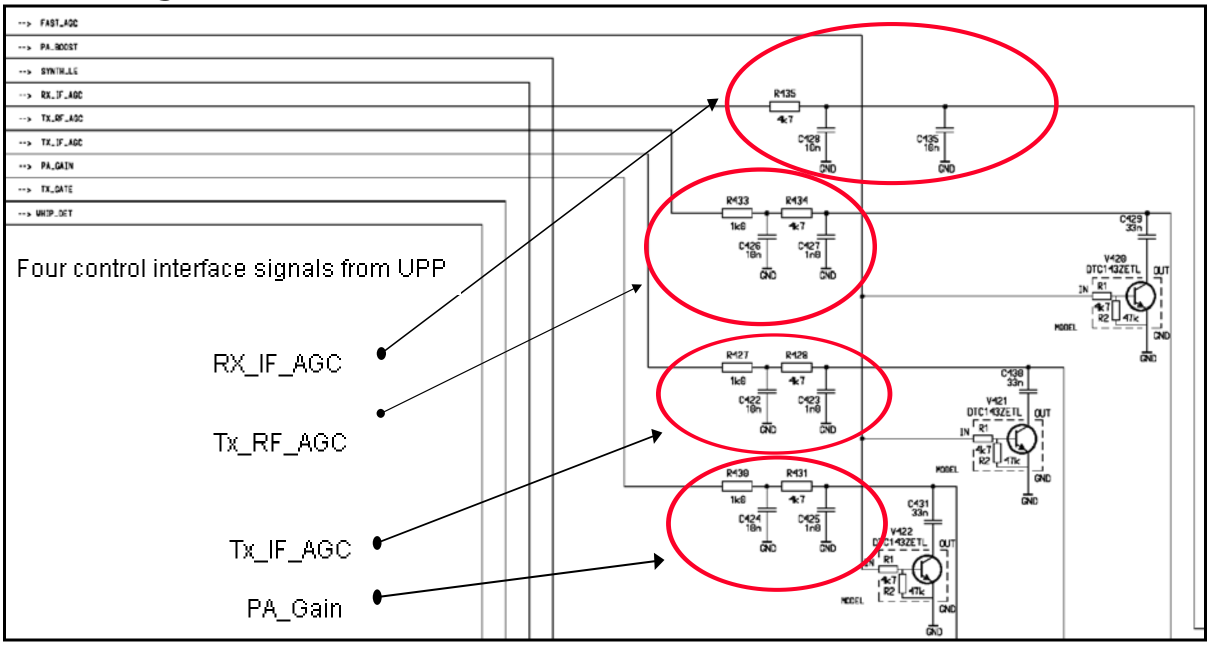
- If Cell and AMPS are working fine, but PCS is not, look at the band select line and the PCS LNA before replacing N750.

Rx DC Troubleshooting N750

Eventually, you will run into an N750 failure that has the symptoms of high current in Local Mode with just the Rx turned on. There can be two common explanations for this: (1) No presence of an LO signal, and (2) input impedance drop shorting out one of the DC supply pins to the chip. IMPORTANT: YOU MUST CHECK FOR BOTH CONDITIONS BEFORE REPLACING THE CHIP. If you have no LO signal, refer to the section of this chapter on troubleshooting the UHF LO. If you have a significant supply voltage drop on one of the supply pins, then change N750.

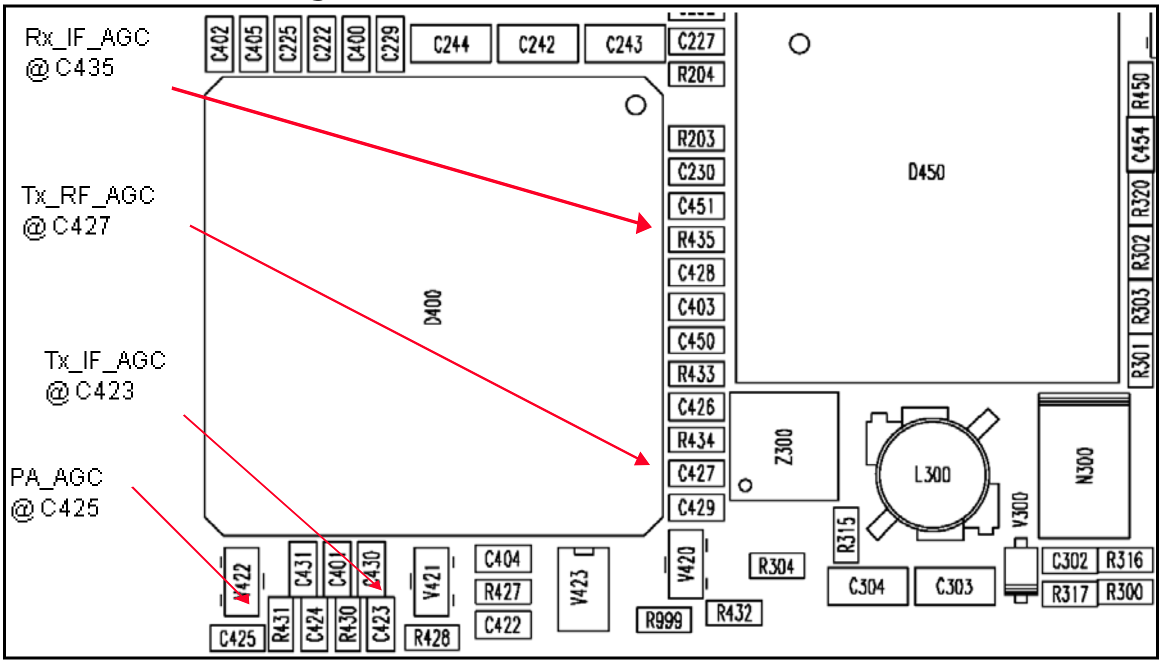
Condition (Local Mode, Set Rx only in RF Main Mode)	Supply Current (from Power Supply)
Good mobile terminal	104mA
No UHF LO Signal present	254mA
Pin 13 shorted	255mA

Control Signals at RF-BB Interface



Note: These components are located at the back panel. Check from SMD or missing components.

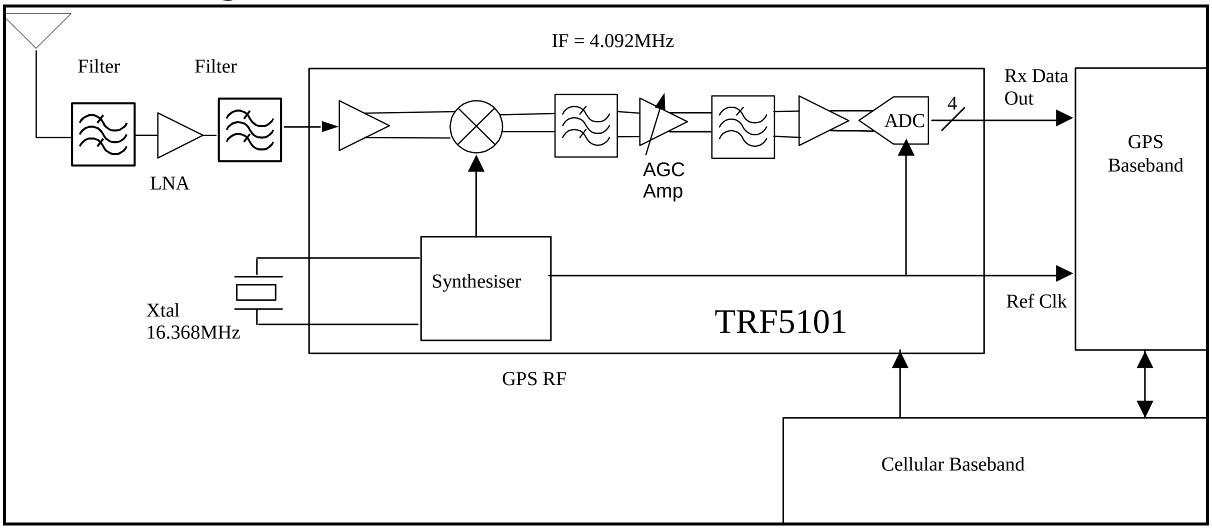
Back Panel Control Signals RF-BB Interface



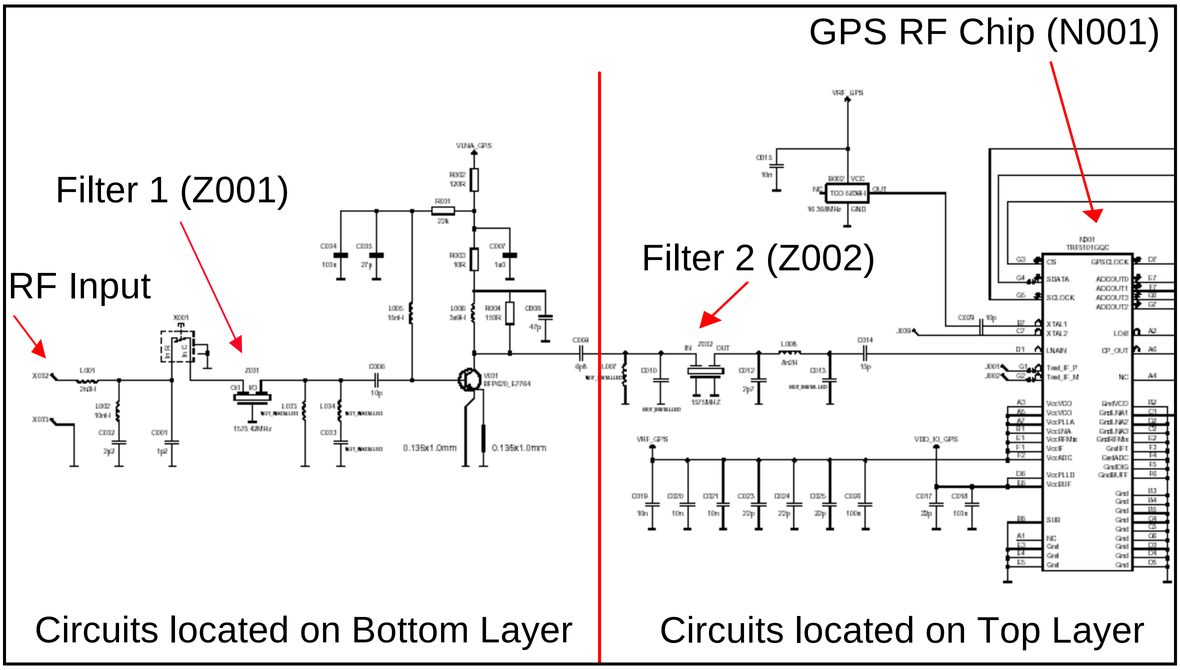
GPS Introduction

The mobile terminal supports 800 AMPS and 800/1900+GPS with IS 2000 capability. The engine supports CDMA and GPS functionality for Enhanced 911 (E911) services. GPS circuitry utilizes RF signals from satellites stationed in geosynchronous orbit to determine latitude and longitude of the handset. The GPS circuitry and the cellular engine (CE) circuitry are completely separate. The GPS circuitry is located almost exclusively on the secondary side of the PWB, underneath the display module.

GPS Block Diagram

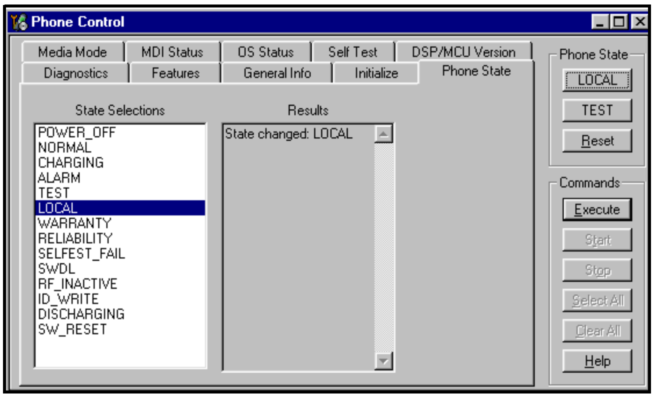


GPS RF Schematic

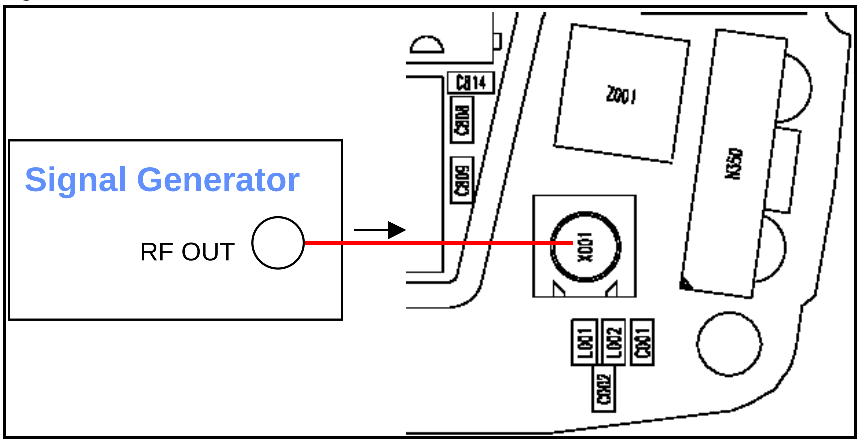


GPS Testing

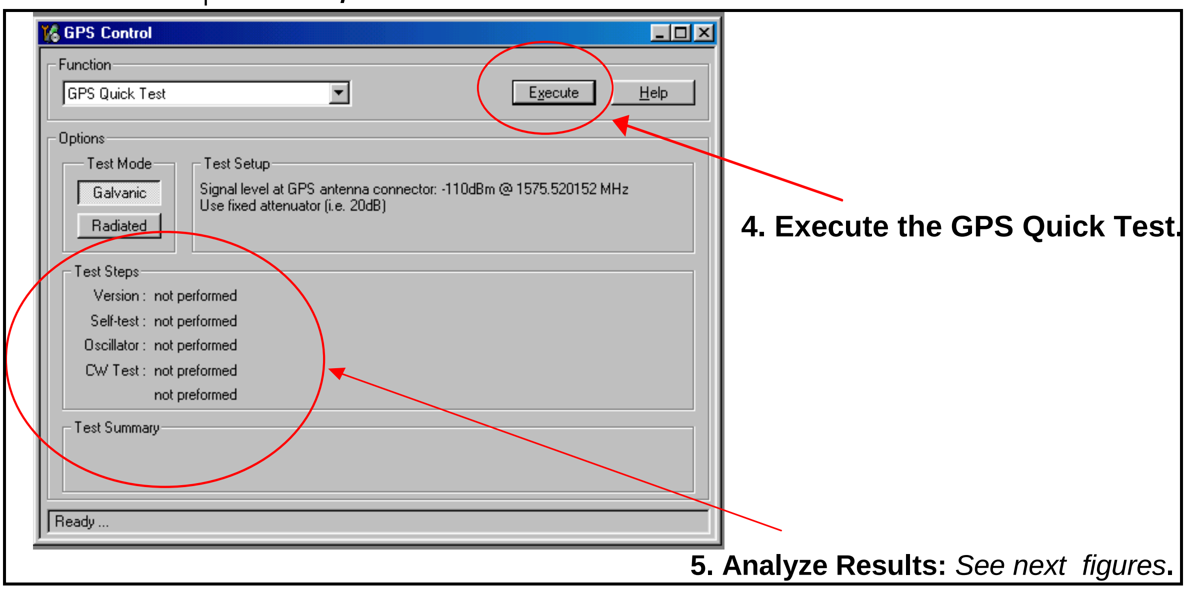
1. Set Local Mode.



2. Inject -110dBm tone @ 1575.52MHz at GPS connector (X001) with a signal generator or call box.



3. Open the **BB/Hwd** menu and select **GPS Control**.

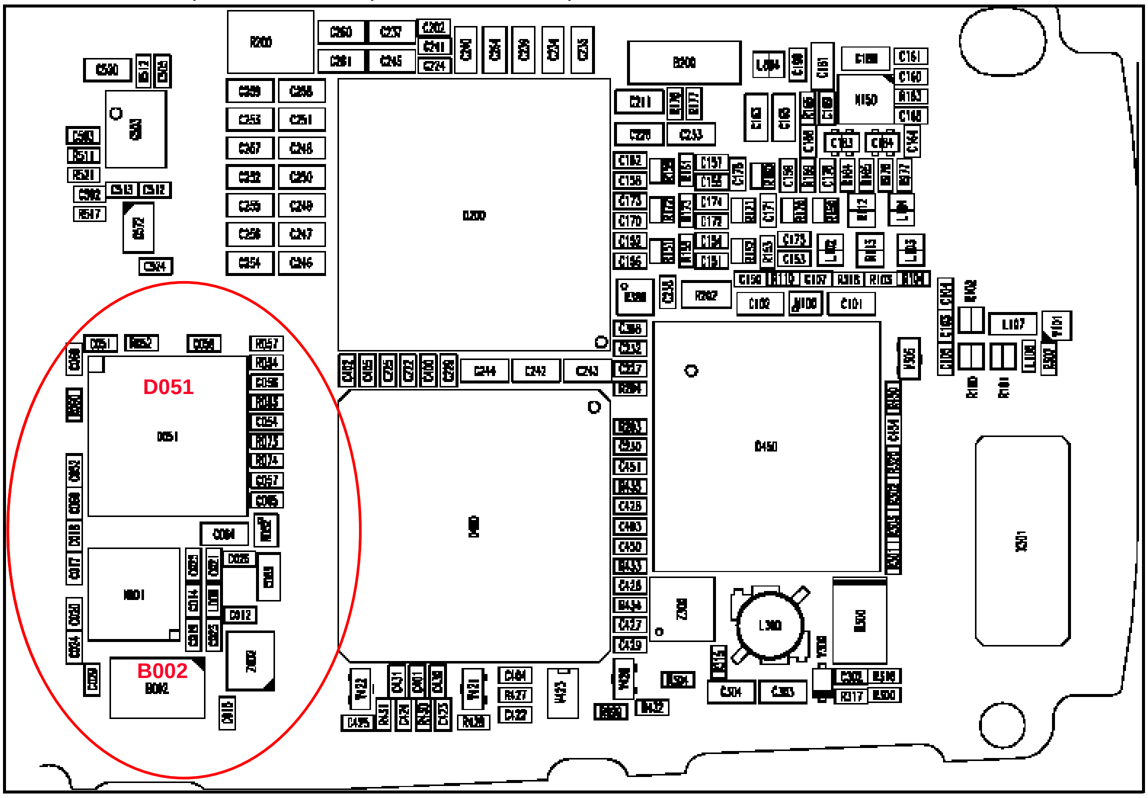


4. Self-Test Failure: Repeat Steps 1-3 for first failure. If the test still fails, continue.
5. Inspect all GPS circuit elements around D051.

   If pass visual inspection, then replace D051.

6. Oscillator Failure: Inspect all GPS circuit elements around D051.

   If pass visual inspection, then replace B002.

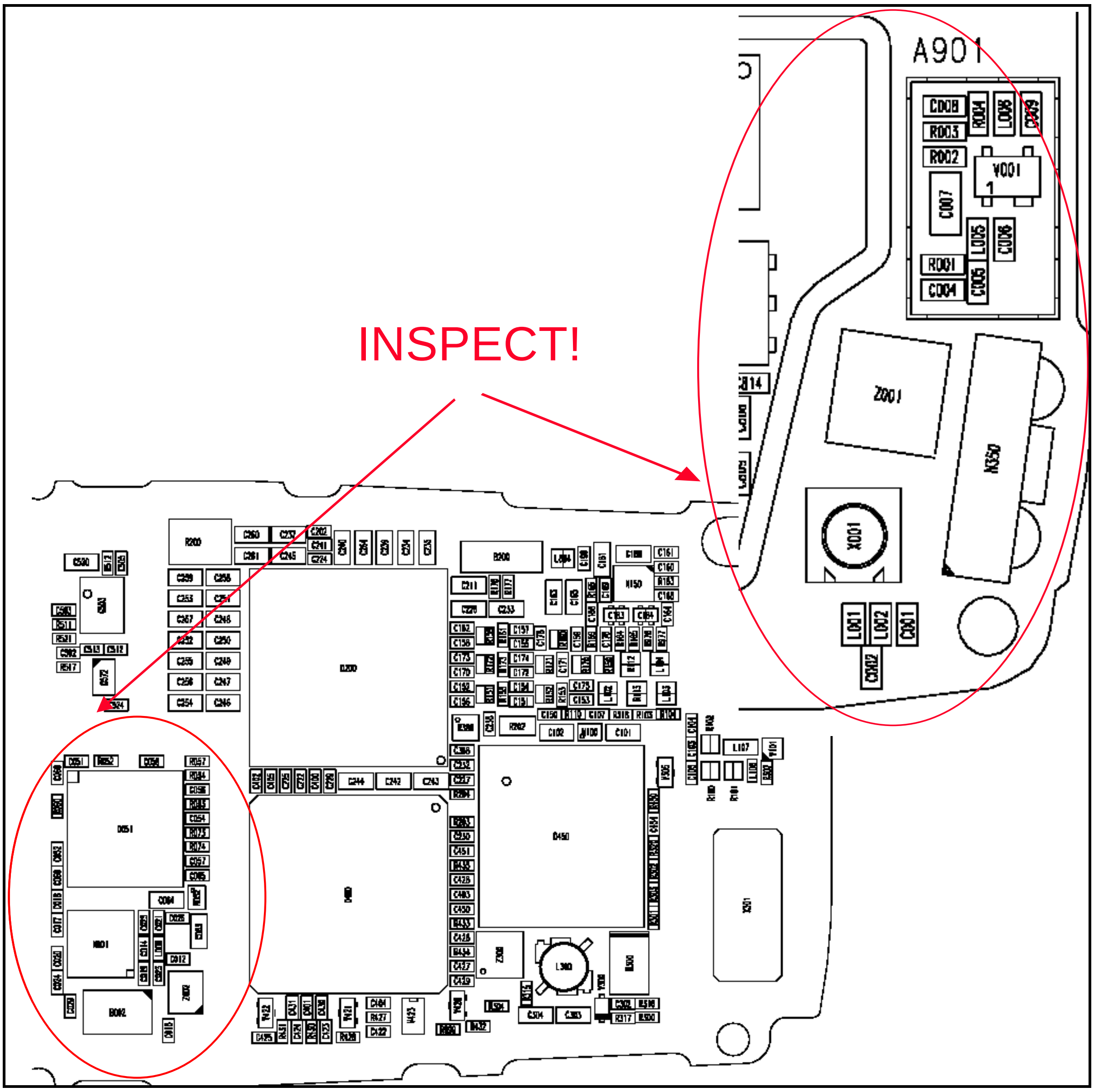


7. CW Test Failure: Check that signal generator is on and sourcing a signal to the GPS RF input port (X001).

   a. Inspect all GPS RF circuit elements.

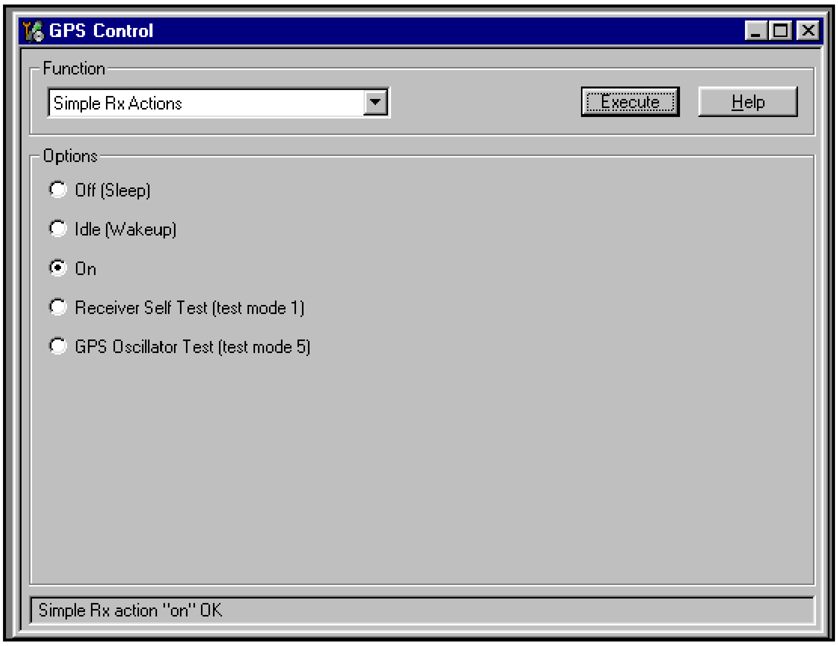
   b. Inspect all GPS circuit elements around D051.

   If all visual inspection looks good, then replace GPS RF IC (N001).

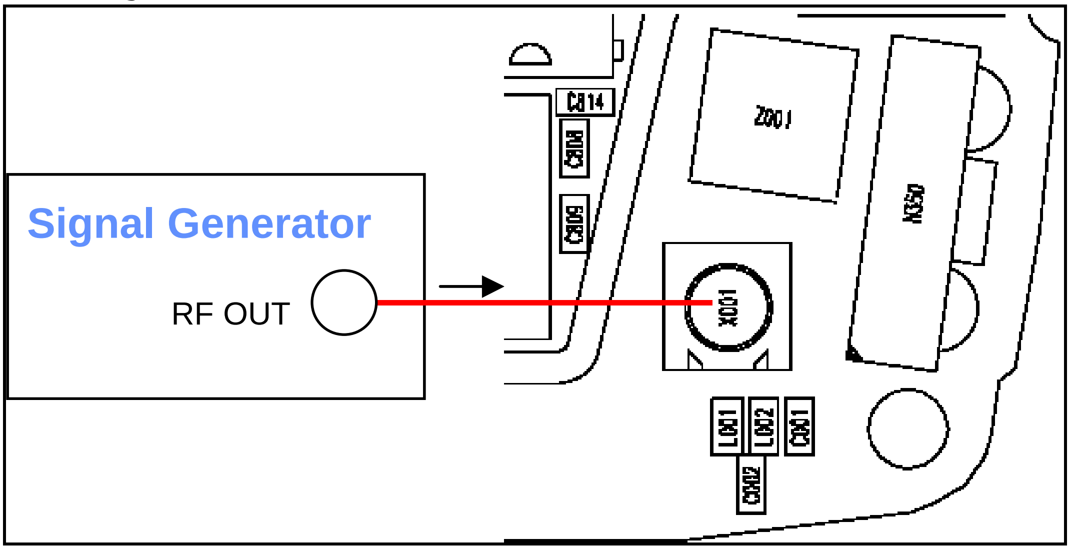

A901
C008
R004
L006
C009
R003
R002
V001
C007
L005
C006
R001
C004
C005
INSPECT!
Z001
N350
X001
L001
L002
C001
C002

GPS RF Probing Setup

1. Turn on the GPS Receiver

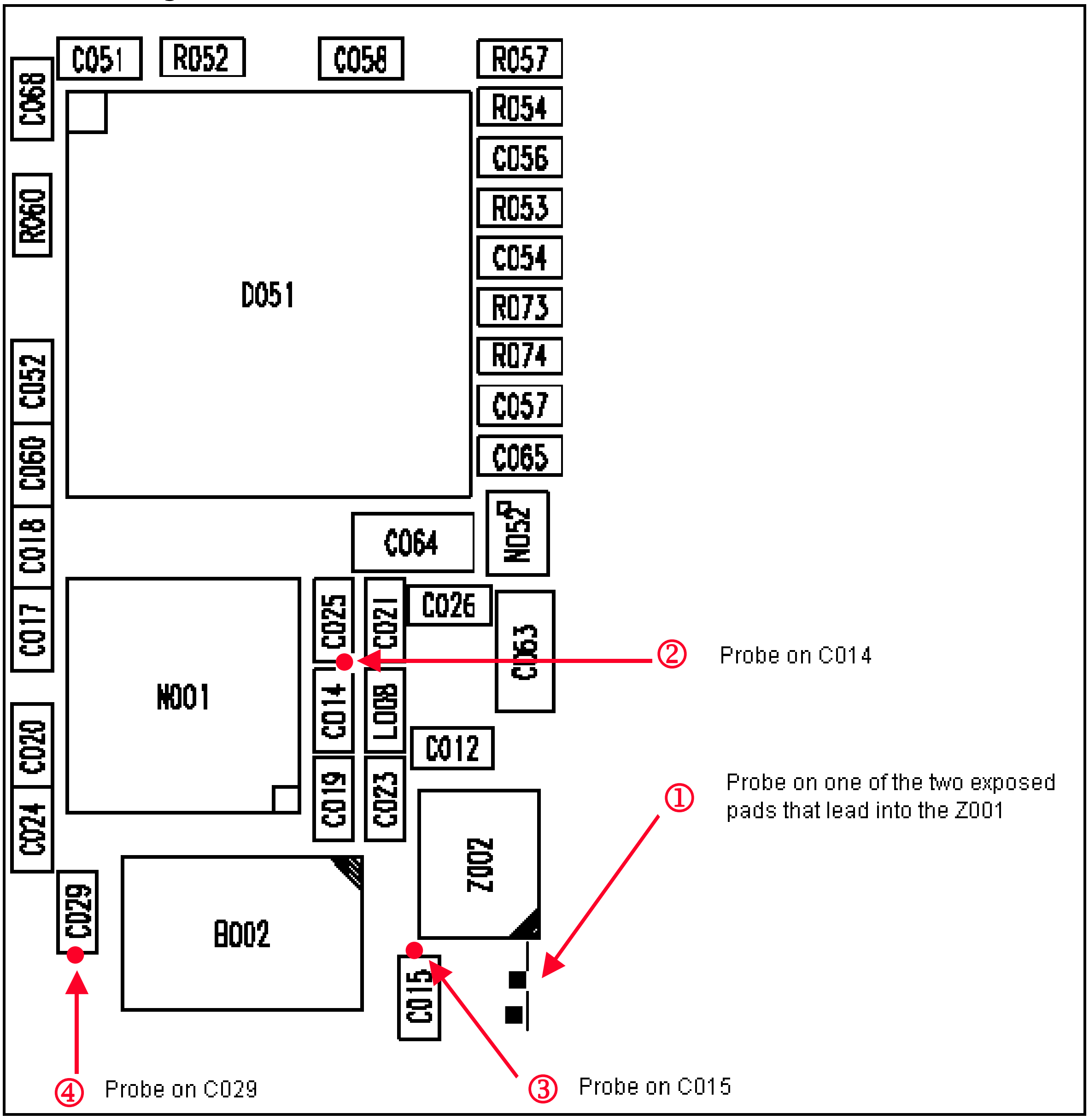


2. Inject -25dBm tone @ 1575.52MHz at GPS Connector (X001) with signal generator or Call Box.



3. Continue to the GPS RF Probing Diagram diagram which follows, and measure probe points with either a FET probe and a spectrum analyzer set at center frequency 1575.25MHz, Span = 500kHz, or a voltmeter as specified.

GPS RF Probing Measurements



Probe Point	Description	Value	Instrument
1	LNA output	1575.25MHz @ -19.5dBm	spectrum analyzer
2	2nd BPF output	1575.25MHz @ -21dBm	spectrum analyzer
3	TXCO supply V_{RF_GPS}	2.78V (DC)	voltmeter
4	TXCO output frequency	16.368MHz @ +6dBm	spectrum analyzer

