RF Description and Troubleshooting

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RF Troubleshooting

3125 General Troubleshooting Notes

Begin by checking the RX AGC PDM value when troubleshooting the receiver. The AGC value should be close to the typical values in the tables. The Rx AGC tries to keep a constant amplitude at the output of the receiver chain. If the AGC value indicates an AGC gain that is substantially higher than normal, the AGC is compensating for extra loss in another component. If the AGC PDM values are normal but there is still a problem, check the actual AGC voltages. RF probing at specific locations in the chain can help to pinpoint the source of the problem.

Likewise, be sure to check the measured output power and AGC values when troubleshooting the transmitter, which give an indication of where to start probing.

Although the tables in this chapter include power levels for many combinations of AGC values, it is generally only necessary to check one combination. The additional information is provided for use in unexpected situations. Likewise, although probing points and signal-level information are given for each point in the receiver and transmitter chains, it is not necessary to probe each point on every phone — only the suspected trouble spots.

Absolute power measurements were made with an Agilent (HP) 85024A active high-impedance probe. Other probes may be used (make sure the probe is high-impedance so the measurement does not load the circuit), but they may have different gains. Therefore, adjust the absolute measurements accordingly, especially if you are using a probe attenuator.

Typically, the higher loss occurs at the band edges where a range is given for loss. Probing is not a very accurate method to measure absolute power; therefore, you cannot expect measured results to exactly match the numbers listed.

Power depends on the impedance of the circuit. For example, if a filter has a nominal loss of 5 dB, straightforward probing on the input and output and then subtracting might not result in 5 dB because the input impedance could be different from the output impedance. Most components in the RF section have the same input and output impedance (50ohms). Where this is not the case, absolute power is noted in the tables in dBm rather than loss or gain in dB.

Inject a CW tone into the receiver when testing the CDMA receiver. The gains and losses are the same for a CW signal as for the CDMA.

Note: After opening the shield lids, always replace them with new lids.

Phone Components

Figure 1 and Figure 2 illustrate the main components of the 3125.

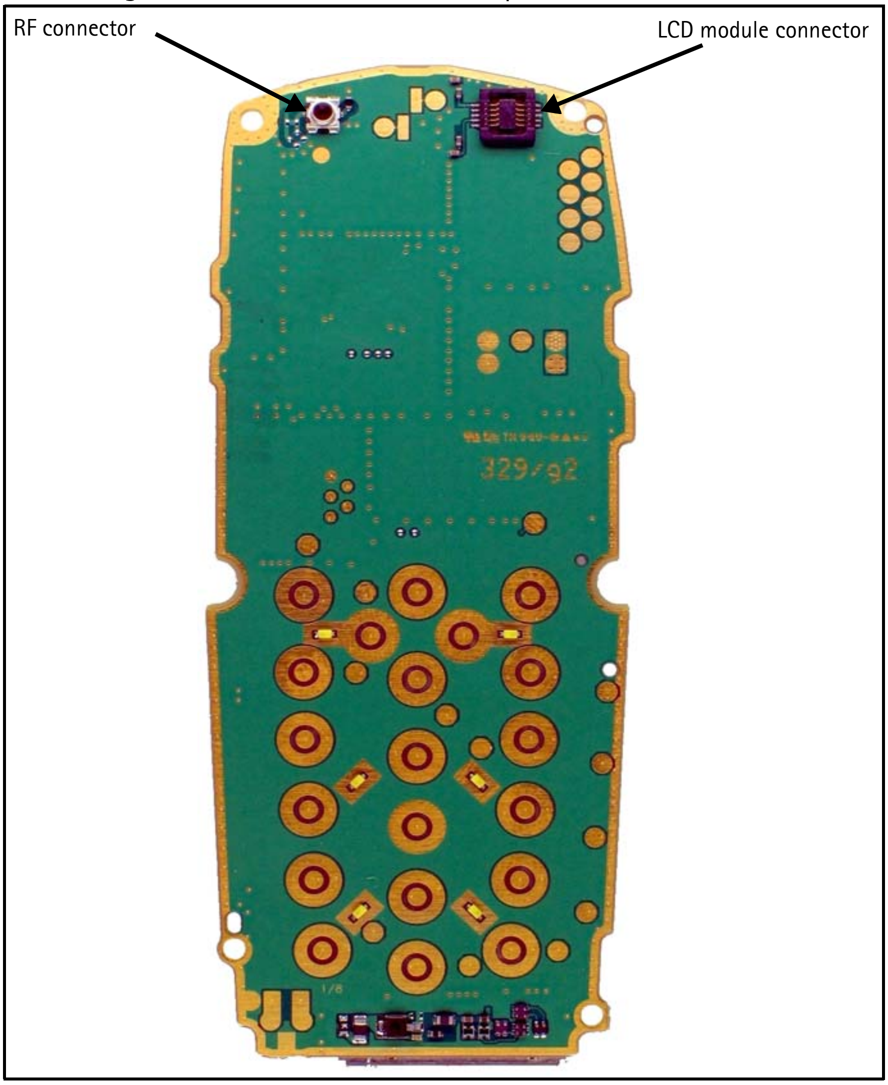

Figure 1: RF components

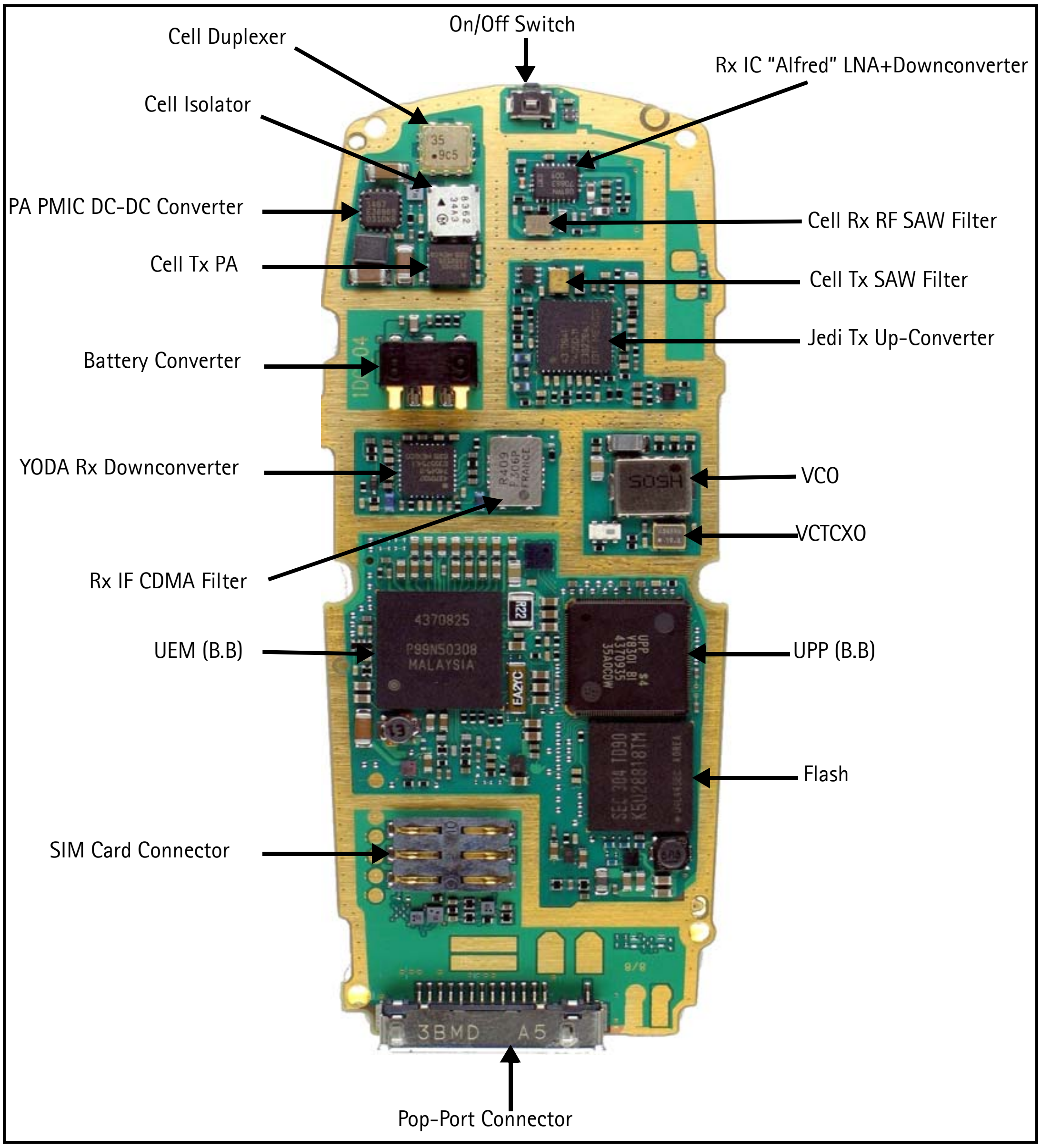

Figure 2: RF components

Phone Cannot Make a Call

Verify the following if the phone cannot make a call:

- The phone is in normal mode (i.e., the phone is searching for a signal, net server is on).
- The Preferred Roaming List (PRL) is loaded into the phone.
- The phone is tuned and has passed tuning. (Read the tuning parameters using the batch tune component in Phoenix; an untuned phone has all zeros in the tuning file.)
- The call box channel is set for a channel in PRL.
- The SID is correct and entered into the phone.

- The MIN and MDN are entered into the phone.
- The VCTCXO is centered as described in the VCTCXO tuning description on page 32.
- The transmitter and receiver are working properly in Local Mode.

Transmitter Troubleshooting

Low Tx Power

Use Phoenix to turn on the transmitter in Local Mode, and check the following:

1. Verify the current (0.7 - 1A for max power, mode, and channel dependent).
2. Use a microscope to visually inspect the PWB for proper placement, rotation, and soldering of components.
3. Look for the presence of a Tx signal on the spectrum analyzer at the correct frequency:
    - If the signal is not on frequency, check in the 100 MHz span.
    - If the signal is present but off frequency, check the synthesizer. Most likely, one of the synthesizers is not locked, or the VCO has no output signal.
    - If the signal is not present, or is present but low in amplitude, use the probing tables to determine where in the chain the fault occurs.
4. Verify that the AGC PDMs are set for the desired Tx power as listed in the Tx AGC Tuning table on page 12, and ensure that the AGC voltages are correct.
5. Check the LOs for proper frequency and amplitude.
6. Ensure that the power supplies to the transmitter have the correct voltage.

Cell Transmitter Setup

Use the following steps to set up the phone for Tx troubleshooting in Phoenix.

1. Open the **Phone Control** dialog box.

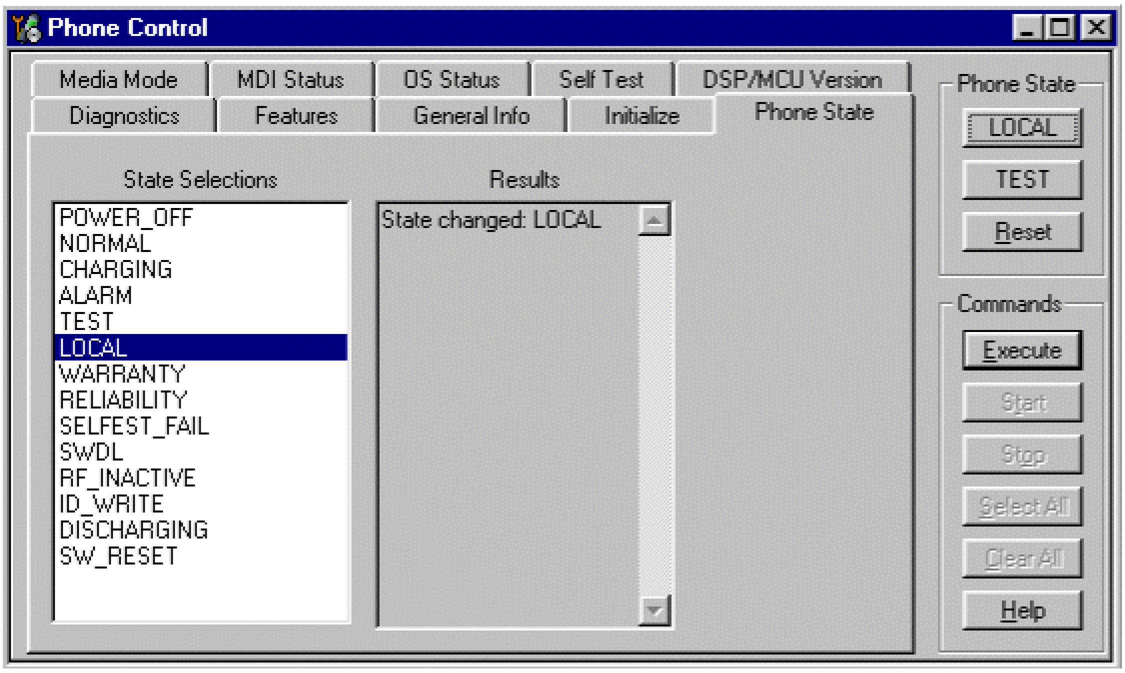

Figure 3: Phone Control dialog box for Tx troubleshooting

2. Click the **LOCAL** button in the **Phone State** area to put the phone into Local Mode.

3. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = Cell (CDMA)
   - **Channel** = 384
   - **Mode** = Rx/Tx

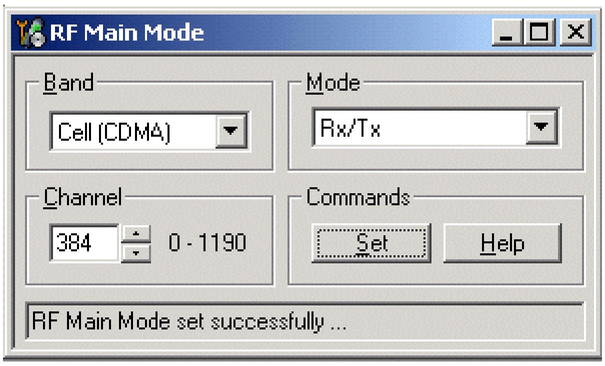

Figure 4: RF Main Mode dialog box for Tx troubleshooting

4. Click the **Set** button.

Note: Be sure that the "RF Main Mode set successfully..." message appears in the status bar.

5. Select the **Rho ON** check box on the **CDMA Control** dialog box.

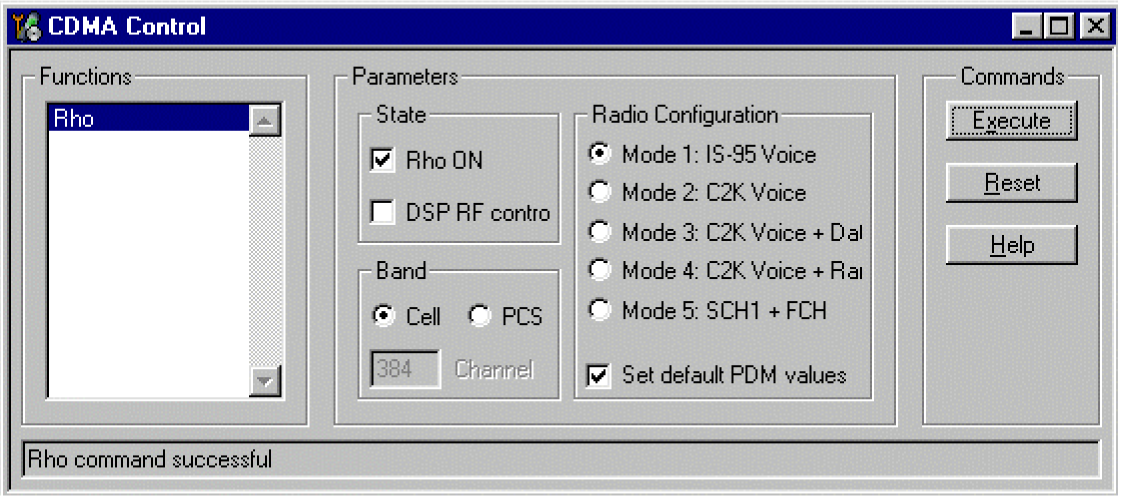

Figure 5: CDMA Control dialog box for Tx troubleshooting

6. Click the **Execute** button.
7. At this point you should be able to measure Tx Pout at the RF connector. The cell band Tx Pout =0 to 2 dBm. If you do not see these values, set the AGC PDM for 25 dBm and probe the Tx path to figure out where in the path the fault occurs.
8. Open the **General I/O** dialog box to set the PA gain state.
9. Enter 10, 13, 12, and 8 in the **PIN #** fields.

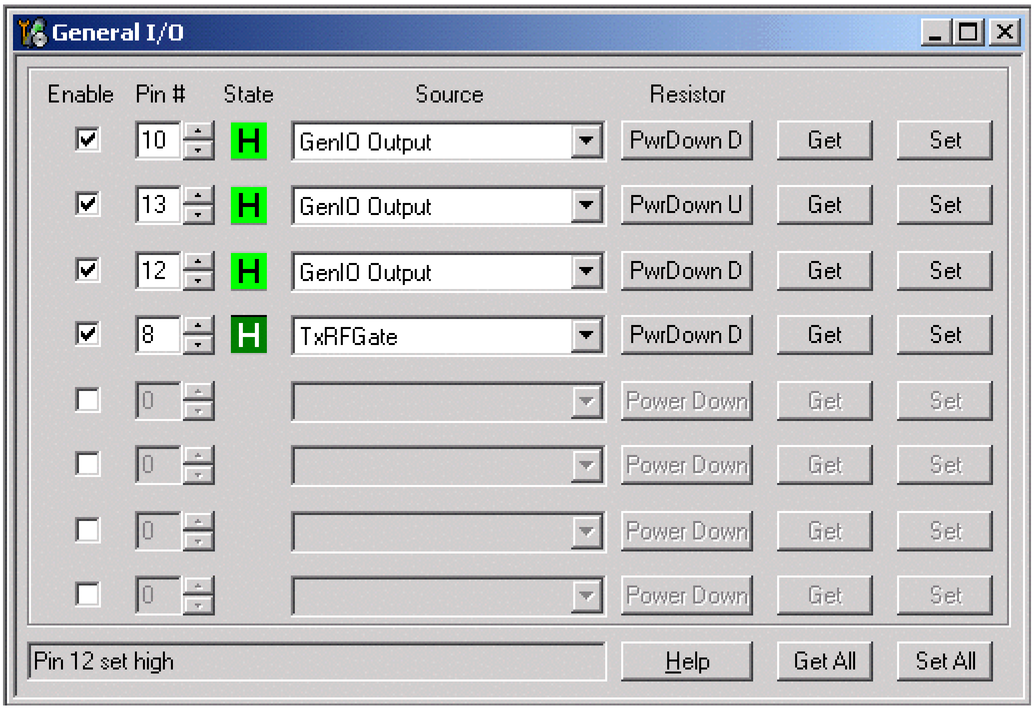

Figure 6: General I/O dialog box for Tx troubleshooting

10. Select the boxes in the **Enable** column for each pin.
11. Click the **Get All** button.

12. Ensure that all of the pins have a value of H in the **State** column. (Click the L values to change them to H values.)

13. Adjust the following PDM field values on the **RF PDM** dialog box:

    - **Tx IF AGC** = -280
    - **Tx RF AGC** = -280

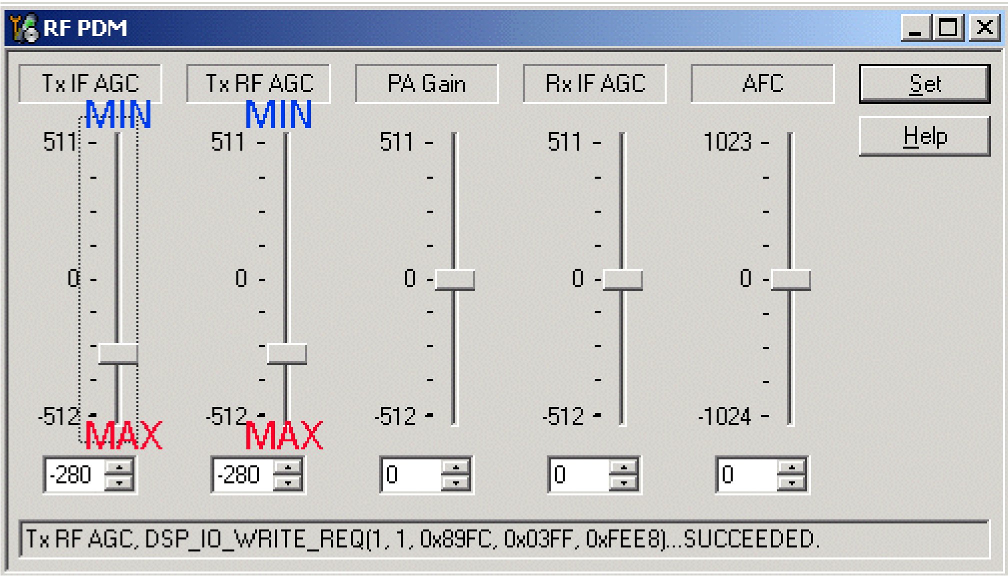

Figure 7: RF PDM dialog box for Tx troubleshooting

14. Ensure that the Phone Tx Pout = +25dBm and the current = 770-860mA.

Cell Transmitter Path

The following table indicates the test points to probe when troubleshooting the cell transmitter path. It is recommended that you follow the steps in order. An HP high frequency probe was used to make the frequency and output power measurements

Table 1: Cell Transmitter Test Points

Test Point	Part*	Function	Typical Value/ Frequency HP85024A	Typical Value Frequency Prod Probe	Comments
T1	Z601 pin1	Jedi-Out	-43dBm/ 836.52MHz	-13.2dBm/ 836.52MHz	Output of Jedi Driver, Input to Tx SAW Filter
T2	Z601 pin 3	PA-In	-25dBm/ 836.52MHz	-15.4dBm/ 836.52MHz	Output of Tx SAW, Input to PA
T3	N803 pin 8	PA-Out	5.0dBm/ 836.52MHz	18.3dBm/ 836.52MHz	Output of PA, Input to Isolator
T4	Z803T	Iso-Out	2.2dBm/ 836.52MHz	10.3dBm/ 836.52MHz	Output of Isolator, Input to Duplexer
T5	C603L	IF-Out	-29dBm/ 228.6MHz	-24dBm/ 228.6MHz	Tx IF Probing Point at IF Filter

Table 1: Cell Transmitter Test Points (Continued)

Test Point	Part*	Function	Typical Value/ Frequency HP85024A	Typical Value Frequency Prod Probe	Comments
T6	C638T, C654T, C633R, C635R, C603LR	VR5	2.7V dc		VHF VCO/PLL, IQ modulator supply from UEM
T7	C655R	VR7	2.7V dc		UHF PLL Supply from UEM
T8	C636L, C624T, L609B, C612L, C630B, L607B	VR2	2.7V dc		Mixer, driver, and IF supply from UEM
T9	C605R, C606R	VAGC-Tx	0.2 to 1.8V dc		Tx AGC Control Voltage from UPP. 0.2V = Max Gain 1.8V = Min Gain
T10	C658R, C600T	VIO-Tx	1.8V dc		Supply for Digital circuits from UEM
T11	C805B, C810T, C816R	VBAT	3.6V dc		Battery Voltage (Nominal Voltage 3.6V dc)
T12	C802L, C813L	VPA	3.6V dc (High Gain)		Main PA Supply Voltage from PMIC. Lgain=0.8V, Mgain=-1.25V, Hgain=Vbat
T13	C814R	C814R	1.8V dc (Enable)		PA Gate Voltage (Enable/Disable) Disable=0V

** The R, L, T, and B values at the end of the part names indicate the Right, Left, Top, and Bottom side of the part respectively in Figure 8 and Figure 9.*

Figure 8 shows each test point for the Jedi TXIC section from Table 1, "Cell Transmitter Test Points," on page 9. *Always* attach a 20 dB pad (11881-60001) when probing with an HP85024A high-frequency probe.

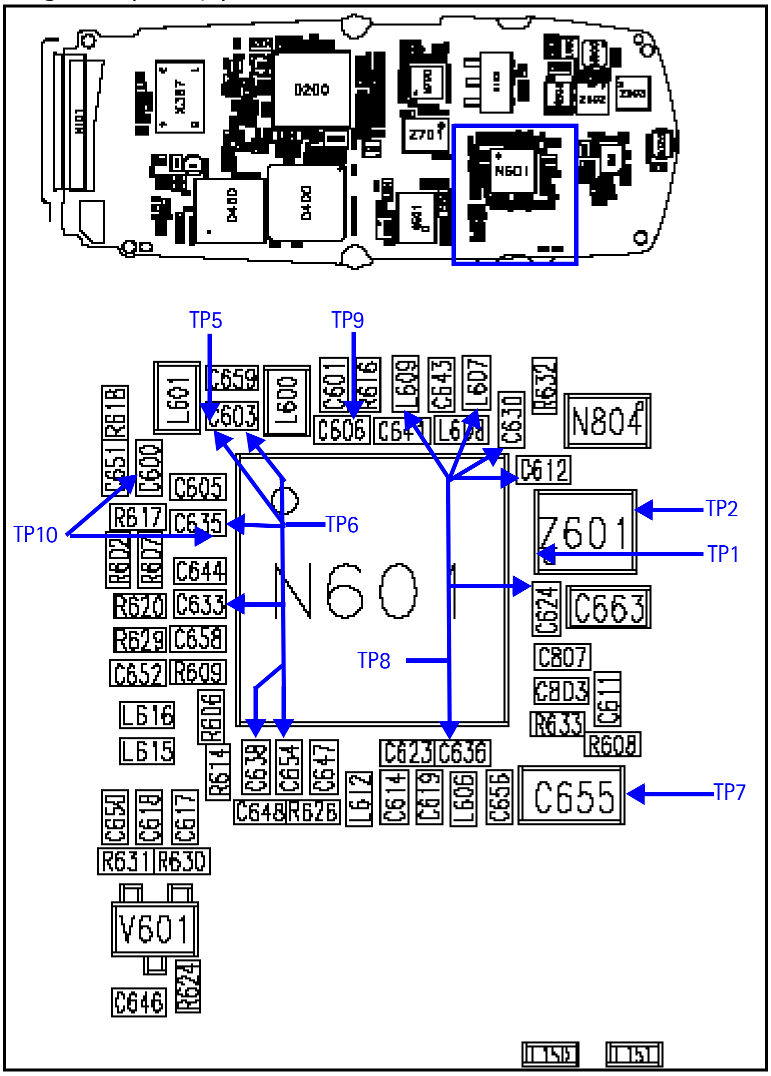

Figure 8: PWB, bottom side (Top). A zoomed view of the Jedi TXIC section with part numbers (Bottom).

Figure 9 shows each testing point for the PA section from Table 1, "Cell Transmitter Test Points," on page 9. *Always* attach a 20 dB pad (11881-60001) when probing with an HP85024A high frequency probe.

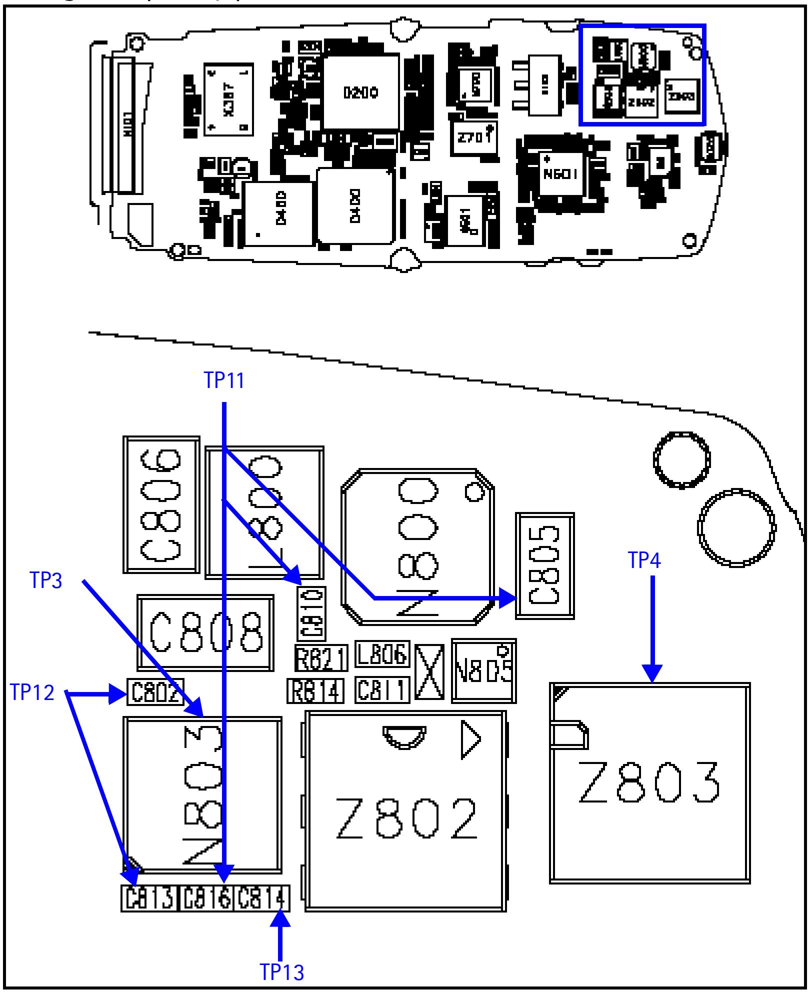

Figure 9: PWB, bottom side (top). A zoomed view of the PA section with part numbers (bottom).

Tx AGC Tuning

Tx power versus IF/RF PDM can be verified against FlaLi specification limits. Make sure that the PA is set in high gain mode (GenIO bits 10, 13, and 12 are set to H).

Table 2: Tx AGC Tuning Steps

Tx Tuning AGC Step	Tx AGC PDM Value	Target Power	Low Limit	High Limit
Tx AGC (0)	308	-46	-55	-37
Tx AGC (1)	130	-24	-34	-14
Tx AGC (2)	85	-15	-25	-6
Tx AGC (3)	51	-4.5	-14	5
Tx AGC (4)	19	2.5	-7	12
Tx AGC (5)	-5	6	-3	15

Table 2: Tx AGC Tuning Steps (Continued)

Tx Tuning AGC Step	Tx AGC PDM Value	Target Power	Low Limit	High Limit
Tx AGC (6)	-94	15	6	24
Tx AGC (7)*	-280*	25	21	27

Cell Power Amplifier

The power amplifier (PA) has the DC/DC converter (PMIC device), which controls the transmitter. The following tables show the circuits that have an effect on the transmitter path and how to troubleshoot them.

Table 3: PA Power and Gain Measurements

Power Amp Input Test Point	Power Amp Output Test Point
pin3-Z601	left-R814

Table 4: PA Power and Gain Specifications

Mode	Name	Power Output Range	Nominal Gain	Vcc Range	Vcc Test Point
Gain mode 0	V0	up to 6	23.8	0.75- 0.88	C806
Gain mode 1	V1	6 to 11	25.2	1.125- 1.375	C806
Gain mode 3	V2	Not used	Not used	2 - 2.5	C806
Gain mode 2	Bypass	11 up	29	3 - 4	C806
Gain mode 0	V0	up to 6	23.8	0.75- 0.88	C806
Gain mode 1	V1	6 to 11	25.2	1.125- 1.375	C806

**Not an actual FlaLi tuning PDM. PDM to produce approximately 25dBm at antenna connector.*

Cell PMIC

The following tables show the PMIC troubleshooting information.

Table 5: PMIC Setup

Mode	Tx	Rx	Band
Local	On	On	CELL

Table 6: PMIC Measurements

Pin	Label	Test Point	Units	Depends On	Comments
1	EP	Pin 1	1.8	UPP	IC enable = GenIO 10
2	M0	Pin 2	1.8	UPP	Control 0 = GenIO 12

Table 6: PMIC Measurements (Continued)

Pin	Label	Test Point	Units	Depends On	Comments
3	M1	Pin 3	1.8	UPP	Control 1 = GenIO 13
4	NC	NC	NC	NC	NC
5	FB	Pin 5	0.75 - 4	M0, M1	See PA worksheet. Output to flyback inductor.
6	FB	Pin 6	0.75 - 4	M0, M1	Shares PWB pad with pin 5
7	BYPVout	bottom-C808	0.75 - 4	M0, M1	PMIC bypass output used at Pout > 12 dBm
8	VDD	right-L810	VBATT	VBATT	Digital DC supply, shared with pin 12, 14, and 15
9	VSS	GND	GND	GND	Digital GND, shared gnd with pin 13
10	NC	NC	NC	NC	NC
11	Vbgap	NC	NC	NC	Bandgap voltage output
12	VDD	right-L810	VBATT	VBATT	Digital DC supply
13	Vss	GND	GND	GND	Digital GND, shared gnd with pin 9
14	Vsw	right-L810	VBATT	VBATT	Switcher supply
15	Vsw	right-L810	VBATT	VBATT	Switcher supply
16	Gsw	GND	GND	GND	Switcher GND, does not share with pin 9 and pin 13

Table 7: Good Phone PMIC Resistances

Pin	Resistance
1	60k
2	75k
3	80k
4	1.59M
5	1.6M
6	2M
7	2M
8	2M
9	0.1
10	100
11	115k
12	60k

Table 7: Good Phone PMIC Resistances (Continued)

Pin	Resistance
13	0.2
14	1.3M
15	1.18M
16	0.1

Cell IF/RF AGC and PA Control

Table 8, "Cell CDMA Channel 384 (Skyworks PA)," on page 16 illustrates the PDM values and their typical values for the IF AGC, RF AGC Jedi Pout, gain steps, and the PA VCC levels. This table also shows the typical power output at the RF connector.

Table 8: Cell CDMA Channel 384 (Skyworks PA)

Tx RF AGC			Tx IF AGC			Jedi Po		PA Gain Step		PA Vcc			Conn RF Pout
PDM	Typical Value	Test Point	PDM	Typical Value	Test Point	Typical Value	Test Point	Gen IO 12	Gen IO 13	Typical Value	Test Point	PA Gain	
-290	0.45	Bottom C606	-290	0.45	Top C605	3	pin 1 Z601	H	H	3.47	C806	DM	25
-196	0.59		-196	0.59		-2		H	H	3.61		28	20
-95	0.75		-95	0.75		-9.2		H	H	3.67		28	13.2
-95	0.75		-95	0.75		-9.2		H	L	1.2		26	11
-48	0.83		-48	0.83		-13		H	L	1.2		25.8	7
-48	0.83		-48	0.83		-13		L	L	0.82		24.5	6
17	0.93		17	0.93		-19		L	L	0.82			0
80	1.04		80	1.04		-29		L	L	0.82			-10
120	1.11		120	1.11		-39		L	L	0.82			-20
168	1.19		168	1.19		-49		L	L	0.82			-30
249	1.32		249	1.32		-59		L	L	0.82			-40
324	1.49		324	1.49		-69		L	L	0.82			-50

Cell Power Detector

The following tables illustrate the measurements required for troubleshooting the cell power detector.

Table 9: Cell Power Setup

Mode	Tx	Rx	Band	Chnn	Rho
Local	On	On	CELL	384	On
	Input Chnn	Tx Freq	Rx Freq		
	384	836.52	881.52		

Table 10: Cell Power Measurements: Cell, Channel 384

Tx ADC	PA Gain Step		Conn RF Pout	Power Detector					Comments
RF/IF pdm	GIO 12	GIO 13		Pout at Detector	Test Point	Det Out	Test Point	mA	Det=Detector Po=Power
324	L	L	-50	-86.3	Right R814	2	Left C807	235	CELL band and detector coupling is about 22 dB
142	L	L	-25	-63		2		235	
17	L	L	0	-41		1.998		235	
-48	L	L	6	-30		1.967		250	
-48	H	L	7	-29		1.957		268	
-95	H	L	11	-26		1.93		286	
-95	H	H	13.2	-23.5		1.9		435	
-146	H	H	17	-21.5		1.86		486	
-178	H	H	19	-19		1.812		550	
-214	H	H	21	-17		1.745		630	
-252	H	H	23	-15		1.667		730	
-290	H	H	25	-12		1.547		860	
-316	H	H	26	-11.5		1.485		950	
-328	H	H	26.5	-11		1.44		1000	
-351	H	H	27.5	-10		1.36		1095	
none			dBm	dBm/ 30kHz		VDC			dBm only refers to total power measured

Table 11: Detector Reference and DC Supply

label	Test Point	Typical Value
Det Ref	left-C803	2
Det Supply	bottom-C257	2.8
		VDC

Tx System Block Diagram

Figure 10 illustrates a simplified block diagram of the transmitter.

Note: See the Schematics *chapter for a transmitter schematic.*

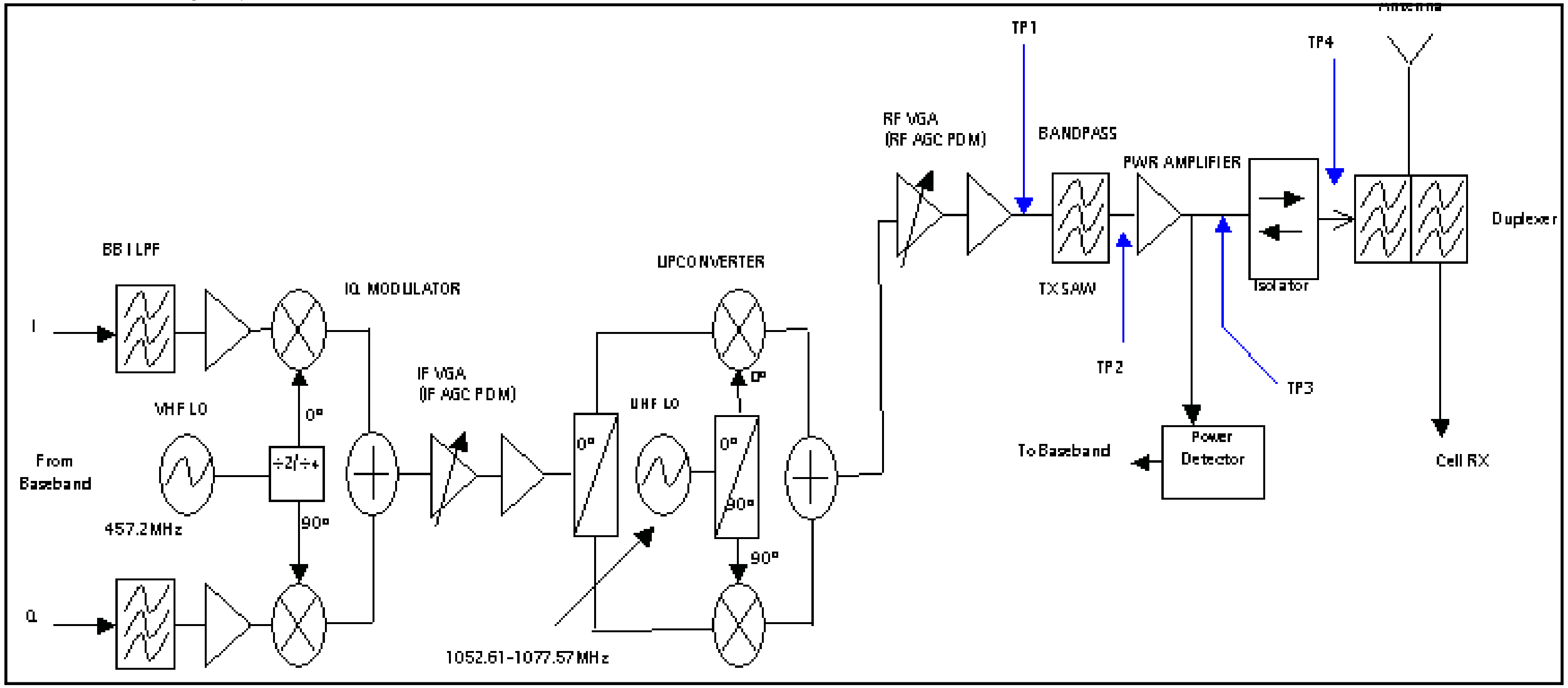

Figure 10: Tx system block diagram

Receiver Troubleshooting

Rx IF

Use Phoenix to perform the following steps for troubleshooting the receiver. Together with the VCO frequency and level verification, this test should be the first test for a non-working receiver. This test verifies the entire receiver chain, from input connector to baseband output.

1. Inject a CW signal 881.82MHz or 881.22MHz (CH-384 offset by 300KHz) at a fixed –75dBm power level. If you do not have a signal generator, use the CALL BOX in AMPS mode on Channel 374 or 394 (10 channels away from channel 384).

2. Open the **Phone Control** dialog box.

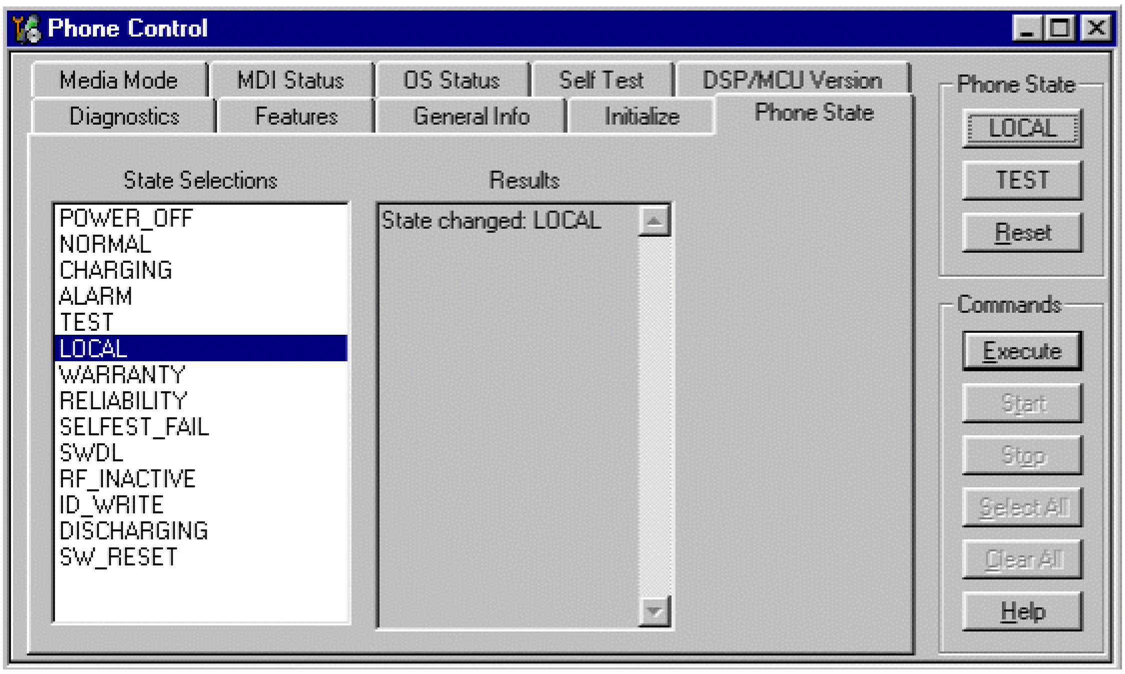

Figure 11: Phone Control dialog box for Rx IF troubleshooting

3. Click the **LOCAL** button in the **Phone State** area to put the phone into Local Mode.

4. Select the following values on the **RF Main Mode** dialog box:

- **Band** = Cell (CDMA)
- **Channel** = 384
- **Mode** = Rx

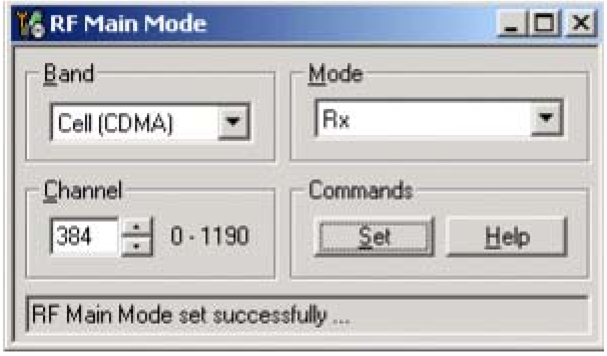

Figure 12: RF Main Mode dialog box for Rx IF troubleshooting

5. Click **Set**.

   Note: Be sure that the "RF Main Mode set successfully..." message appears in the status bar.

6. Use a spectrum analyzer to test TP3 (I+,I-, Q+, Q-). Set the S.A to 300KHz center frequency, 200KHz SPAN, and +10dBm reference level. The spectrum analyzer should read –8dBm without any settings to the PDM.

Use the following CDMA Generator Code Domain Setup table to configure the CDMA generator code domain.

Table 12: CDMA Generator Code Domain Setup

Channel	Power	Walsh Code
Pilot	-7dB	0
Paging	-12dB	1
Traffic	-15.6dB	10
Sync	-16dB	32

Table 13 shows the steps for Rx IF troubleshooting.

Table 13: Rx IF Troubleshooting

Step #	Part	Function	Typical Value/ Frequency HP85024A	Typical Value Frequency Prod Probe	Comments
TP1	L702R	IF-IN	+1.3 dBm/ 183.6MHz	-12/-27 dBm 183.6MHz	I.F Input to Z701 (I.F filter). *NOT 50 ohm*
TP2	L701L/R	SAW Out	-16 dBm/ 183.6MHz	-35/-50 dBm 183.6MHz	Differential outputs of Z701. *NOT 50 ohm*

Table 13: Rx IF Troubleshooting (Continued)

Step #	Part	Function	Typical Value/ Frequency HP85024A	Typical Value Frequency Prod Probe	Comments
TP3	I+, I-, Q+, Q-	I/Q outputs of Yoda N700	300KHz tone for input: 881.22MHz	-69/-84 dBm 300KHz	Baseband differential outputs of the IF IC (N700). To test: set the input to 881.22 or 881.82MHz/-75dBm to get a 300KHz tone when receiver is on channel 384 (881.52MHz)
TP4	C728T	19.2MHz In	+6.5 dBm 19.2MHz	-22 dBm 19.2MHz	Sine wave input to N700 from VCTCXO.
TP5	C711T	19.2MHz Out	+4 dBm 19.2MHz	-25 dBm 19.2MHz	Square wave output of N700 to baseband.
TP6	L708R (L708R for Prod Probe)	VHF VCO	+1.0 dBm 367.2MHz	-61 dBm 367.2MHz	Rx VHF VCO - Fixed at 367.2MHz (Be careful not to load the circuit with the probe.)
TP7	C731T	VREF	1.35Vdc		System reference voltage 1.35Vdc from UEM.
TP8	R702L (C703R)	RX_IF_AGC	0.2 to 1.8 Vdc		AGC control Voltage. 0.2V = Max Gain, 1.8V = Minimum Gain
TP9	R703T (R701L, R715T)	VR7	2.7Vdc		VHF VCO Supply from UEM
TP10	C734B	VR3	2.7Vdc		VCTCXO buffer supply from UEM.
TP11	C712R, C744R	VR6	2.7Vdc		Main supply to N700, from UEM.
TP12	C710T, C704B	VIO	1.8Vdc		Digital circuits supply from UEM.

** The R, L, T, and B values at the end of the part numbers indicate the Right, Left, Top, and Bottom side of the part respectively in Figure 13.*

Figure 13 shows each testing point from the Rx IF Troubleshooting table for the Rx IF section.

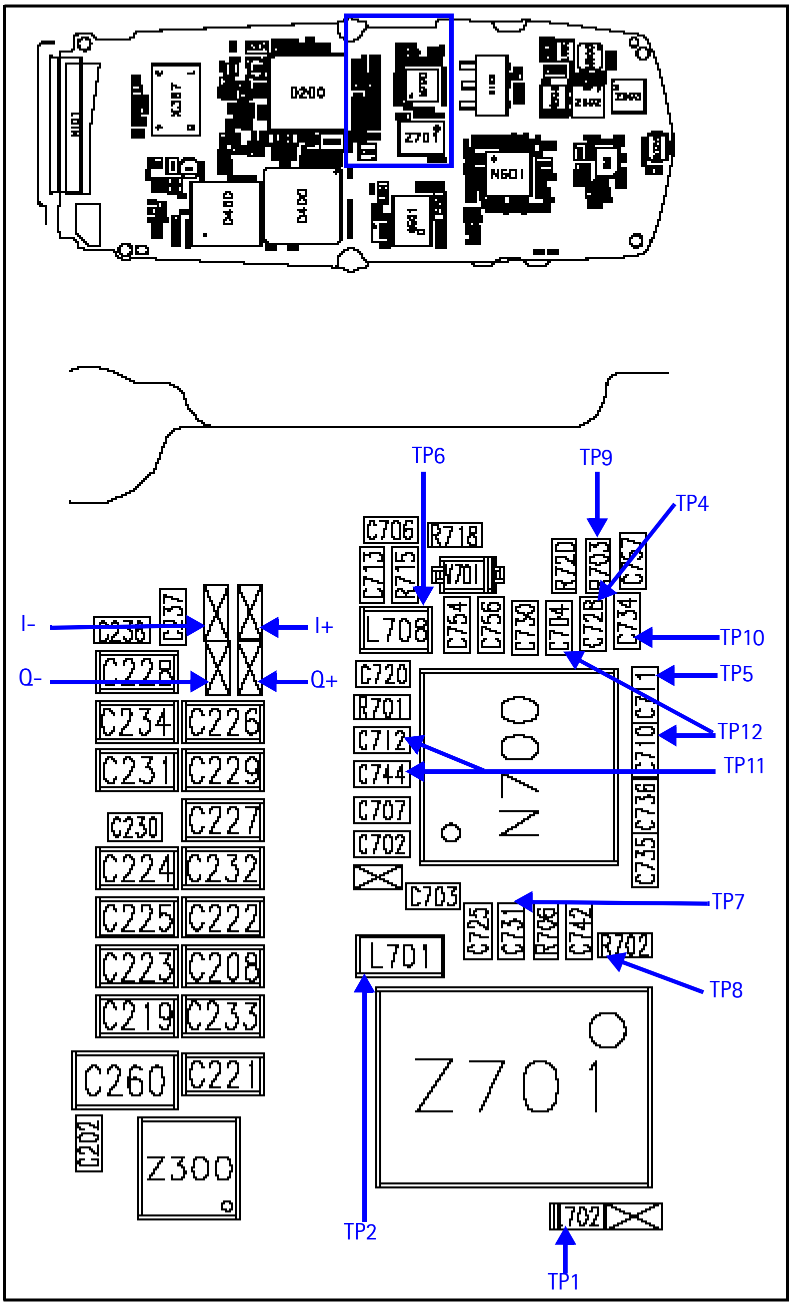

Figure 13: PWB, bottom side (top). A zoomed view of the testing points on the Rx IF section (bottom).

Switching the Gain

Use the following steps if the receiver is not working properly and you need to switch the Rx gain state.

1. Open the **Phone Control** dialog box.

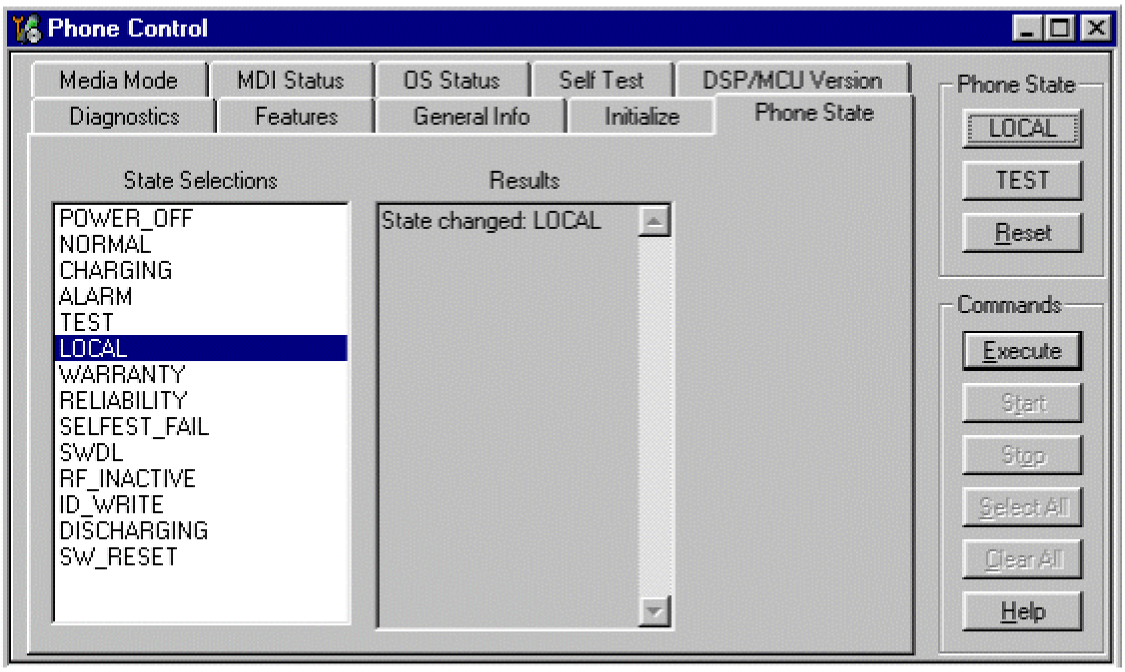

Figure 14: Phone Control dialog box for switching the Rx gain state

2. Click the **LOCAL** button in the **Phone State** area to put the phone into Local Mode.
3. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = Cell (CDMA)
   - **Channel** = 384
   - **Mode** = Rx

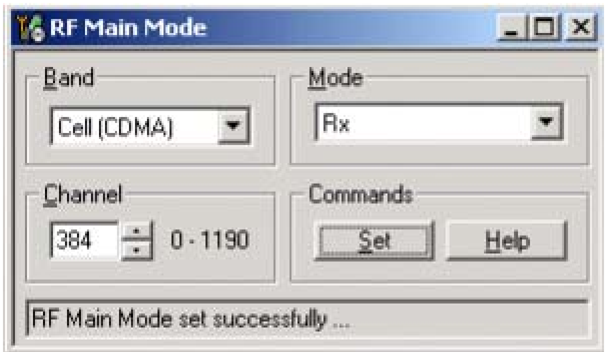

Figure 15: RF Main Mode dialog box for switching the Rx gain state

4. Click the **Set** button.

Note: Be sure that the "RF Main Mode set successfully..." message appears in the status bar.

5. Connect a signal generator in CW mode (881.52MHz, -25dBm) to the RF connector. If you do not have a generator, use the Call Box Amps Mode RF Generator, Channel 384, -25dBm and set the FM modulation to 100Hz, deviation 400Hz.
6. To switch the Rx gain states, open the RF Register R/W dialog box. Two gain states (Hi and Lo) are available in the receiver.

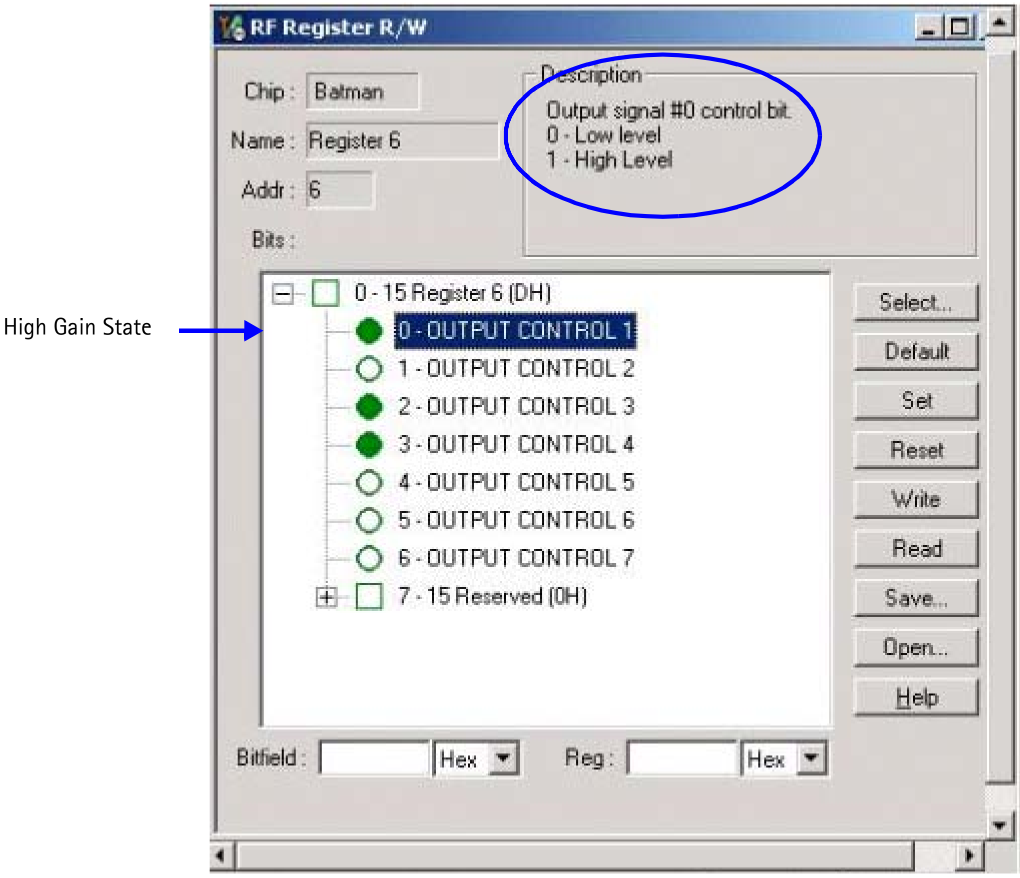

Figure 16: RF Register R/W dialog box for switching Rx gain states

7. Select the RF register: Yoda Register #6 and select the appropriate gain states. The following values apply:
   - Bit 0=1, means a Hi gain state.
   - Bit 0=0, means a Lo gain state.

Rx RF

The following Rx RF Troubleshooting table indicates the test points to probe when troubleshooting the Rx RF. It is recommended that you follow the steps in order.

Table 14: Rx RF Troubleshooting

Step #	Part	Function	Typical Value/ Frequency HP85024A	Typical Value Frequency Prod Probe	Comments
R1	L802R (Top side of the PWB)	RF-IN	-25dBm/ 881.52MHz	-42dBm 881.52MHz	Input Connector reference level
R2	L906L	LNA-In	-35dBm/ 881.52MHz	-42dBm 881.52MHz	Test Duplexer insertion Loss (Without DC Block)
R3	C903L	LNA-Out	-13/-31dBm 881.52MHz	-29/-45dBm 881.52MHz	Test LNA gain ~ 13dB
R4	Z901-R-Bottom, N901-Pin16	RF Filter Output Mixer-In	-18/-35dBm 881.52MHz	-30/-45dBm 881.52MHz	Test RF Filter Insertion loss (Without DC Block)
R5	C906R	Mixer-out	-5/-21dBm 183.6 MHz	-23/-38dBm 183.6MHz	Test Output on Downconverter on N901
R6	C912B/R914R	IF Output to N700	+1.5/-15dBm 183.6MHz	-12/-29dBm 183.6MHz	Test Alfred output to Yoda IF-IC (N700)
R7	R912B/R911L	L.O Input to N901	-2.5dBm 1065.12MHz	-18dBm 1065.12MHz	Test VCO output to Alfred (N901) Levels are for Channel 384
R8	R9056T, L909L, L901T, R910B	VR4	2.7V dc		Power supply to Alfred (N901)
R9	R902B	Rx-SW1	H.G = 2.7V L.G = 0V		LNA gain control, on the Alfred side, High Gain > 2.5V dc

** The R, L, T, and B values at the end of the part names indicate the Right, Left, Top, and Bottom side of the part respectively in Figure 17.*

Figure 17 shows the Rx RF testing points from the Rx RF Troubleshooting table.

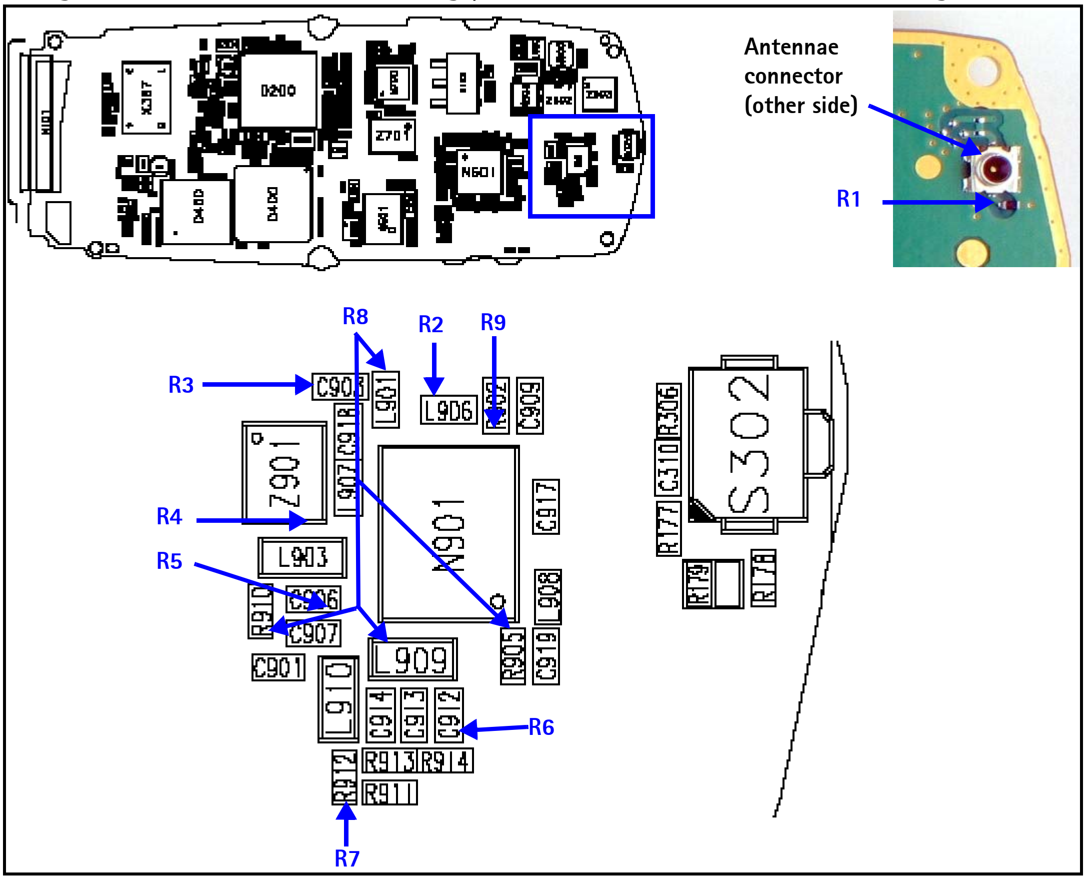

Figure 17: PWB, bottom side (top left). The antenna connector on the opposite side of the PWB (top right). A zoomed view of the test points on the Rx RF section (bottom).

Rx AGC (Cell Mode)

The following Rx RF AGC PDM vs. AGC Voltage table shows the Rx RF AGC PDM vs. AGC voltages in local mode on channel 384.

Table 15: Rx RF AGC PDM vs. AGC Voltage

PDM	Typical Value	Test Point
-512	0.08	right R702
-400	0.260	
-300	0.436	
-200	0.597	
-100	0.753	
0	0.913	
100	1.076	
200	1.24	
300	1.403	
350	1.494	
400	1.570	
500	1.740	
511	1.761	
UNITS	VDC	

Table 16: Rx AGC vs. RF Pin for CELL Band

Conn RF Pin	CELL RF AGC	Comments
-25	1.492	
-35	1.298	
-45	1.159	In Normal mode, the phone will adjust RF RX AGC
-55	1.019	Rx power is coming in, the I and Q will be about 0.5Vpp and 1.3V
-65	0.861	
-75	0.705	Approximately 1pdm per 1mV
-85	0.530	
-92	0.425	
-95	0.633	Note the reduced delta because the LNA is switched on
-100	0.594	
-105	0.524	

Table 16: Rx AGC vs. RF Pin for CELL Band (Continued)

Conn RF Pin	CELL RF AGC	Comments
-107	0.470	
UNITS	**VDC**	

Receiver Block Diagram

Figure 18 illustrates a simplified block diagram of the receiver.

Note: See the Schematics *chapter for a receiver schematic.*

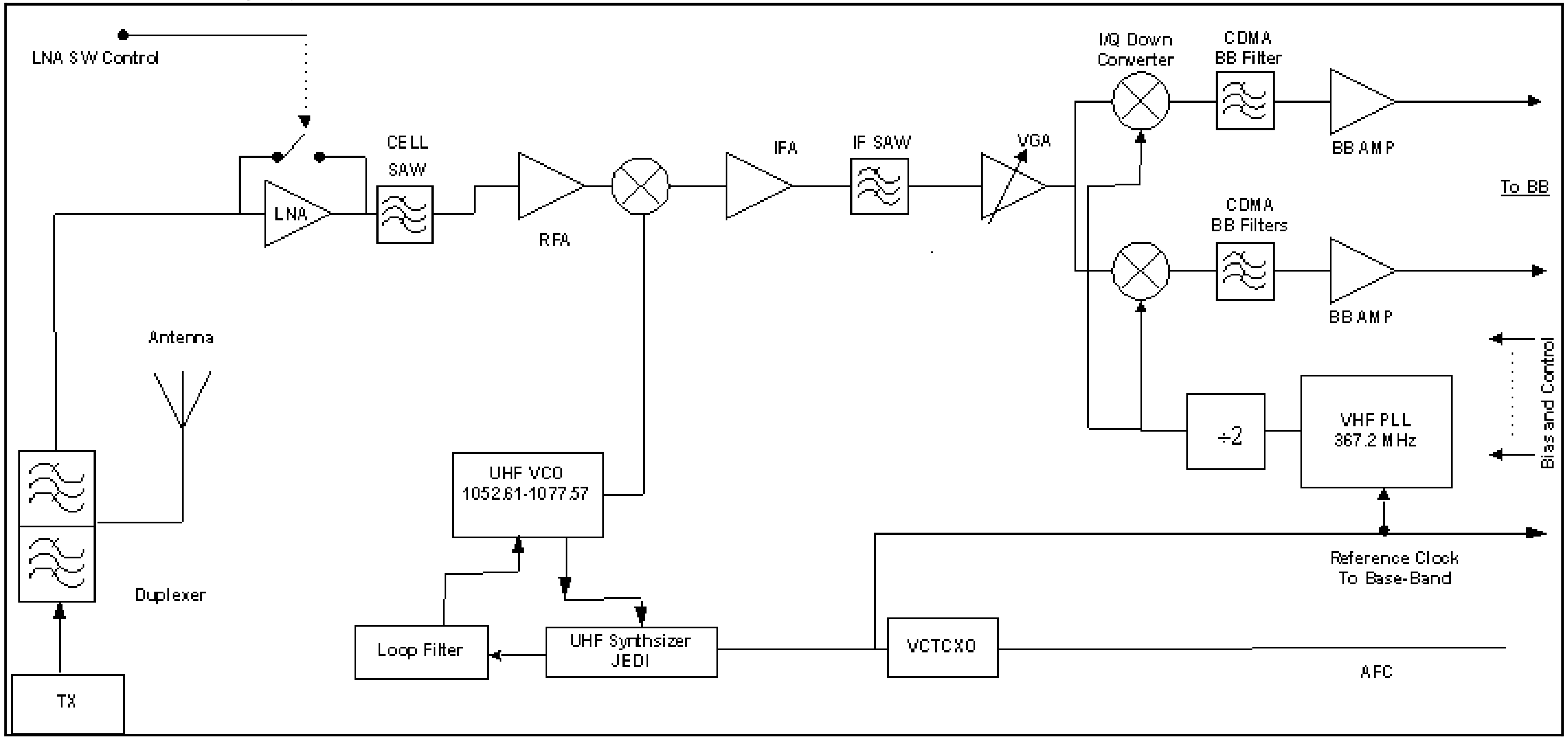

Figure 18: Receiver block diagram

Synthesizer Troubleshooting

Faulty synthesizers can cause both Rx and Tx failures during tuning, in addition to the VCTCXO tuning. The following synthesizers are incorporated into the 3125:

- UHF (cell) PLL inside Jedi IC (N601)
- Tx VHF (457.2MHz) with PLL in Jedi IC
- Rx VHF (367.2MHz) with PLL in Yoda IC

Synthesizer Setup

Use the following steps to set up the phone for Tx troubleshooting in Phoenix.

1. Open the **Phone Control** dialog box.

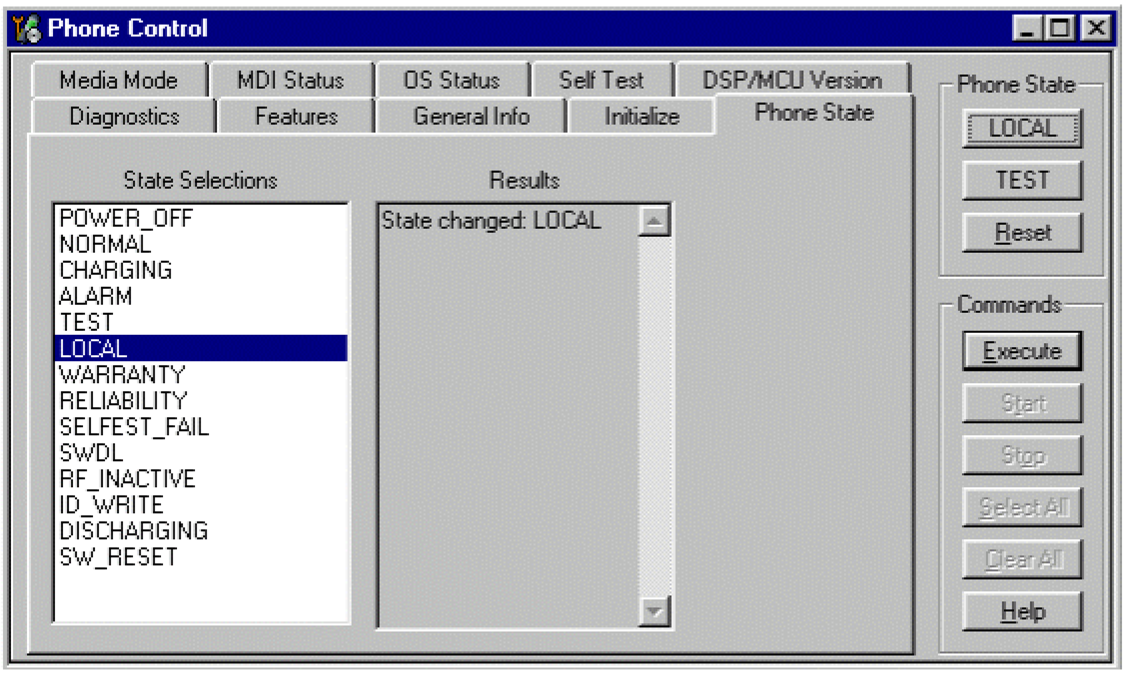

Figure 19: Phone Control dialog box for Tx troubleshooting

2. Click the **LOCAL** button in the **Phone State** area to put the phone into Local Mode.
3. Use the following settings for the **Band**, **Channel**, and **Mode** fields on the **RF Main Mode** dialog box:
   - UHF: Use the Rx/Tx mode in Cell band. This allows you to check power in both the Rx and Tx circuits.
   - Rx VHF: Use the Rx mode. One band is enough.
   - Tx VHF: Use the Rx/Tx mode in Cell band.

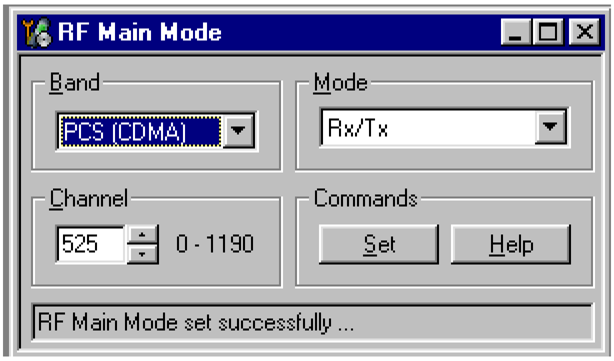

Figure 20: RF Main Mode dialog box for synthesizer troubleshooting

4. Click **Set**.

   Note: Be sure that the "RF Main Mode set successfully..." message appears in the status bar.

5. Read register templates Jedi(0) bits 10 and 11 for the UHF and Tx VHF lock condition on the **RF Register R/W** dialog box.

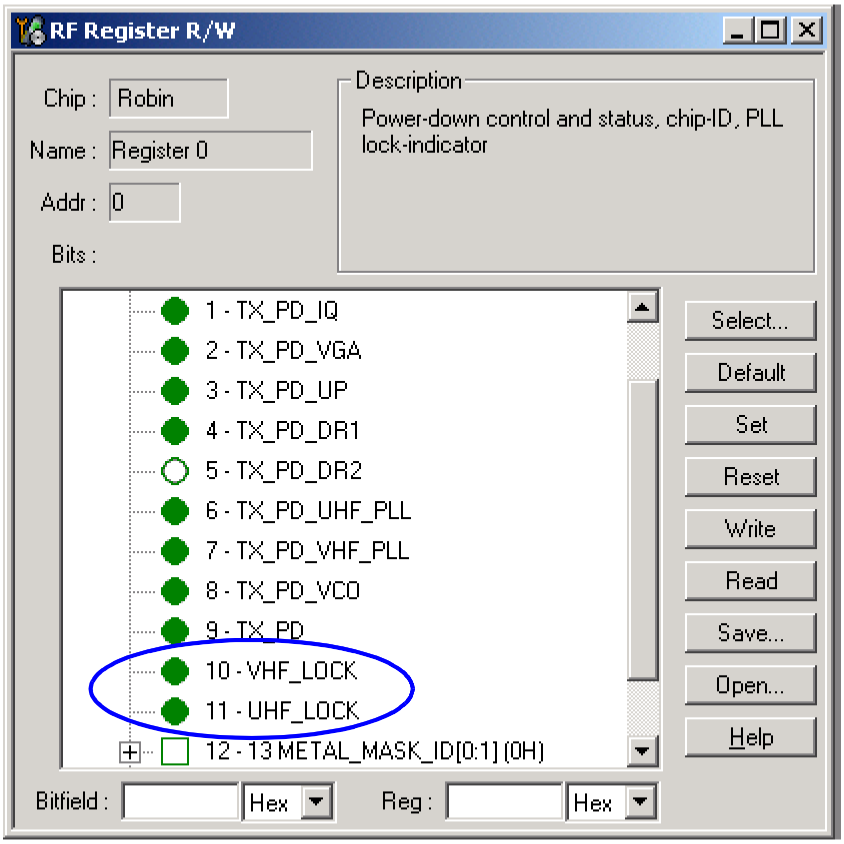

Figure 21: RF Register R/W dialog box for synthesizer setup

6. Read register templates Yoda(0) bit 11 for the RX VHF lock condition.

VCTCXO Tuning

The VCTCXO can be manually tuned to verify failed tuned phones, or to verify if a phone cannot make a call. This can be done with the phone in Local Mode and generating a CW signal. The frequency accuracy of the VCTCXO can be measured using an HP8960 callbox in AMPS mode, an HP4406 Tx tester, or a spectrum analyzer (preferably using a lab system 10MHz source as equipment reference). Replace the VCTCXO if the VCTCXO AFC DAC value does not meet the tuning requirements after tuning.

Use the following steps to manually tune the VCTCXO:

1. Open the **Phone Control** dialog box.

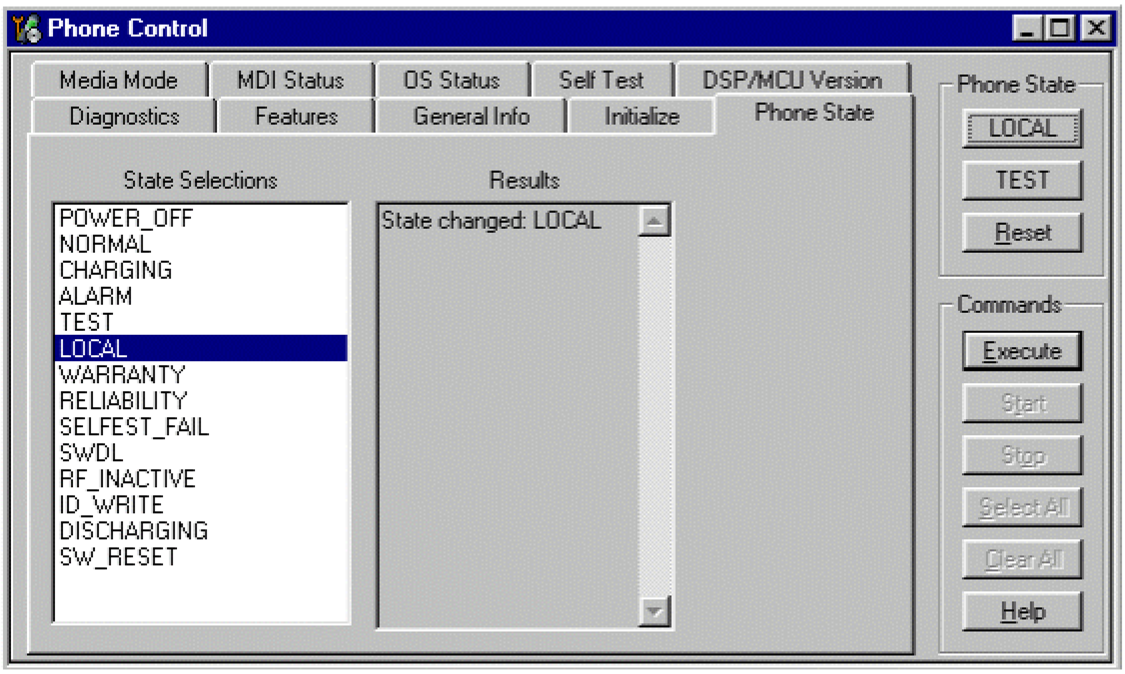

Figure 22: Phone Control dialog box for VCTCXO troubleshooting

2. Click the **LOCAL** button in the **Phone State** area to put the phone into Local Mode.
3. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = Cell (CDMA)
   - **Channel** = 384
   - **Mode** = Rx/Tx

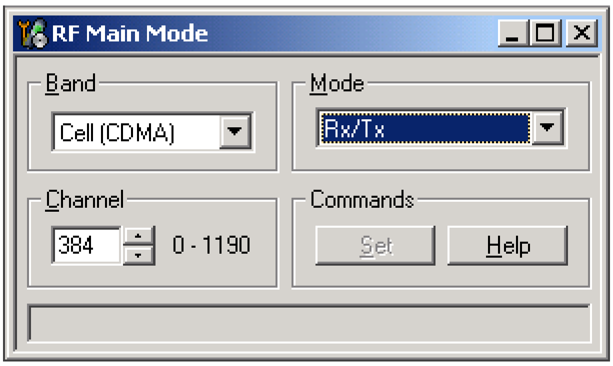

Figure 23: RF Main Mode dialog box for VCTCXO troubleshooting

4. *Do not* use CDMA control to turn on Rho.
5. Open the **BB General I/O** dialog box to set the CW signal.

6. Type 10, 13, 12, and 8 in the fields in the **PIN #** column.

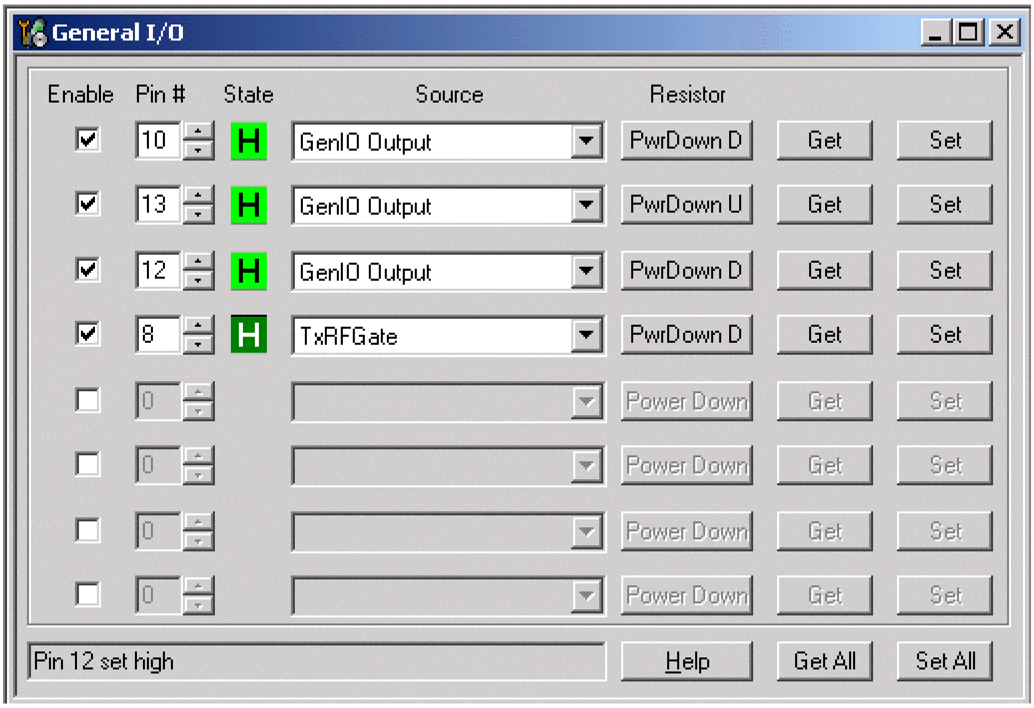

Figure 24: General I/O dialog box for VCTCXO tuning

7. Click the **Get All** button.
8. Change the value for Pin 8 in the **Source** column to GenIO Output.
9. Ensure that all of the pins have a value of H in the **State** column. (Click the L values to change them to H values.)
10. If using an HP4406 or a spectrum analyzer to measure the signal, set the center frequency to 836.52MHz and the span to 2MHz. Establish a marker at 836.52MHz.
11. If using an HP8960 to measure the frequency accuracy, set the callbox state to AMPS and set the channel to 384. Use the frequency accuracy measurement to center VCTCXO.

12. Adjust the AFC value to center the VCTCXO on the **RF PDM** dialog box. The tuning range is approximately +/- 10kHz.

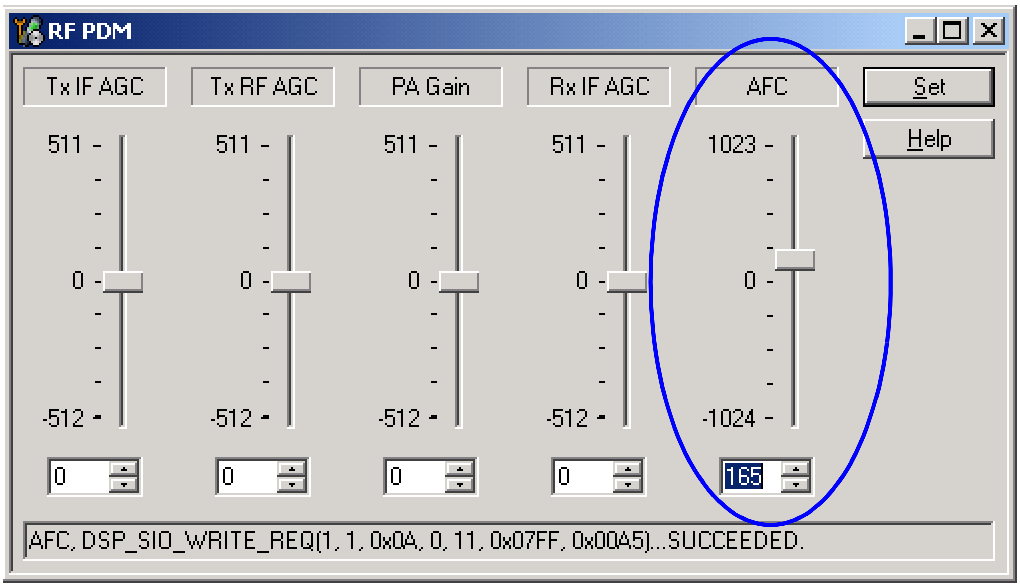

Figure 25: Manually adjusting the AFC to center VCTCXO

13. Adjust the AFC value so that the output signal is within +/- 100Hz. If you are using an HP4406 or a spectrum analyzer, narrow the span to 1kHz or less.

VCTCXO Reference Clock

Figure 26 shows the 19.2 MHz VCTCXO reference clock.

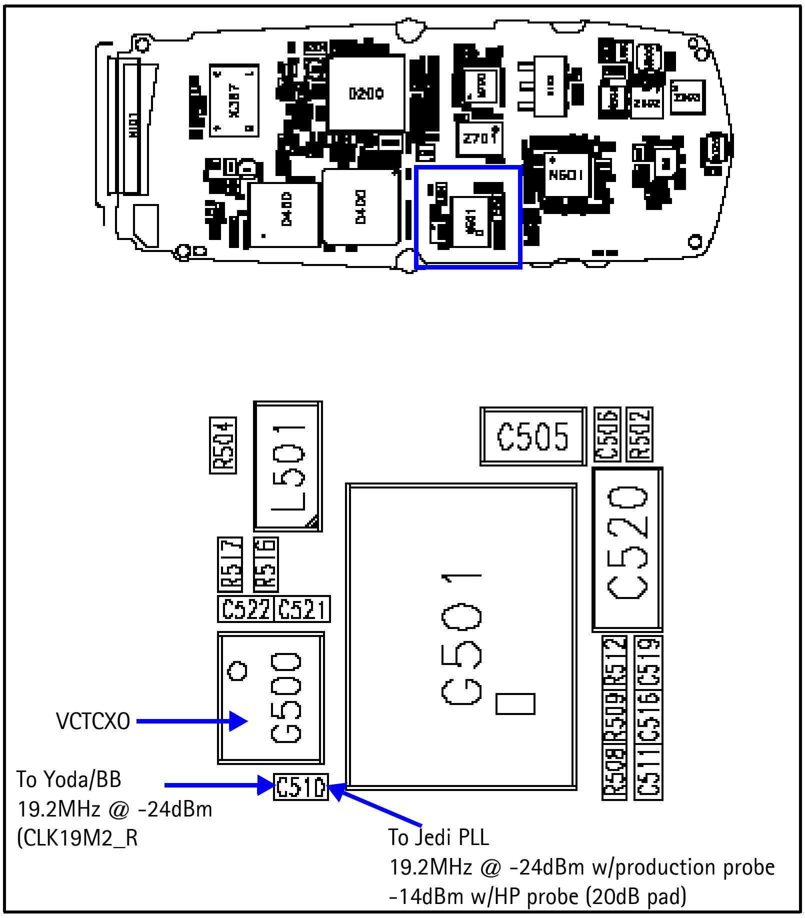

Figure 26: PWB, bottom side (top). A zoomed view of the testing points on the 19.2 MHz VCTCXO reference clock (bottom).

Synthesizer Block Diagram

Figure 27 shows the synthesizer block diagram.

Note: See the Schematics *chapter for an 3125 (RH-61) synthesizer schematic.*

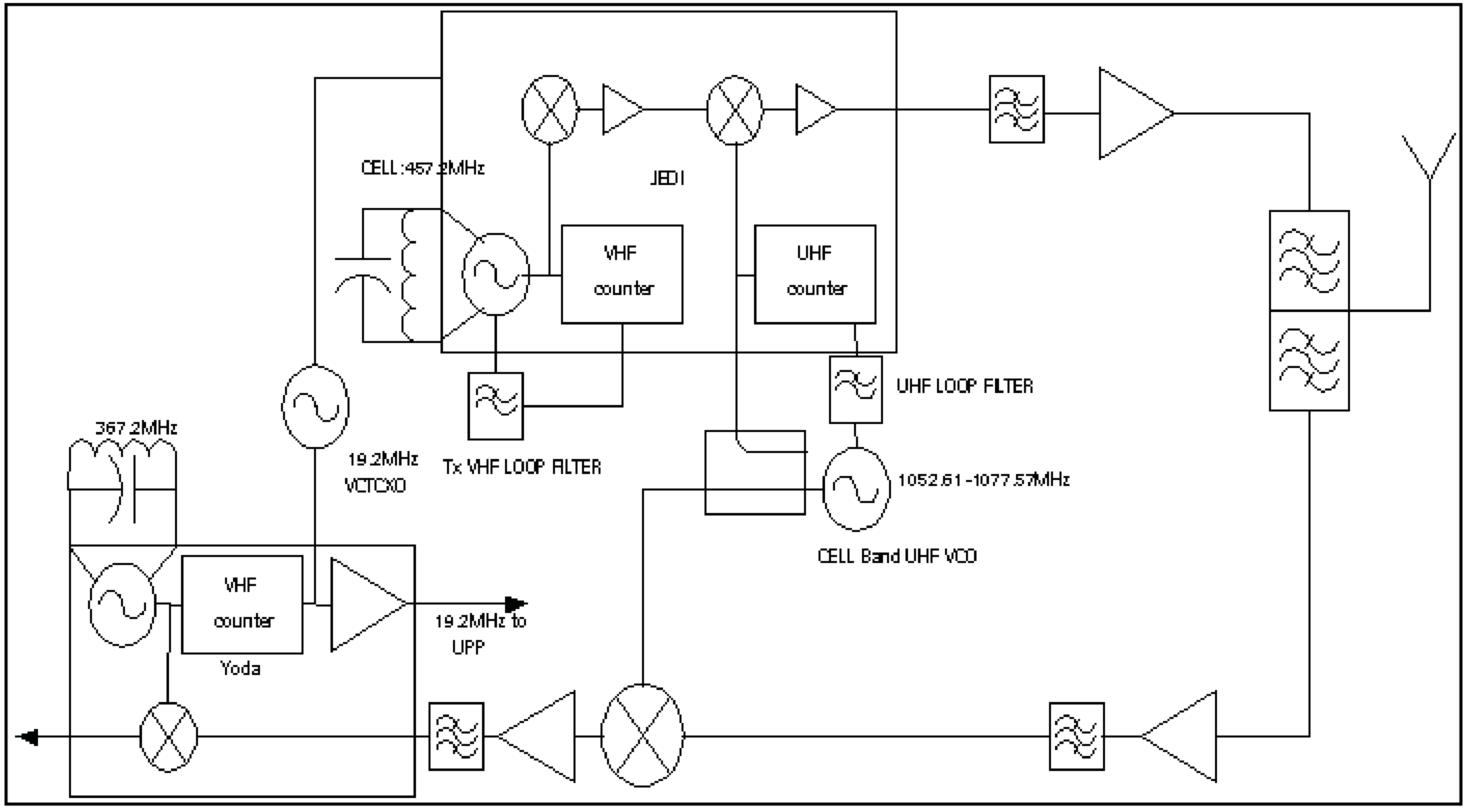

Figure 27: Synthesizer block diagram

UHF Synthesizer

Following are possible causes for an incorrect UHF frequency:

- Power supplies to Jedi PLL (N601) are missing or low (VR7)
- Loop filter components are missing or incorrectly installed
- Matching components to Jedi TxLO/PLL input are missing or incorrectly installed
- 19.2MHz reference clock is missing or low
- Programming is incorrect
- Component failure (VCO or PLL portion of Jedi)

Figure 28 and Figure 29 show the UHF synthesizer layout.

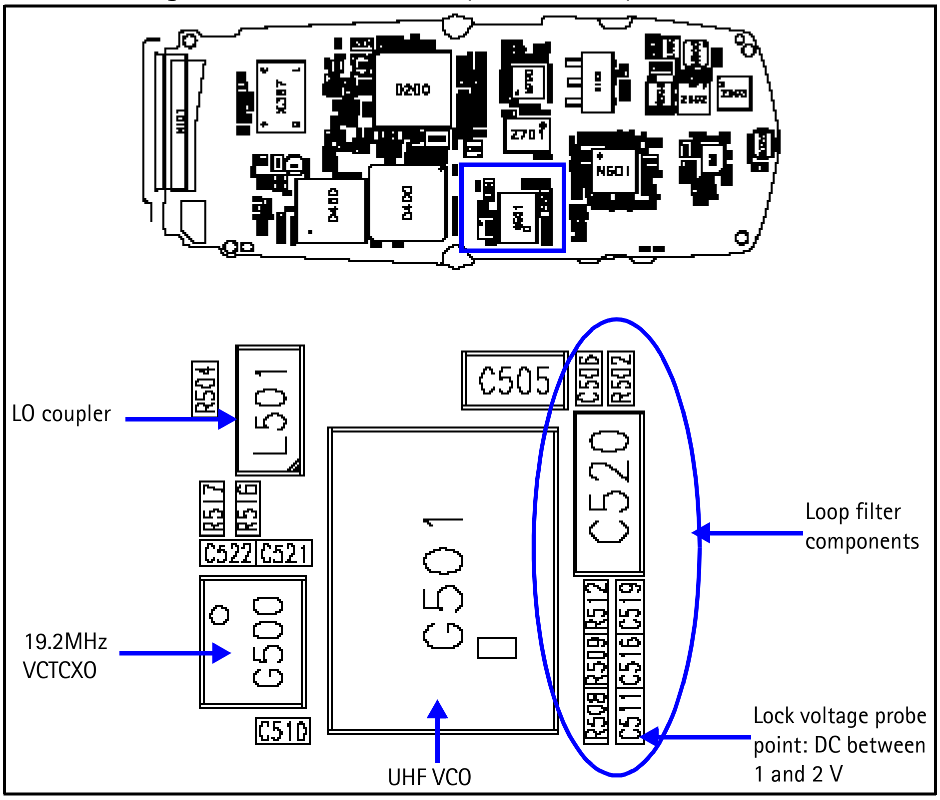

Figure 28: PWB, bottom side (top). A zoomed view of the testing points on the UHF synthesizer layout (bottom).

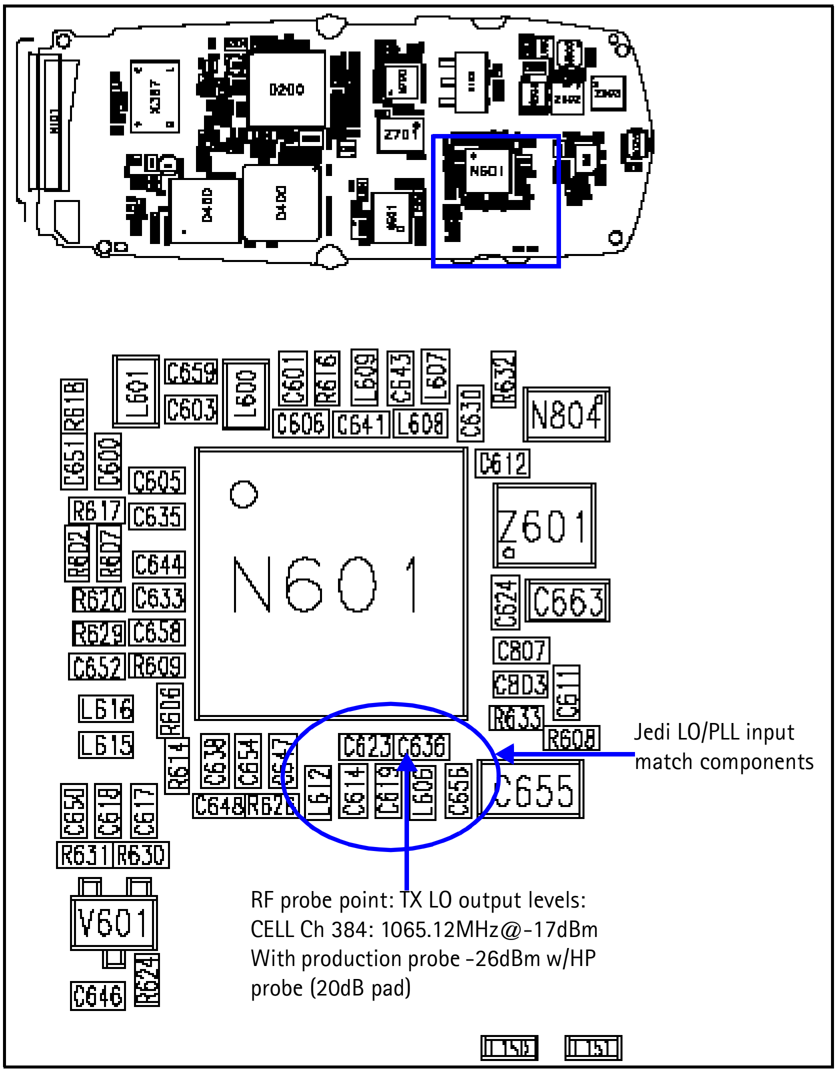

Figure 29: PWB, bottom side (top). A zoomed view of the Jedi LO/PLL input match components on the UHF synthesizer layout (bottom).

Rx VHF

Following are possible causes for an incorrect Rx VHF frequency:

- Power supplies to the PLL portion of Yoda IC (N700) are missing or low (VR7)
- Loop filter or resonator components are missing or incorrectly installed
- 19.2MHz reference clock is missing or low (C512)
- Programming is incorrect
- Component failure (PLL IC)

Note: See the Schematics *chapter for an Rx VHF schematic.*

Figure 30 shows the layout for the Rx VHF.

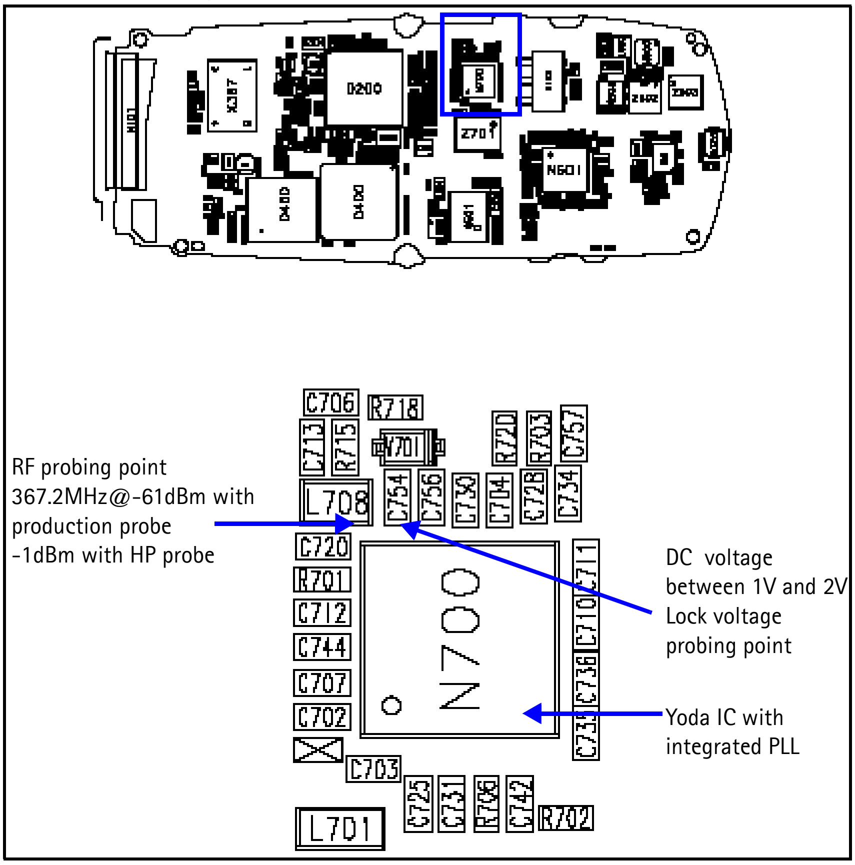

Figure 30: PWB, bottom side (top). A zoomed view of the testing points on the Rx VHF section (bottom).

Tx VHF

Following are possible causes for an incorrect Tx VHF frequency:

- Power supplies to the PLL portion of Jedi IC (N601) missing or low (VR5)
- Loop filter or resonator components are missing or incorrectly installed
- 19.2MHz reference clock is missing or low (C510)
- Programming is incorrect
- Component failure (Jedi IC)

Note: See the Schematics *chapter for a Tx VHF schematic.*

Figure 31 shows the layout for the Tx VHF.

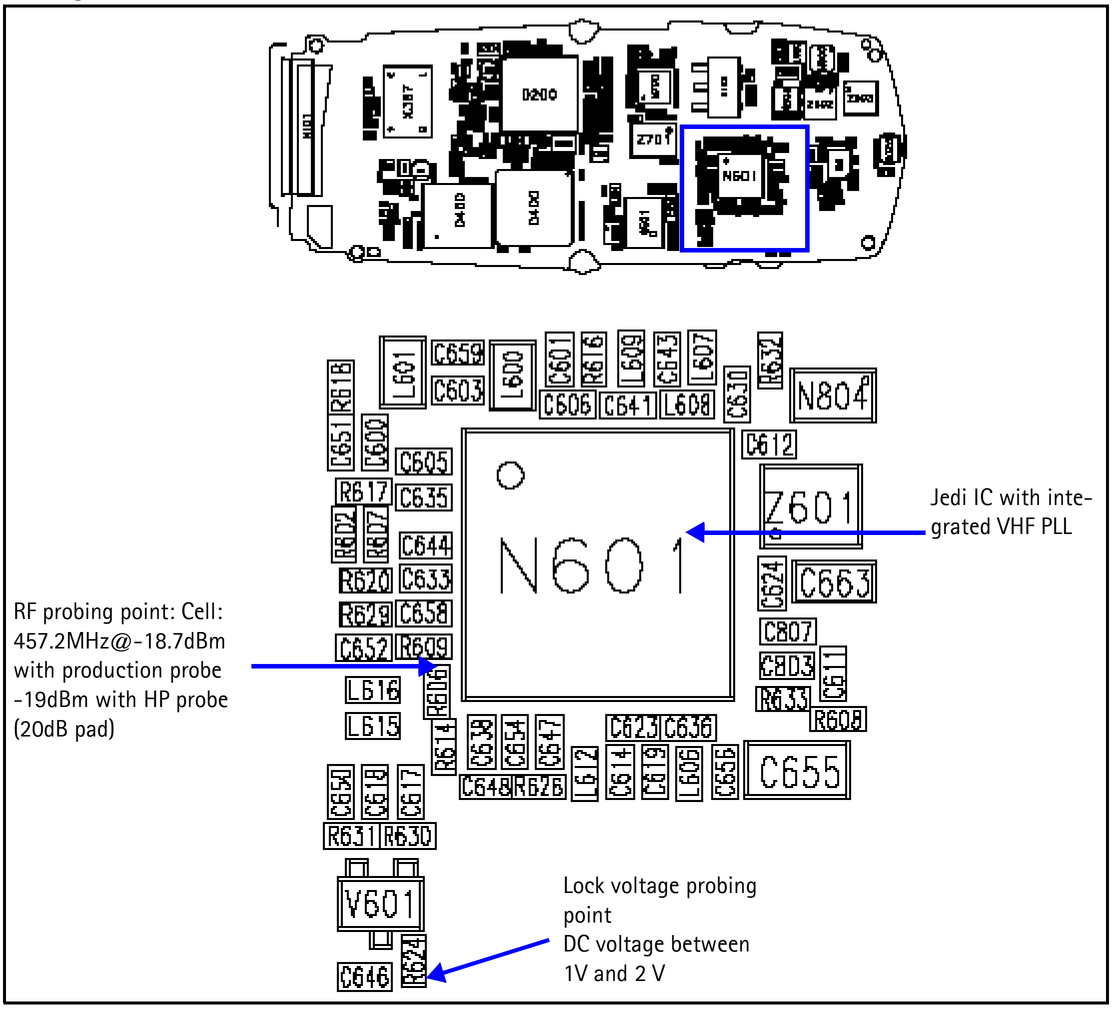

Figure 31: PWB, bottom side (top). A zoomed view of the testing points on the Tx VHF section (bottom).

Tuning Descriptions

Tuning Title	Description	Troubleshooting
Tx Detector	This is one of the phone's self-tests which gives either a *pass* or *fail* result only. The phone transmits at several power levels and checks the ADC value of the power detector. The ADC value is measured first for a set of AGC values, then each AGC value is changed one at a time to make sure that the ADC changes as each AGC is changed individually.	Check the AGC voltages and components of the associated PDMs. For problems with the IF or RF AGC, also check Jedi and supporting components. For PA AGC problems, also check the PA and supporting components. If all of the above cases fail, troubleshoot the Tx chain. If all the output powers are passing, then perhaps the test is failing because the ADC voltage is wrong (which at this point we cannot read, so we are measuring the actual output power). If the voltages are wrong, then check the power detector at N805, C803, C807, and also Jedi. If the voltages are correct and it still fails, check the UEM (D200).
Cell PA Temp	This is one of the phone's self tunings, which reads the ADC voltage of a thermistor R821, and checks to make sure the phone is at room temperature. The reason for this is that a phone should not be tuned while it is hot or cold.	If the phone was recently transmitting in Cell band at full power for an extended period of time, it is probably hot for that reason. Let it cool down for a few minutes, then try again. If it still fails, there may either be a short on the board or else a problem with the PA Temp circuitry. To check PA Temp circuitry, check R821 and D200. If a short is suspected, check the cell PA first. If an infrared camera is available, this is one of the easiest methods to detect a short.
Cell Rx DC Offset I (or Q)	This is one of the phone's self tunings, which measures and adjusts the cell band CDMA receiver DC offsets until they are within the limits.	Check Yoda (N701) and supporting components.
Tx Start-up Current	This test turns on the transmitter and measures current of the whole phone, which can detect some assembly errors.	If current is very high, there may be a short circuit on the phone caused by a solder bridge, a failed component that is internally shorted, a component placed with the wrong rotation which shorts two nodes that should not be, or some other reason. A visual inspection can find solder bridges or wrong component rotations. A failed component can be found by functional tests of the phone's sub-blocks.
Tx Start-up Amplitude	This test turns on the transmitter and checks for the presence of a Tx signal with an amplitude within a specified range. A wide range is allowed since the transmitter is not yet tuned.	Check proper placement, rotation, and soldering of the components in the Tx chain. Check for the presence of LO tones. Check for the presence of a Tx signal at each point in the Tx chain.

Tuning Title	Description	Troubleshooting
VCTCXO Frequency	The purpose of this tuning is to determine what the AFC DAC value needs to be in order to center the VCTCXO frequency. The transmitter is turned on and no Tx baseband modulation is provided. The carrier is then centered in frequency. This is done to the carrier after it has been mixed up to 836.52MHz, since it's easier to measure the tolerance of 1ppm at 836.52MHz than it is at 19.2MHz. Additionally, the tone at 836.52MHz can be measured without taking the phone apart.	1) If there is no tone, probe pin 3 of G501 for a tone at 19.2 MHz. If this is not present, check power supplies, particularly ensure 2.7v on VCTCXO Vcc pin, pin 4 of G501. Also check the control pin, pin 1 of G501, for a voltage between 0.4 and 2.7v. If the voltages are correct, and soldering of all G501 terminals is correct, replace G501. If 19.2 MHz tone is present but tone at 836.52 MHz is not, troubleshoot cell Tx chain. 2) If the carrier is present but the PDM needed to center it is outside of the +/- 150 range, or if it cannot be centered, there is a hardware problem. 3) In the following procedure, performing frequency centering on the RF carrier at 836.52MHz will detect frequency errors due to the VCTCXO and supporting hardware, which will account for the majority of the problems, but will not detect frequency errors due to the hardware that mixes the VCTCXO tone at 19.2MHz up to 836.52MHz. In order to troubleshoot this hardware, frequency centering should be performed on the 19.2MHz tone to +/- 19.2Hz on pin 3 of G501 using a frequency counter, then the VHF and UHF LOs should be checked. Because this will be time-consuming and will probably only account for a small percentage of the failures, it is not recommended unless the situation justifies the time spent. The VHF LO is inside the Jedi IC (N601) and troubleshooting of the cell UHF LO is required. 4) If the carrier can be centered but the PDM is out of range, check the control voltage on pin 1 of G501. If it is 2.2v, (and pin 4 is at 2.7v, and pin 2 at 0v), then the VCTCXO (G501) is working correctly but the circuit that delivers the control voltage is not. Check soldering of all G501 terminals, also check R510, R511, C503, and D200. If the control voltage on pin 1 of G501 is not 2.2v, but the carrier is centered, then there is a problem with the VCTCXO G501. If there is 2.7v on pin 4 and the soldering is correct, then replace G501.

Tuning Title	Description	Troubleshooting
		5) If the carrier cannot be centered, check to see if you can adjust to 2.2v on pin 1 of G501. If you can, within the PDM range of +/- 150, then the circuitry that delivers the voltage is working correctly, and the VCTCXO has a problem. Troubleshoot it as described in the previous section. If you cannot adjust to 2.2v within the accepted range, then the AFC circuitry has a problem. Troubleshoot it as described in the previous section. 6) If there is a fault with both the AFC circuitry and the VCTCXO, then several combinations of the previously described conditions are possible. Start by ensuring 2.2v on pin 1 of G501 using a PDM within the range +/- 150, then center the tone.
PA Gain Cell Po(0)-Po(3)	These tunings model the cell PA gain curve by setting the PA AGC PDM to several values and measuring output power. First, the Tx PA AGC and the Tx RF AGC are set to (approximately) their maximum used values (not the maximum possible values, but the maximum of the range over which they are used). Then the Tx IF AGC is set so that the transmit power on the antenna connector is approximately +11dBm (this power is reported in the next tuning). Then, six PDM values are written to the PA AGC and the output power is measured for each. These values are reported in this tuning. The software then performs curve fitting to interpolate between the measured data points.	If the power readings are low, check the AGC voltages. You can also probe on the PA input to find out if the power level is low going into the PA, or if the power level is correct going into the PA but the PA gain is too low. If the power level going into the PA is too low, probe the Tx chain at all the other points prior to the PA listed in the table to see where the gain is lacking. When that point is identified, check the soldering of all related components, and replace components until the fault is found. If the power on the PA input is not low and the PA AGC voltage is correct, similarly probe the power at all points after the PA to find the fault, being extremely careful not to short the probing point to ground because this will instantly destroy the PA. Visually check soldering first, and probe on PA output as a last resort.
Tx AGC	This tuning characterizes the AGC curve by entering PDM values to the RF AGC and measuring the output power.	Check Jedi (N601). Also check D400, which generates the PDM signals. Check AGC PDM voltages. Troubleshoot the rest of the cell transmitter if needed.

Tuning Title	Description	Troubleshooting
Tx Gain Comp	This tuning ensures that the value of TxdBCtr correctly corresponds to the absolute Tx output power. On the mid channel, with TxdBCtr set to a specified value, G_Offset is adjusted so that the output power is -8dBm, and that value of G-Offset is recorded (which is an absolute value) in the next tuning. The output power in dBm is recorded in this tuning.	Set the phone to local mode and program it to Cellular CDMA Rx/Tx mode on channel 384, using the Main Mode window. Using the Phoenix RF Tuning window, choose *mode* = RF Tuning, and choose this test. Adjust G_Offset in the "Values" dialog box line until the Tx output power (measured on the RF connector with a spectrum analyzer) is equal to -8.0dBm +/- 0.5dB. Use the G_Offset limit range as a guide to which values to enter.
TN G_Offset	See description of previous tuning. This step reports G_Offset.	If G_Offset is not within the limits, trouble-shoot the Cell Tx.
Tx Limiting Cell	This tuning provides an upper limit on the transmit power while in Cell IS95 mode. The reason for this is to ensure that the phone never goes above the maximum transmit power level. After this is done on the mid channel, the channel is changed to each of the other channels, and detector offset is reported.	If the maximum cannot be reached, either a component in the transmitter has too much loss, or not enough gain. Troubleshoot the transmitter, with the phone set to the same channel as the failed channel. Once this is done on the center channel, change to each of the other channels, and record the power. Do not adjust G_Offset on the other chan-nels, just record the power. It should be within the limits listed in the tuning results file. **Channel** / **Cell** / **Power** Low 1013 22.86-23.06 LowMid 125 23.61-23.81 MidLow 225 24.16-24.36 Mid 384 25.03-25.23 MidHigh 558 24.83-25.03 HighMid 750 24.60-24.80 High 777 24.57-24.77
Rx IF AGC Rx dB Ctr	This tuning calibrates the Rx IF AGC curve. The tuner injects three known signal power levels into the phone's receiver, and for each one the phone's AGC algorithms, adjusts the RX_IF_AGC to get the same amplitude at the output of Yoda, although different amplitudes are going in. From these three points, curve fitting is used to interpolate between measurement points.	While injecting a signal into the receiver, check the values of RX_IF_AGC PDM value and, if needed, voltage. RSSI should be within +/- 2 dB of the actual power in dBm on the RF connector. The AGC will try to keep the same amplitude on Yoda output; therefore, if the AGC value is larger than normal, then the AGC is compensating for loss in the chain prior to the variable gain amplifier.
LNA Gain	This tuning records RxdBCtr (which is automatically adjusted to produce the same amplitude on the receiver output no matter what the input is) for the receiver with the LNA in high gain mode, and again with the LNA in low gain mode.	Check Alfred and supporting components.

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