Nokia Customer Care
6265/6265i/6268 (RM-66)
Mobile Terminals

RF Description and Troubleshooting

Contents

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Mobile Terminal Components

The mobile terminal includes two PWB boards, the main PWB and the UI PWB.

Following are the components of the PWB.

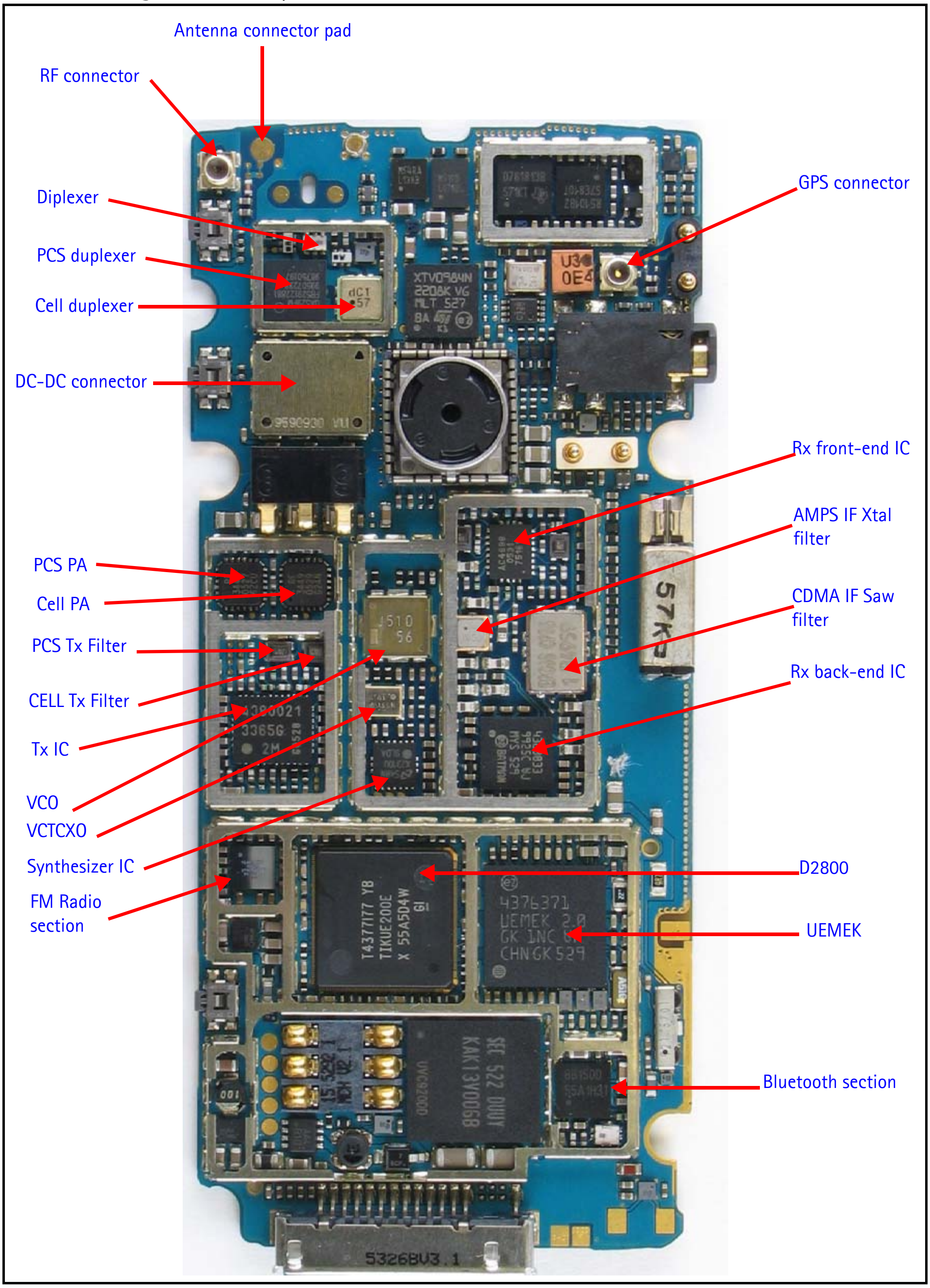


Figure 1: PWB – RF component layout – top

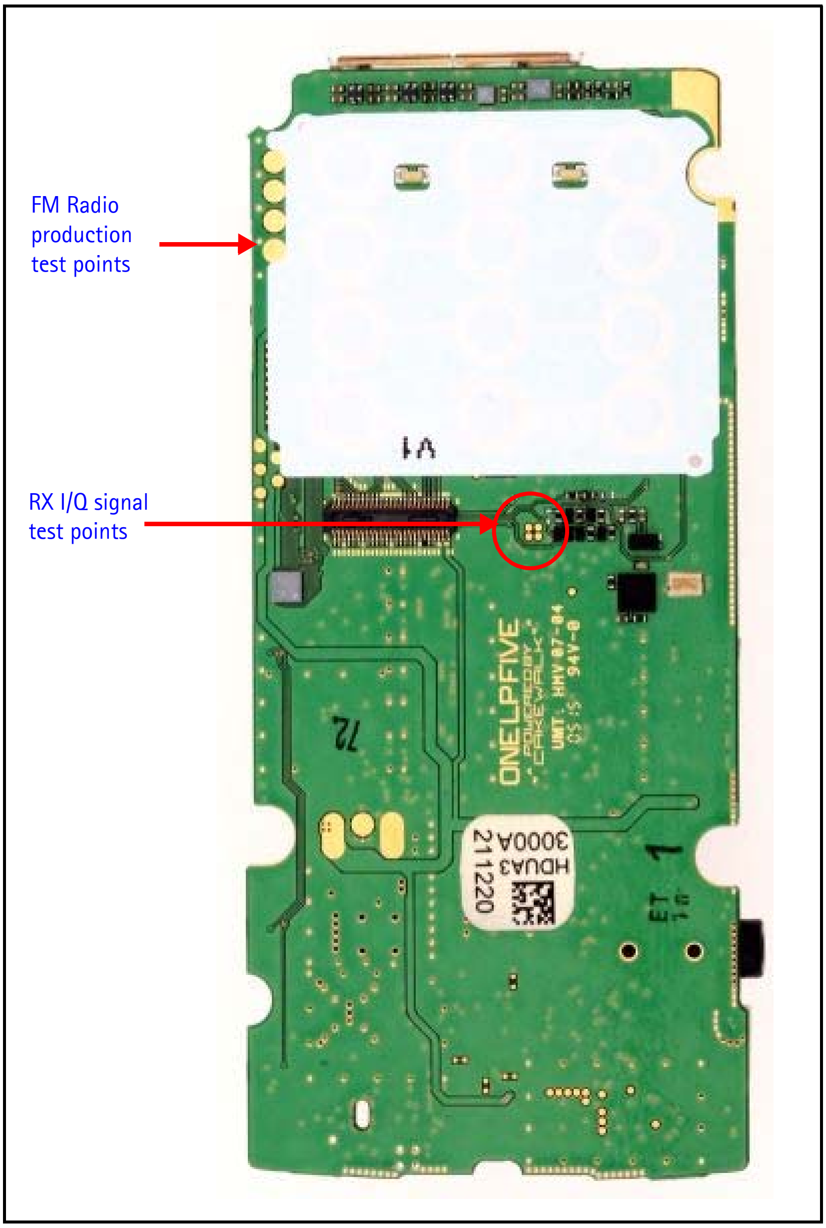


Figure 2: PWB – RF component layout – bottom

Preliminary RF Troubleshooting

The following sections identify steps to troubleshoot some common RF issues.

Mobile Terminal Cannot Make a Call

Verify the following if the mobile terminal cannot make a call:

1. The mobile terminal is in Normal Mode (i.e., the mobile terminal is searching for a signal).
2. The Preferred Roaming List (PRL) is loaded into the mobile terminal.
3. The mobile terminal is tuned and has passed tuning. Read the tuning parameters using the **Read Parameters** component in Phoenix. An untuned mobile terminal has all zeros in the tuning file.
4. The call box channel is set for a channel in PRL.
5. The SID is correct and entered into the mobile terminal.
6. The VCTCXO is centered as described in the "VCTCXO Manual Tuning" section on page 53.
7. The transmitter and receiver are working properly in Local Mode. See "Transmitter RF Troubleshooting" on page 8 and "Receiver RF Troubleshooting" on page 25 for detailed information.

Tx Power Low

Complete the following steps if Tx power is low:

1. Perform a visual inspection of the PWB under a microscope to check for the proper placement, rotation, and soldering of components.
2. Use Phoenix to turn on the transmitter in Local Mode.
3. Look for the presence of a Tx signal on a spectrum analyzer at the correct frequency.
    - If a signal is present but off-frequency, check the synthesizers for proper frequency and amplitude. One of the synthesizers may be unlocked or the VCO has no output signal.
    - If a signal is not present or is present but is low in amplitude, check the probing diagrams to determine where in the chain the fault occurs. (See "DC Test Points" on page 24.)
4. Ensure that the power supplies to the Tx have the correct voltage. (See "Tx DC Test Points" on page 22)
5. Ensure that the AGC PDMs are set for the desired Tx power and that the AGC voltages are correct. (See "AMPS Tx Setup" on page 12, "Cell Tx Setup" on page 15, or "PCS Setup" on page 17.)

Transmitter RF Troubleshooting

Following are the main Tx RF components.

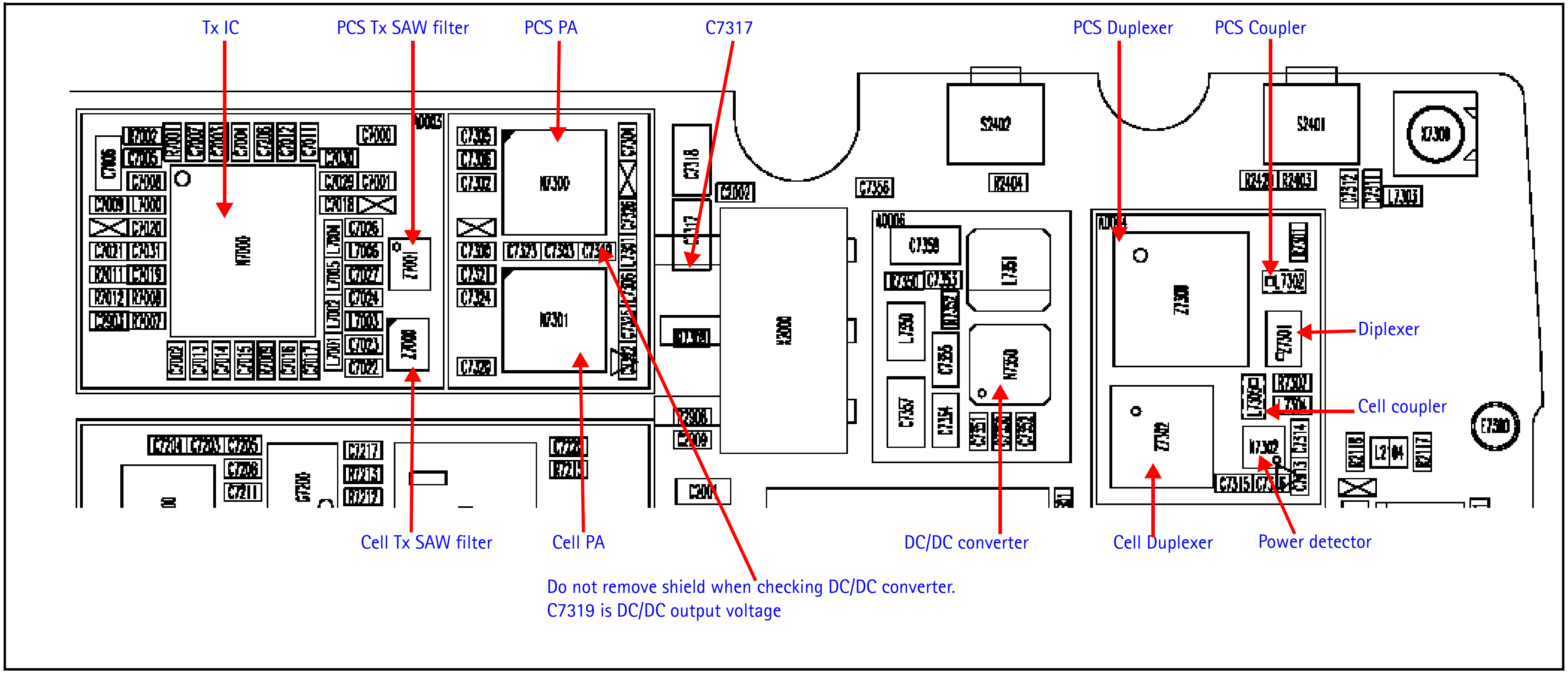


Figure 3: Main transmitter RF components

Transmitter Block Diagram

Following is the block diagram for the Tx RF system.

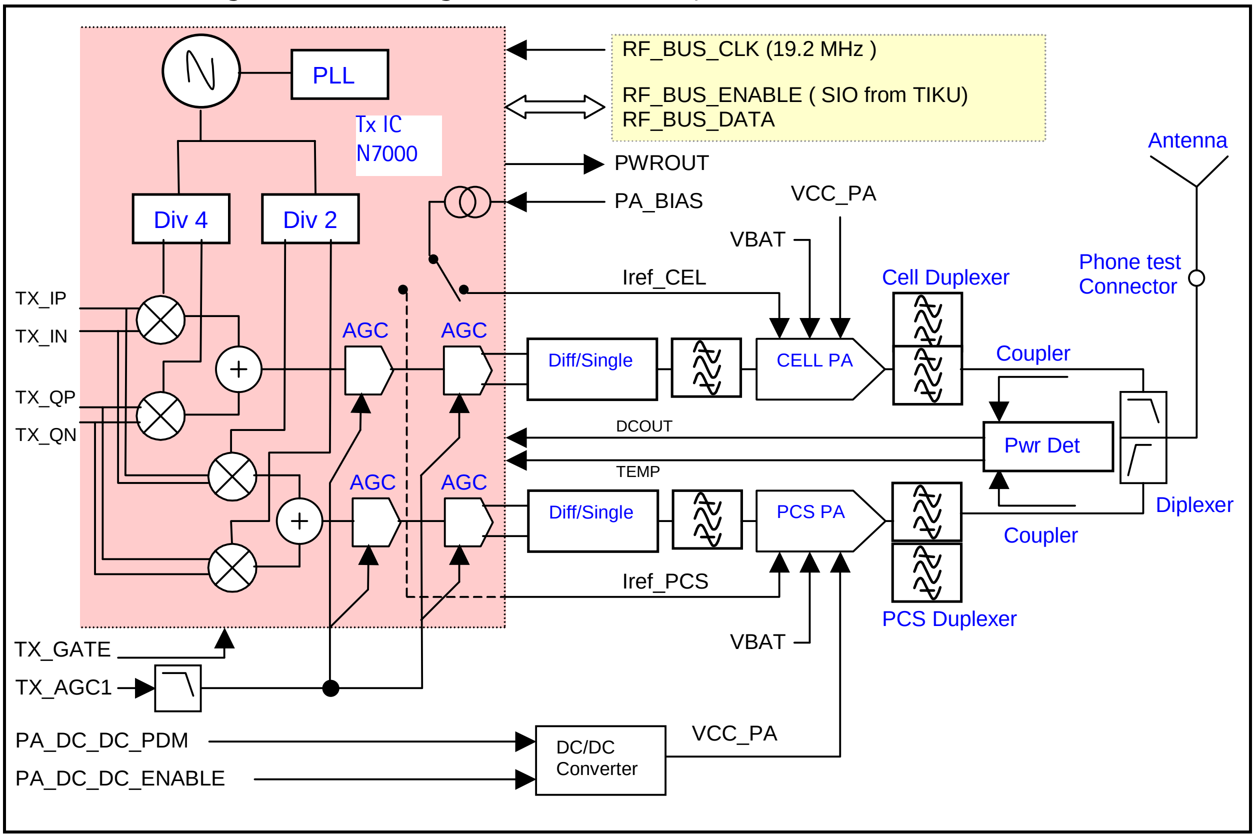


Figure 4: Tx system block diagram

Transmitter Schematics

The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

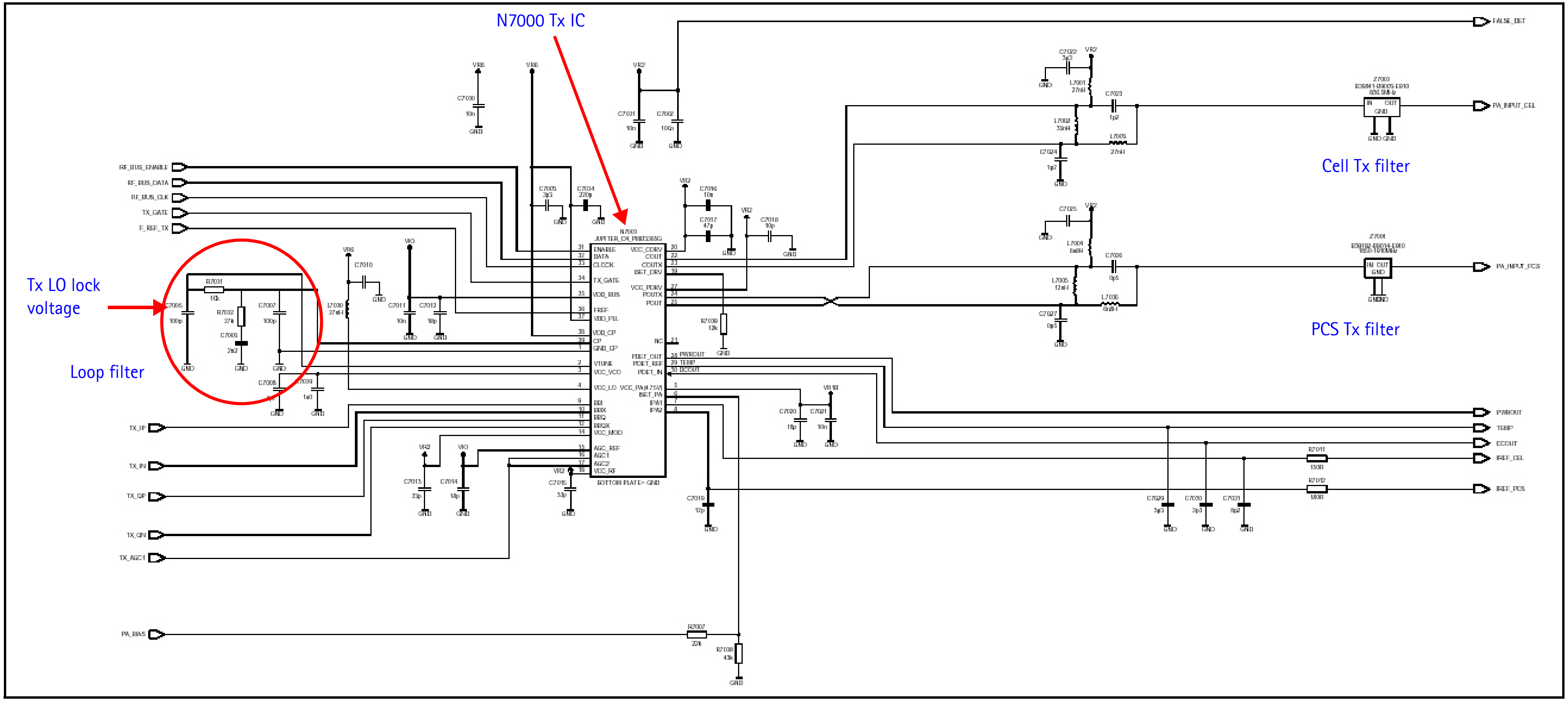


Figure 5: Transmitter schematic 1

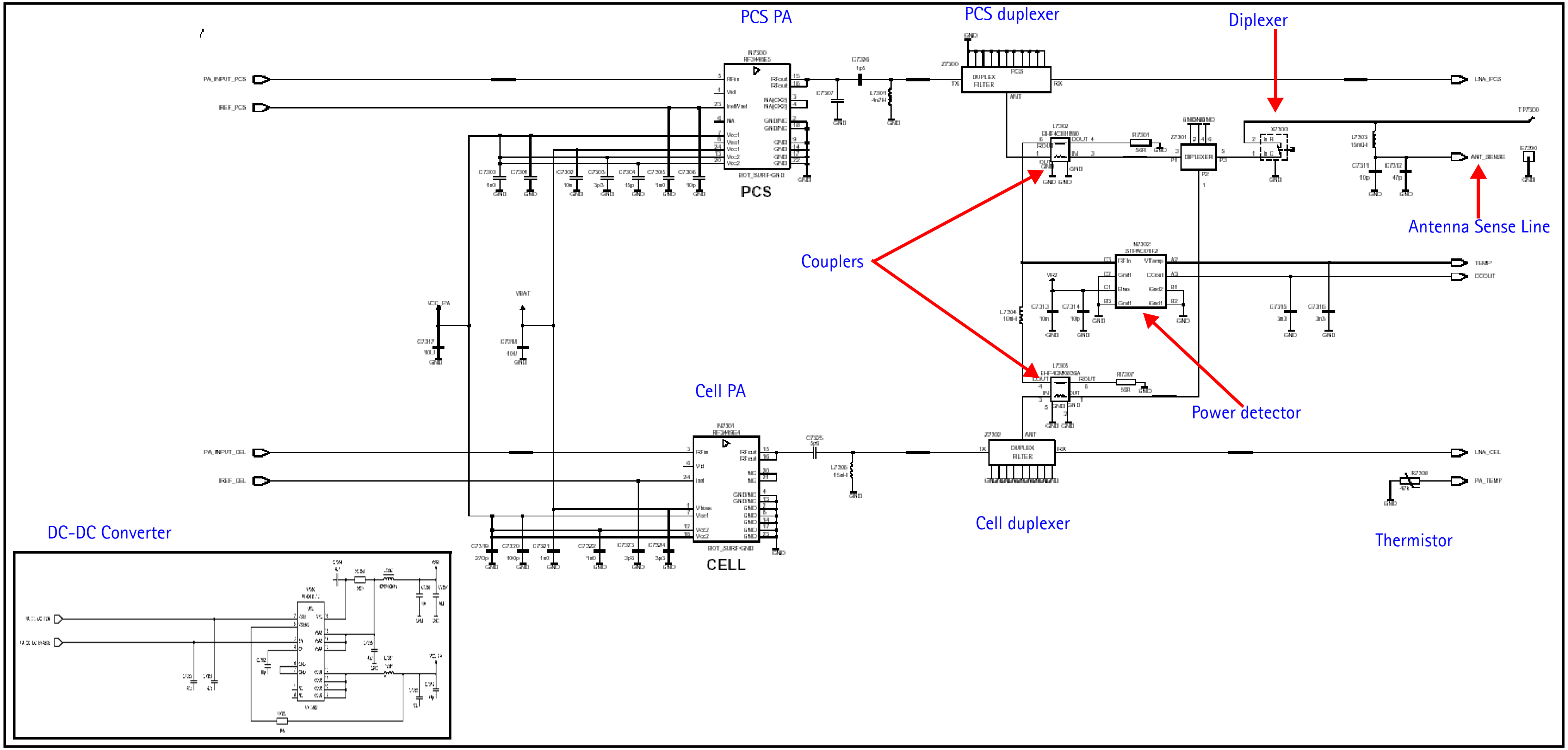


Figure 6: Transmitter schematic 2

Transmitter Troubleshooting Setup

Use the following sets of procedures to troubleshoot the transmitter using Phoenix. Due to the compact layout of the mobile terminal, some of the major test points are not accessible without destroying the shield frames and the LED lamp. To minimize effort, check the following in order:

1. Tx power at the RF connector.
2. All Tx DC points.
3. All soldering jig points for the whole Tx chain.
4. UHF LO presence:
   - If the UHF LO is present, check the N7000 output.
   - If the UHF LO is not present, it is a synthesizer problem.
5. If there is no N7000 output:
   a. Change the N7000.
   b. If the problem persists, reflow the duplexers, diplexer, and couplers.
   c. If the problem persists, change the PA.
6. If there are several failed mobile terminals with the same symptoms, it may be necessary to break one to determine the cause.

Use the following sections to set up troubleshooting in Phoenix according to the band you are using:

- "AMPS Tx Setup" on page 12
- "Cell Tx Setup" on page 15
- "PCS Setup" on page 17

AMPS Tx Setup

Use the following procedures to prepare for AMPS Tx troubleshooting using Phoenix.

1. Connect the RF test connector to a spectrum analyzer.
2. Connect the mobile terminal to the PC via a test jig. (The bottom connector is a USB port.)
3. Connect a power supply to the mobile terminal.
4. Open the **Troubleshooting** menu, and click **Phone Control**.

   The **Phone Control** dialog box appears.

5. Click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.

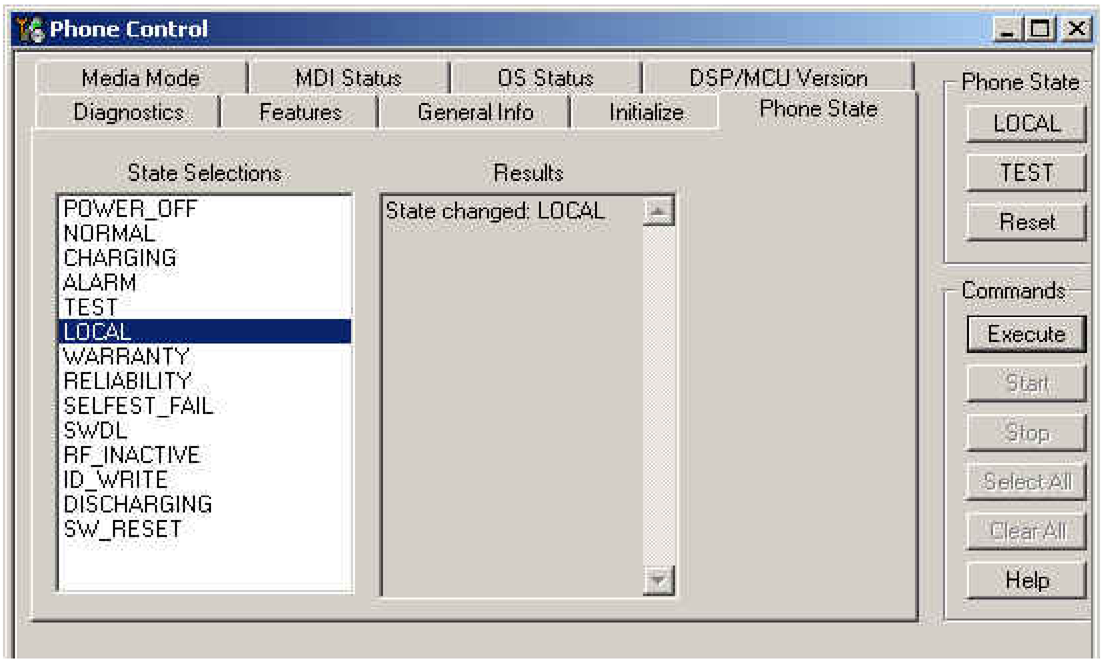


Figure 7: Phone Control dialog box

6. Open the **Troubleshooting** menu, point to **AMPS**, and click **AMPS Control**.

   The **AMPS Control** dialog box appears.

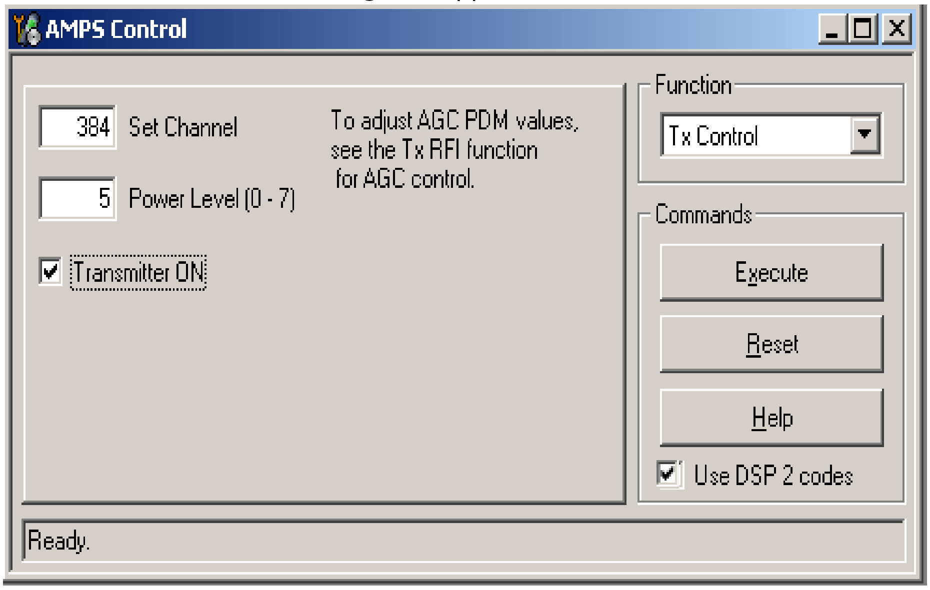


Figure 8: AMPS Control dialog box

7. Click the **Tx Control** tab.
8. In the **Set Channel** field, type 384.
9. In the **Power Level** field, type 5.
10. Select the **DSP 2 codes** check box
11. Select the **Transmitter ON** option, and click **Execute**.

12. Configure the spectrum analyzer using the following values:
    - Center Frequency = 836.52 MHz
    - Span = 100 MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 1: RF PDM Values at Power Level 5

Description/Field	Reference Value
AGC1	-512
PA_Bias	129
PA_DC_DC	197
Pout at RF connector	TBD dBm
Current	TBD mA

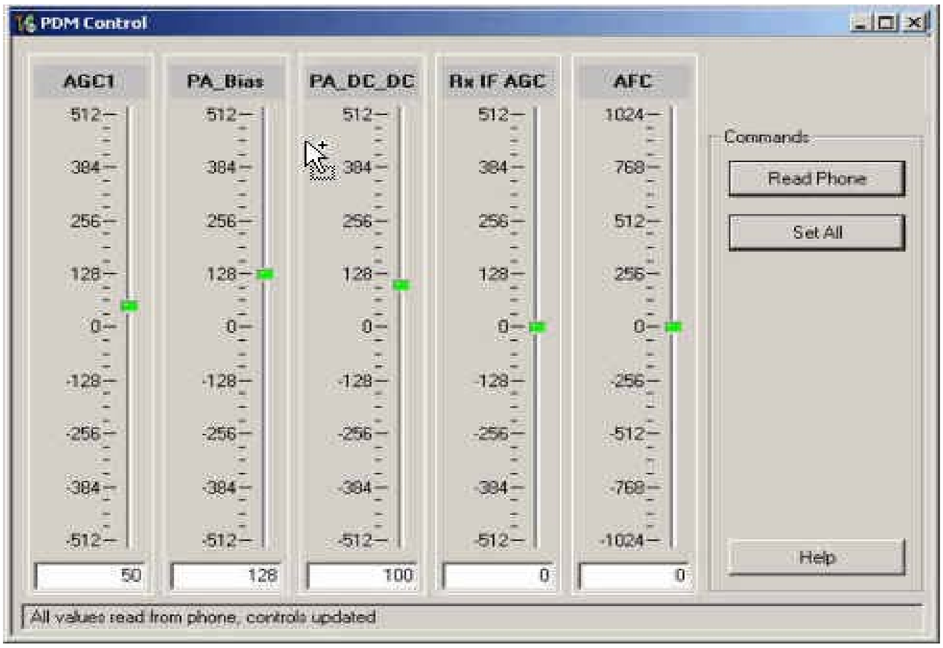


Figure 9: RF PDM dialog box for AMPS

13. Click **Read Phone** to update the values.

Cell Tx Setup

Use the following procedures to prepare for Cell Tx troubleshooting using Phoenix.

1. Connect an RF test connector to a call box.
2. Connect the mobile terminal to the PC via a test jig.
3. Connect a power supply to the mobile terminal.
4. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 13.)
5. Open the **Troubleshooting** menu, point to **RF**, and click **RF Main Mode**.

   The **RF Main Mode** dialog box appears.

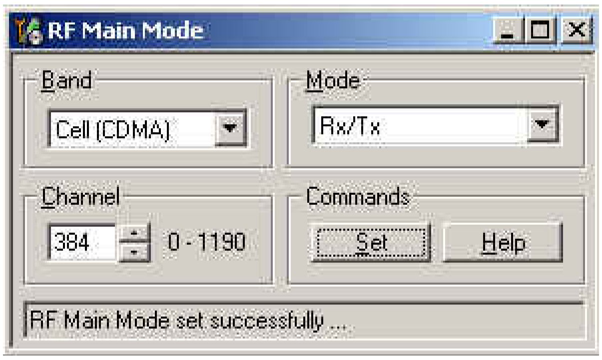


Figure 10: RF Main Mode dialog box for Cell Mode

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

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

8. Open the **Troubleshooting** menu, point to **RF**, and click **CDMA Control**.

   The **CDMA Control** dialog box appears.

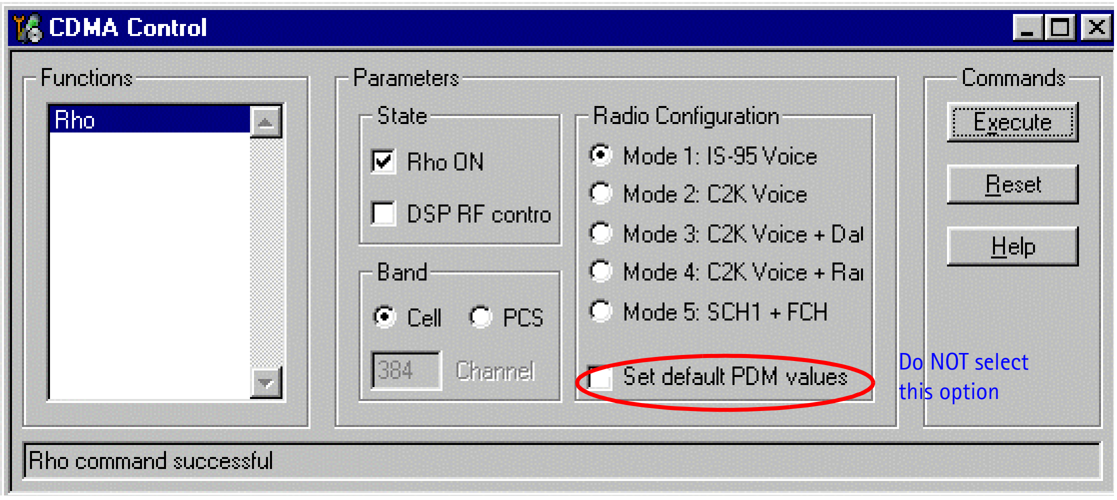


Figure 11: CDMA Control dialog box for Cell Tx troubleshooting

9. Select the following values:
   - **State** = Rho ON
   - **Band** = Cell
   - **Radio Configuration** = Mode 1: IS-95 Voice

   Note: Do NOT select the Set default PDM values option

10. Click **Execute.**
11. Configure the spectrum analyzer using the following values:
    - Center Frequency = 836.52 MHz
    - Span = 100MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 2: RF PDM Values

Description/Field	Reference Value
AGC1	-130
PA_Bias	85
PA_DC_DC	110
Pout at RF connector	+16dBm
Current	340mA

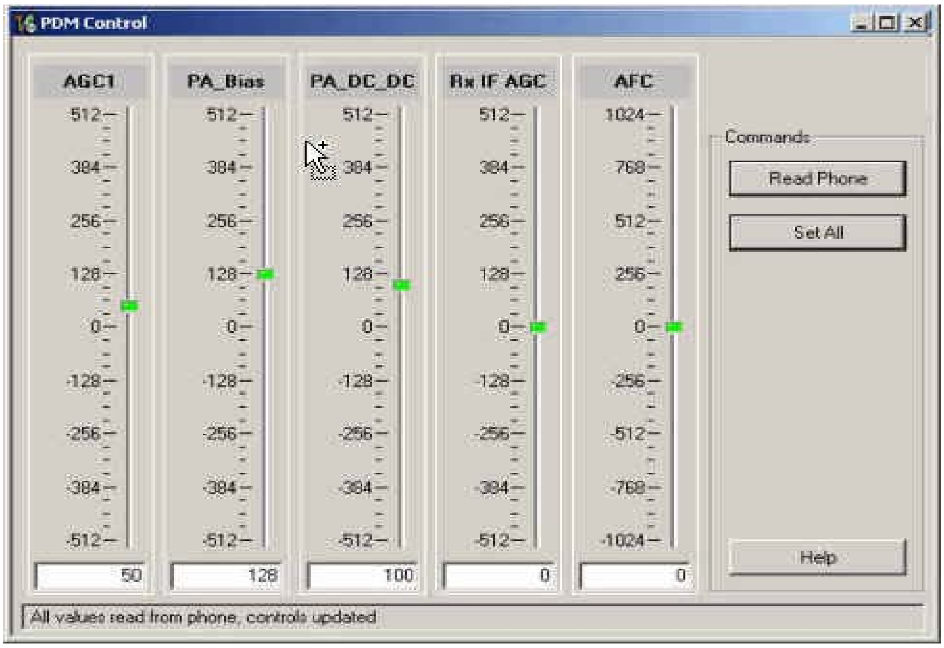


Figure 12: RF PDM Control dialog box for Cell band

12. Click **Read Phone** to update the values.

PCS Setup

Use the following procedures to prepare for PCS Tx troubleshooting using Phoenix.

1. Connect an RF test connector to a call box.
2. Connect the mobile terminal to the PC via a test jig. (The bottom connector is a USB port.)
3. Connect a power supply to the mobile terminal.
4. Open the **Troubleshooting** menu, and point to **Phone Control**.

   The **Phone Control** dialog box appears. (See Figure 7 on page 13.)
5. Click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.
6. Open the **Troubleshooting** menu, point to **RF**, and click **RF Main Mode**.

   The **RF Main Mode** dialog box appears. (See Figure 10 on page 15.)

7. Select the following values on the **RF Main Mode** dialog box:
   - **Band** = PCS (CDMA)
   - **Channel** = 600
   - **Mode** = Rx/Tx
8. Click **Set.**

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

9. Open the **Troubleshooting** menu, point to **RF**, and click **CDMA Control**.

   The **CDMA Control** dialog box appears. (See Figure 11 on page 16.)
10. Select the following values on the **CDMA Control** dialog box.
    - **State** = Rho ON
    - **Band** = PCS
    - **Radio Configuration** = Mode 1: IS-95 Voice

    Note: Do NOT select the Set default PDM values option.

11. Click **Execute.**
12. Open the **Troubleshooting** menu, point to **RF**, and click **PDM Control**.
13. Configure the spectrum analyzer using the following values:
    - Center Frequency = 1880 MHz
    - Span = 100 MHz
    - Amplitude = 20 dBm
    - Attenuation = Auto
    - BW = Auto

Table 3: RF PDM Values

Description/Field	Reference Value
AGC1	-130
PA_Bias	85
PA_DC_DC	110
Pout at RF connector	+15dBm
Current	340mA

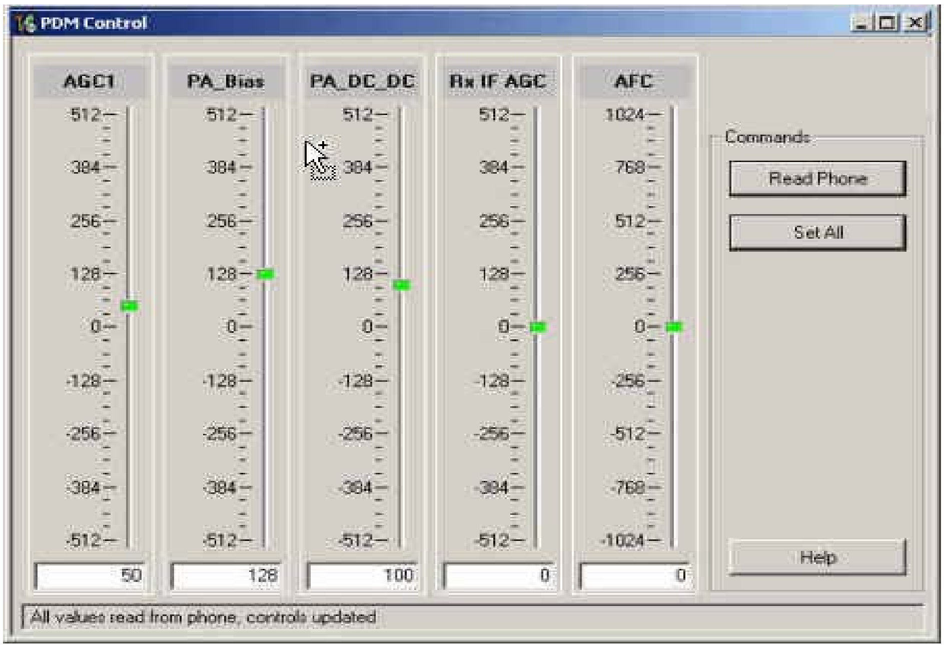


Figure 13: RF PDM Control dialog box for PCS band

14. Click **Read Phone** to update the values.

Transmitter RF Troubleshooting Procedures

After Phoenix is set up using either the AMPS, Cell, or PCS setup procedures, use the following steps to troubleshoot the transmitter.

1. Using a voltmeter, check to see that all VR2, VR6, and VR1B are on the transmit system. (See "Tx DC Test Points" on page 22.)
   - If any are missing, look for SMD problems around the Tx IC and the UEMEK.
   - If SMD is good, replace the UEMEK.
2. Once all DC voltages are present, check the AGC control voltages. (See "AMPS Tx Setup" on page 12, "Cell Tx Setup" on page 15, or "PCS Setup" on page 17.)
   - If the voltages are incorrect, check the SMD around TX_AGC1.
   - If the SMDs are correct, replace the D2800.
3. Using an oscilloscope, check the I and Q input modulation wave forms at test points. See "Tx DC test points of the PWB" on page 22. They should all be present with an AC swing of about 500mVpp, with an offset of +1.2V.
   - If one or more waveforms is missing, look for SMD problems around these resistors.
   - If the SMD is good, replace the UEMEK.
4. Use an AAS-10 RF probe to probe the Cell Tx output of the Tx IC.
   - If there is no RF or low RF, look for a faulty SMD around the Tx IC.

- If the SMD is okay, replace the N7000.

5. Probe the PA input.
   - If the level is low, look for an SMD issue on the Tx filter.
   - Reflow or replace the filter as necessary.
6. Probe the PA output.
   - If the RF is missing or low, look for Vbatt voltages and SMD issues on and around the PA.
   - If these are okay, replace the PA.
7. Probe the duplexer output.
   - If the RF is missing or low, reflow or replace the duplexer.
8. Probe the coupler output.
   - If the RF is missing or low, reflow or replace the coupler.
9. Probe the diplexer output.
   - If the RF is missing or low, reflow or replace the diplexer.

Failed Test: Tx PA Detector

Use the following steps if you encounter a failed test for the Tx PA detector:

1. Use Phoenix to set the mobile terminal into Local Mode and activate the Tx with default output power.
2. The output power at the RF test connector should be 15dBm +/- 4dB. If not, adjust the PDM values, or troubleshoot per procedure above.
3. Using a voltmeter on DC, probe the detector output at C7315. The voltmeter should read approximately 1.4V. If not, replace N7302.

Tx Output Spectrum

Following is the correct output of the mobile terminal on a spectrum analyzer with 100MHz span. Note that if you are using the AAS-10 probe with the mobile terminal connected to the call box, the amplitude should be approximately -7dBm at the antenna test point on the top of the PWB.

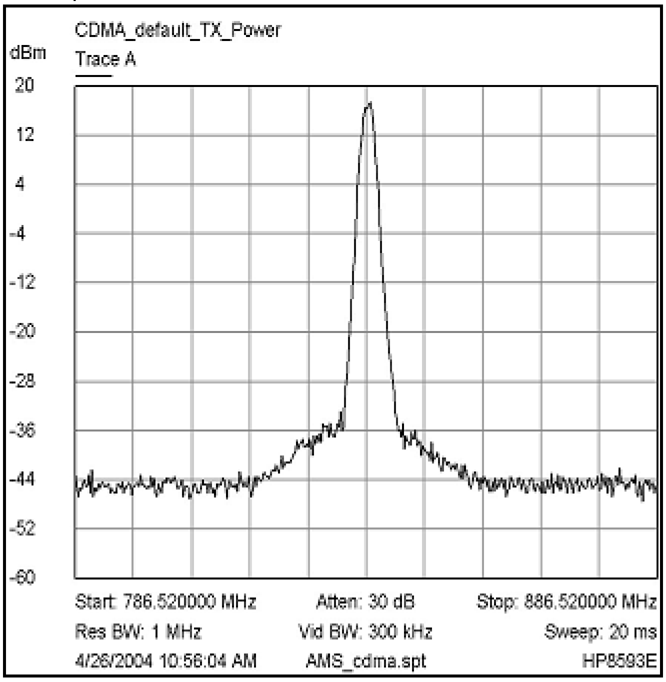


Figure 14: Correct output spectrum

Following is an example of *incorrect* output.

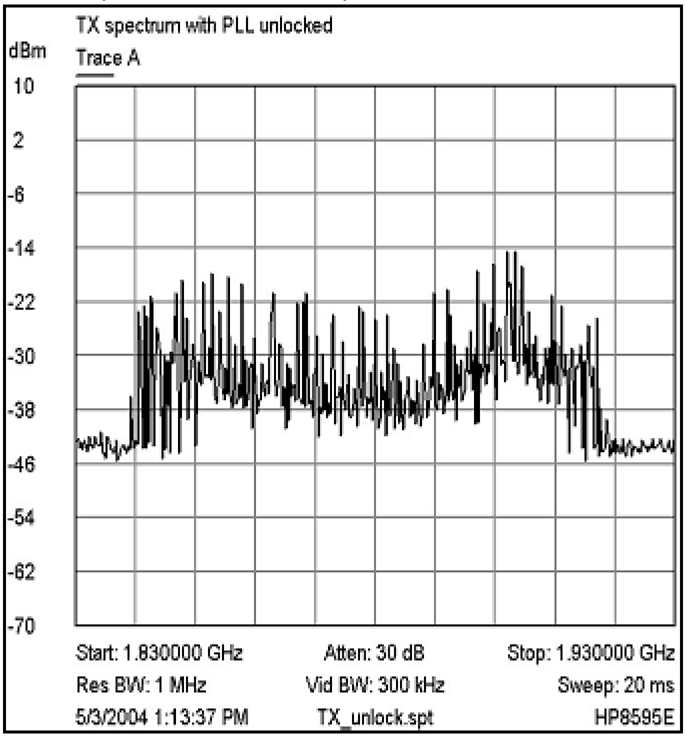


Figure 15: Incorrect output spectrum

Tx DC Test Points

Following are the Tx DC test points.

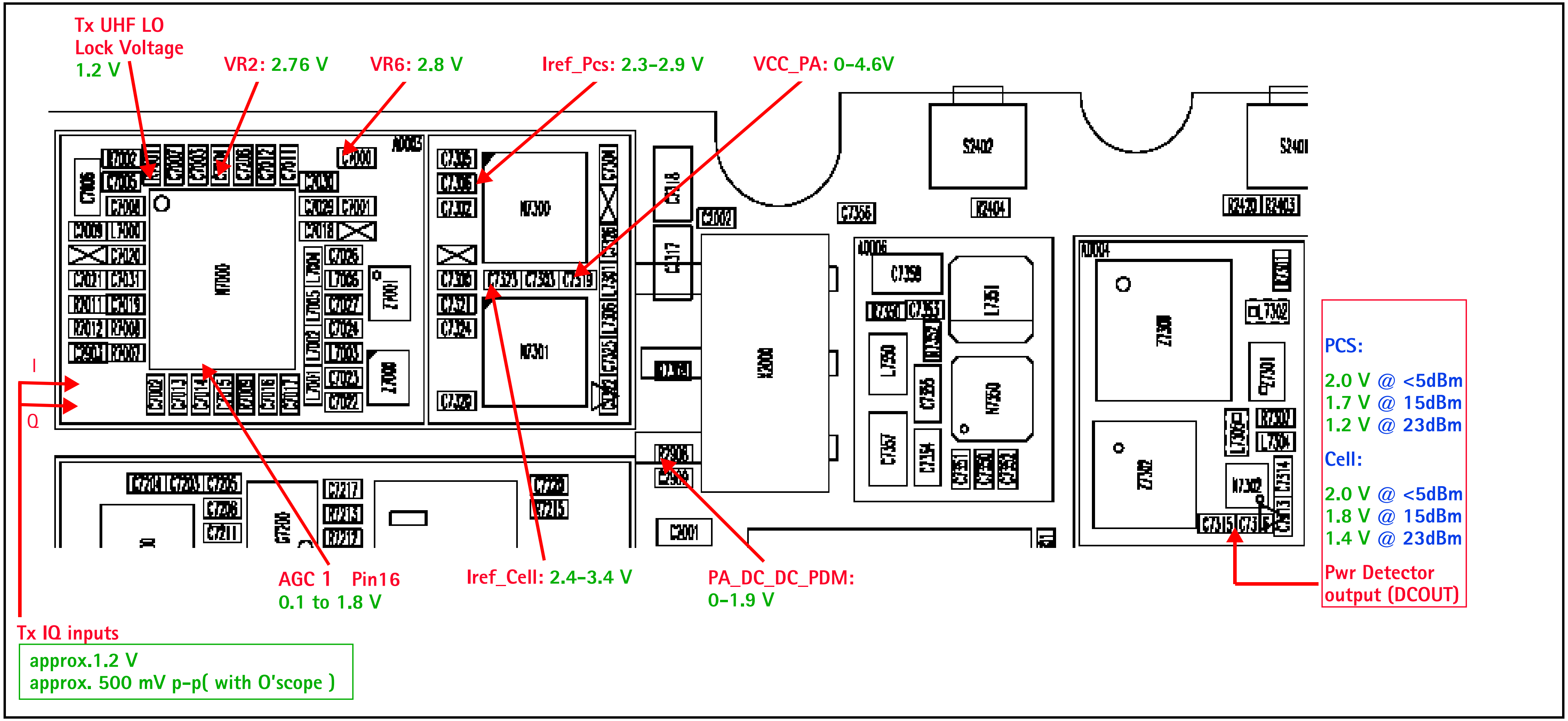


Figure 16: Tx DC test points of the PWB

Tx RF Test Points

Following are the Tx RF test points of the PWB.

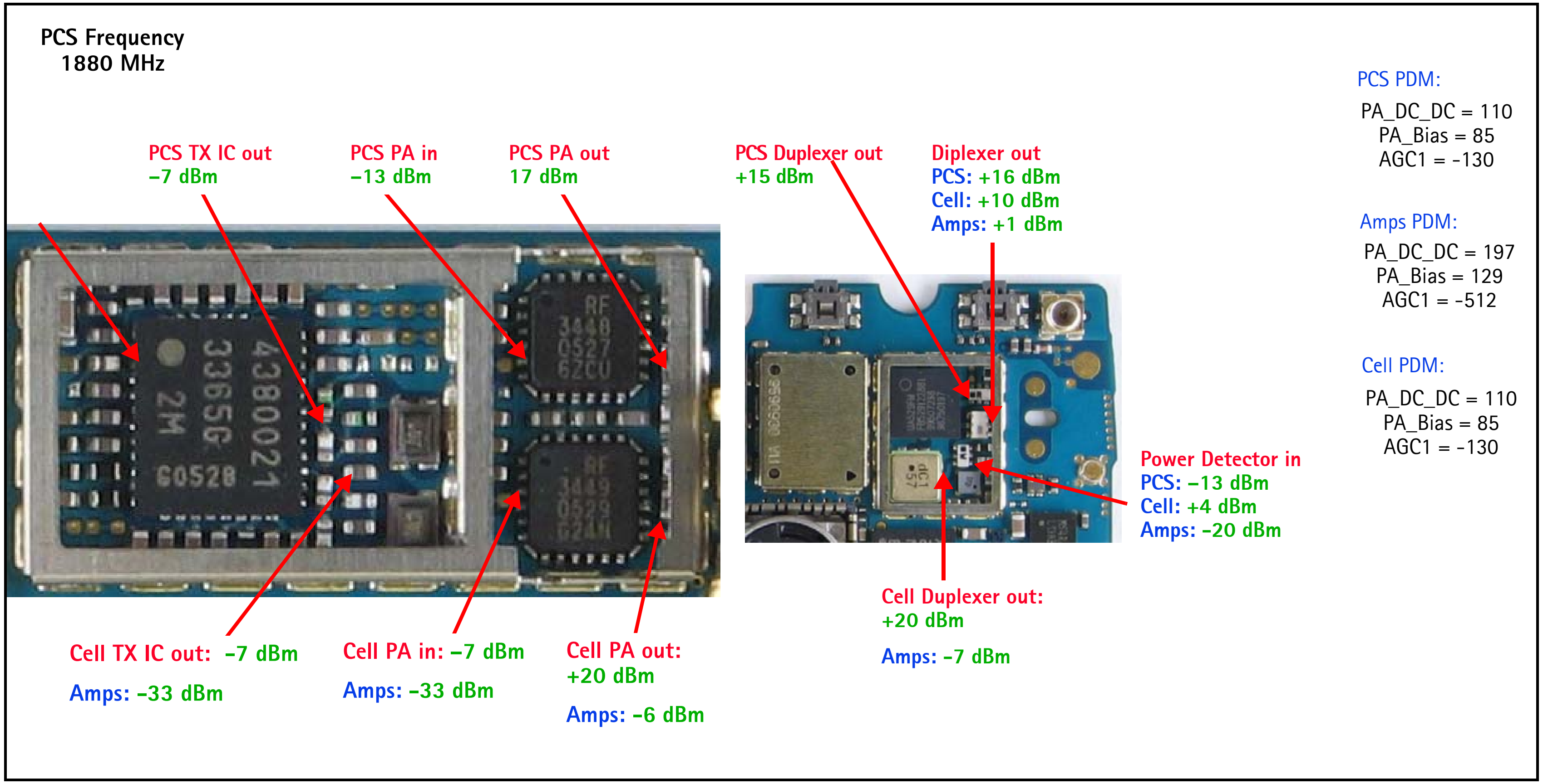


Figure 17: Tx RF test points

DC Test Points

Figure 18 shows the DC test points.

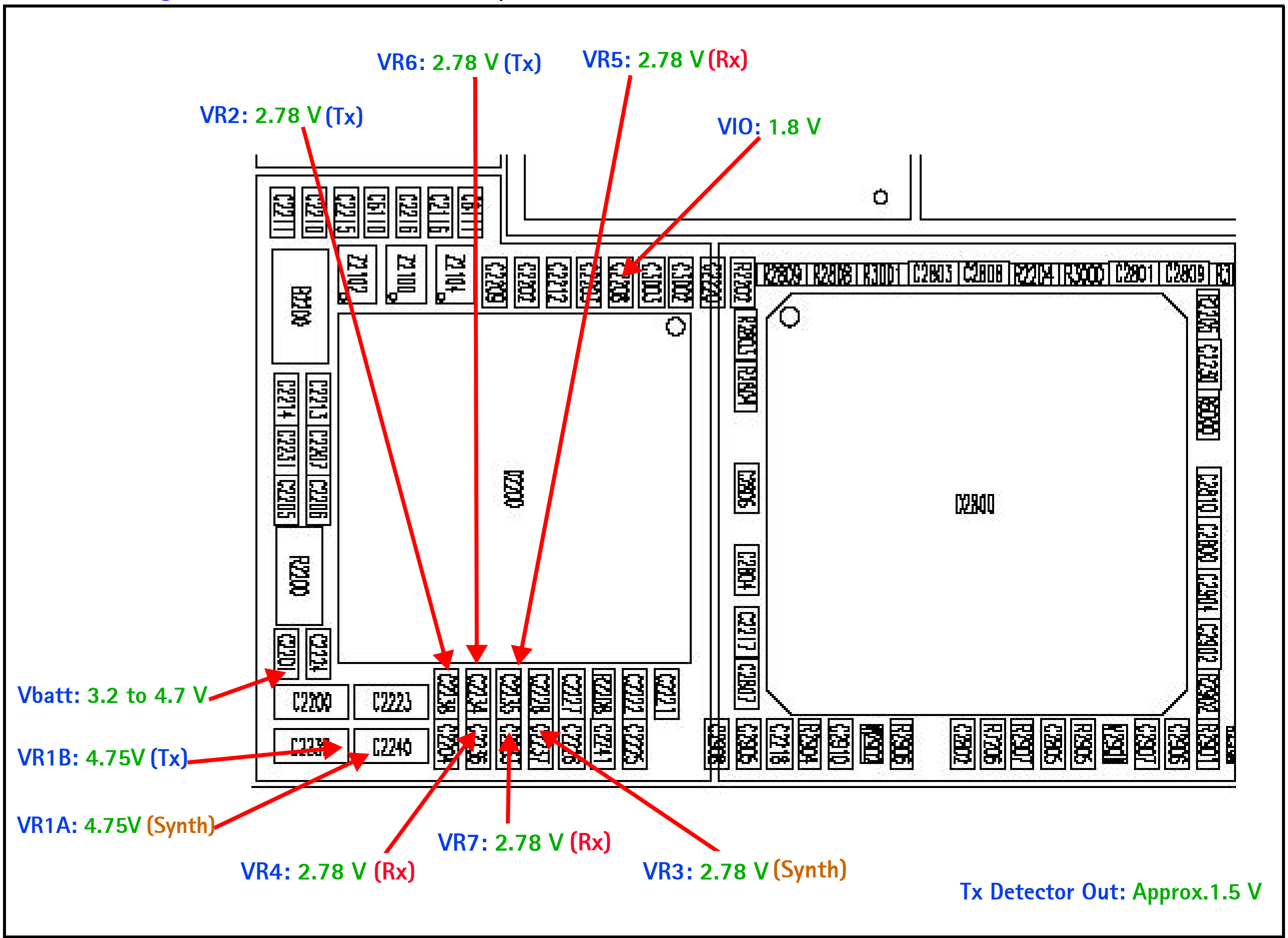


Figure 18: Tx DC test points

Table 4: RF PDM Values

Description		Supply
VR1A	> 100 Ohms to Gnd	UHF PLL
VR1B	> 100 Ohms to Gnd	Tx IC
VR2	7.5k Ohms to Gnd	Tx IC PA detector
VR3	> 500 Ohms to Gnd	VCTCXO
VR4	4.3k Ohms to Gnd	VCO
VR5	3.2 - 5.1 Ohms to Gnd	Rx FE IC, Rx BE IC
VR6	300 Ohms to Gnd	Tx IC
VR7	~ 500 Ohms to Gnd	Rx BE IC
VIO	> 1M Ohms to Gnd	Rx BE IC

Receiver RF Troubleshooting

The heart of the receiver is the Rx Front-end IC, which contains two LNAs and mixers. The other components are passive. There are two RF SAW filters for the Cell and PCS bands. In addition, there are two IF filters, an IF SAW for CDMA and an IF Crystal for AMPS. The back-end of the receiver consists of the RX Back-End IC. VGA and IQ Demodulator are the main function.

Receiver Block Diagram

Following is the Rx system block diagram.

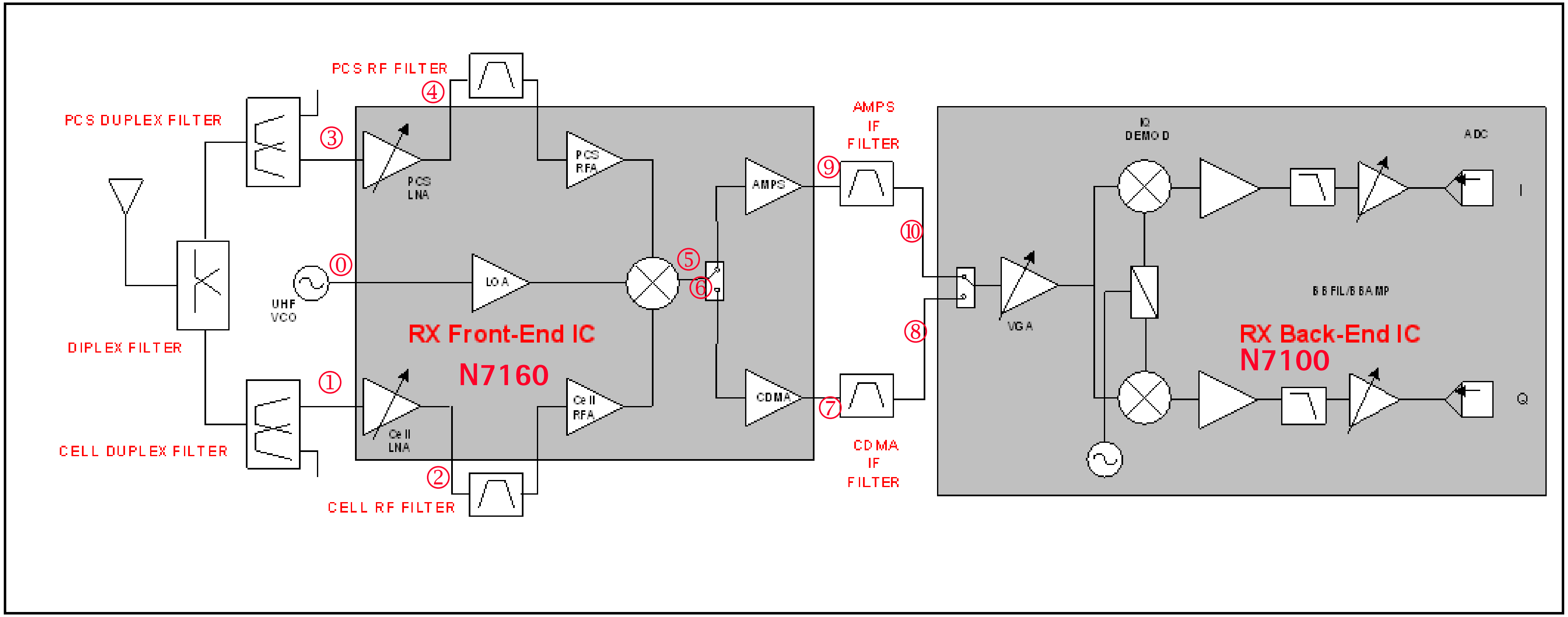


Figure 19: Receiver system block diagram

Receiver Schematics

The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

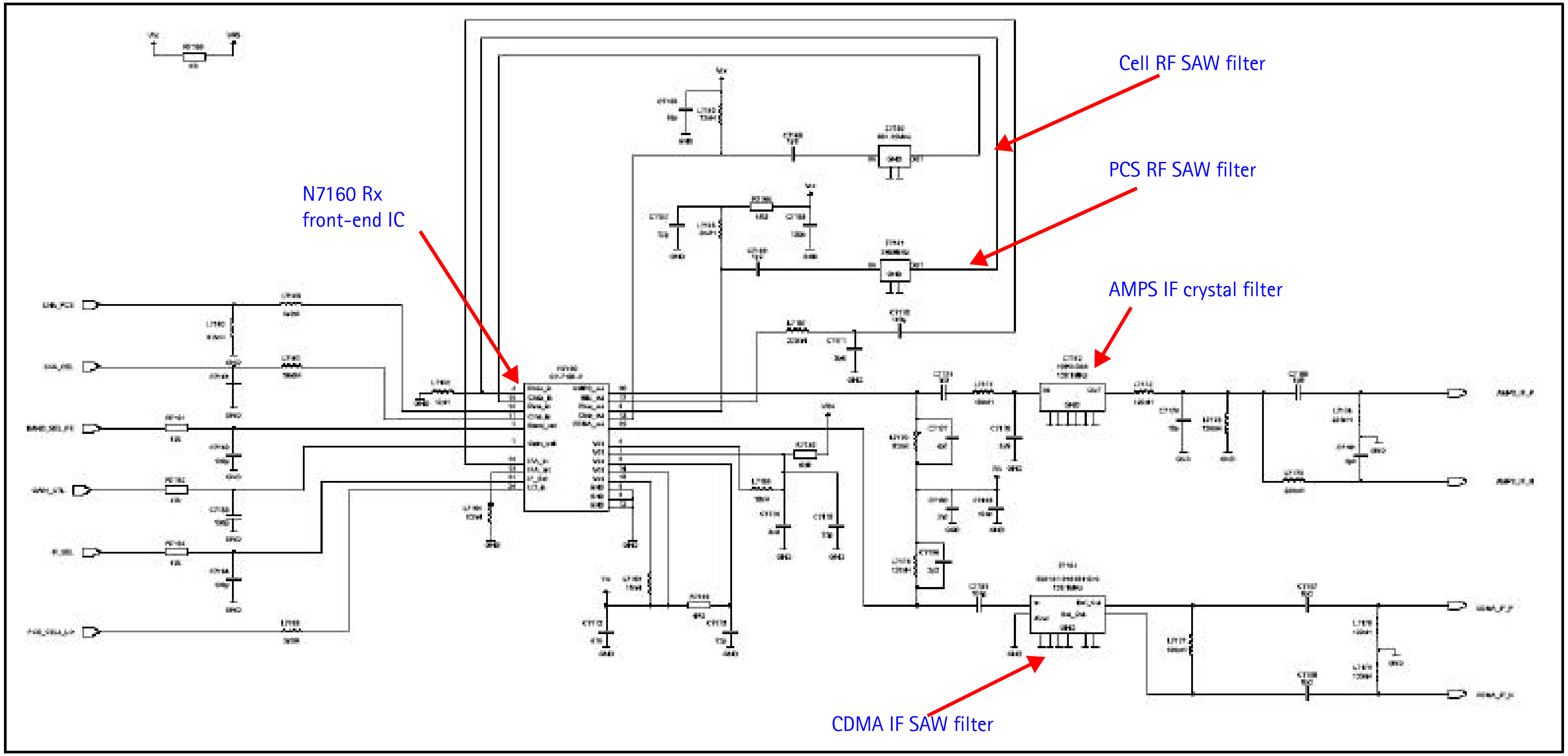


Figure 20: Receiver schematics - 1 Rx Front-end

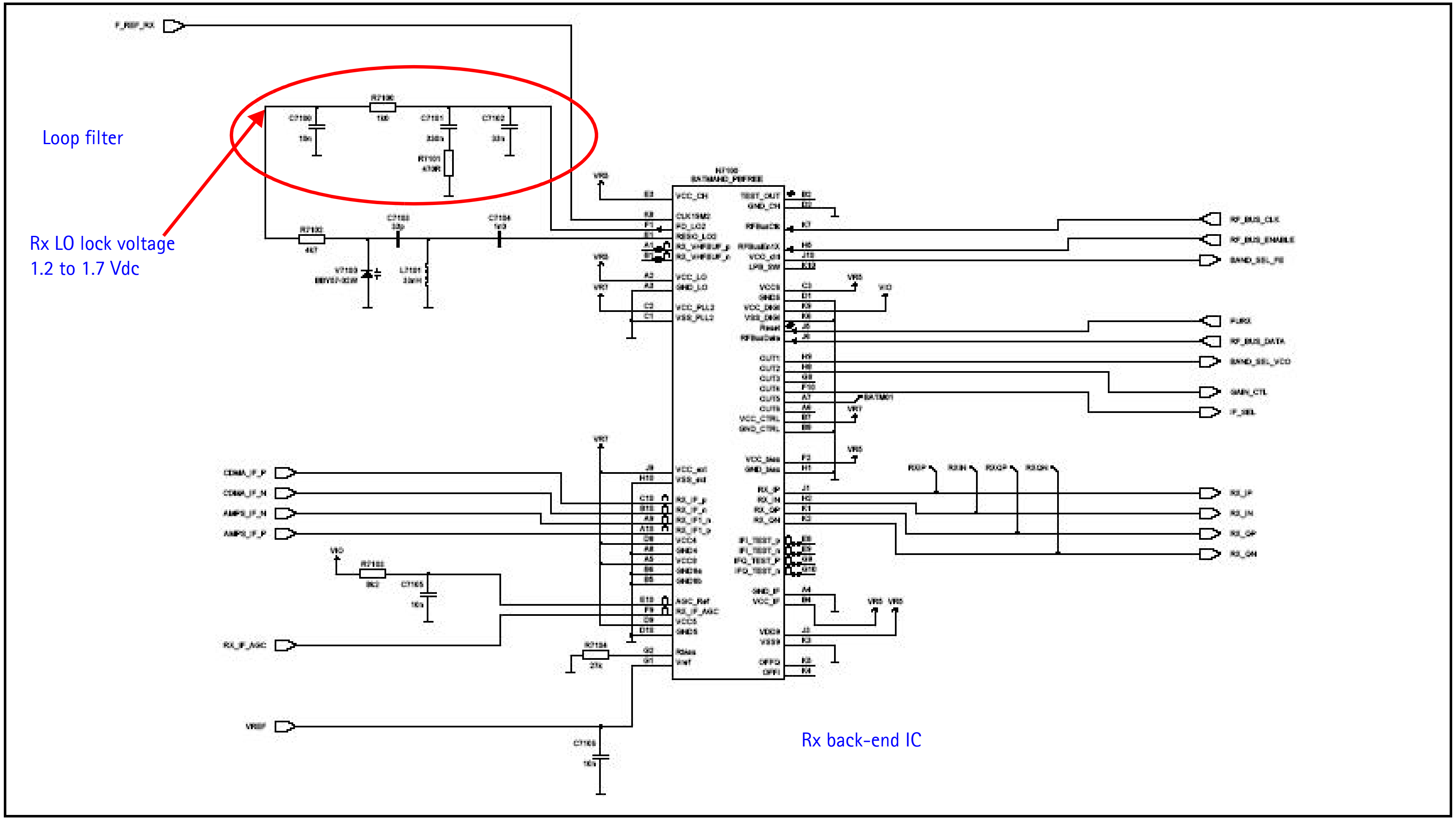


Figure 21: Receiver schematic - 2 Rx Back-end

RF AGC Status

When configuring the values on the **RF AGC Status** dialog box, note the following:

- The RF AGC status functionality only works in Call Mode.
- In the **PLL Lock Status** area, bright green indicates a locked PLL and dark green indicates an unlocked PLL.
- Clicking the **Update Now** button updates the screen once.
- Clicking the **Auto Update** button updates the screen every second continuously.

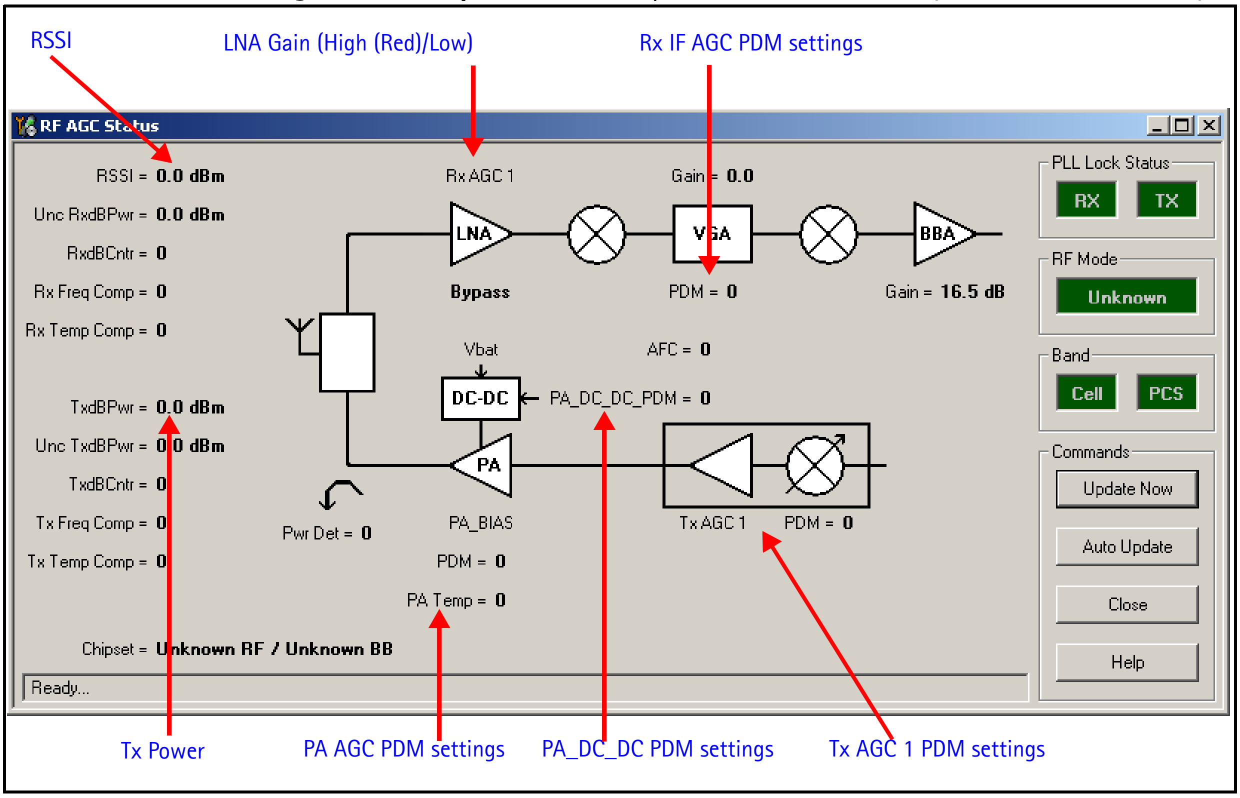


Figure 22: RF AGC Status dialog box

Turning on the Rx Path

Use the following steps to turn on the Rx path using Phoenix.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.

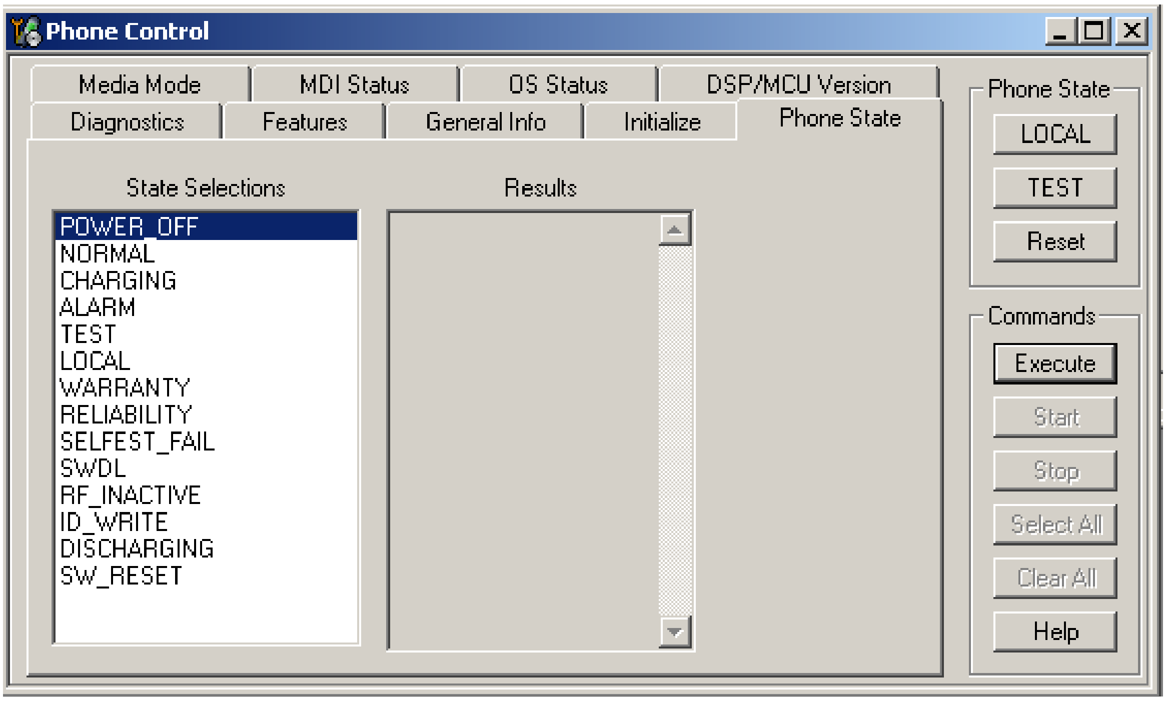


Figure 23: Phone Control dialog box

2. Click the **Execute** button.
3. Depending on the band, use the applicable settings from the table below on the **RF Main Mode** dialog box.

Table 5: RF Main Mode Dialog Box Settings

Band	Mode	Channel
AMPS	Rx = 881.52 MHz	384
Cell	Rx = 881.52 MHz	384
PCS	Rx = 1960 MHz	600

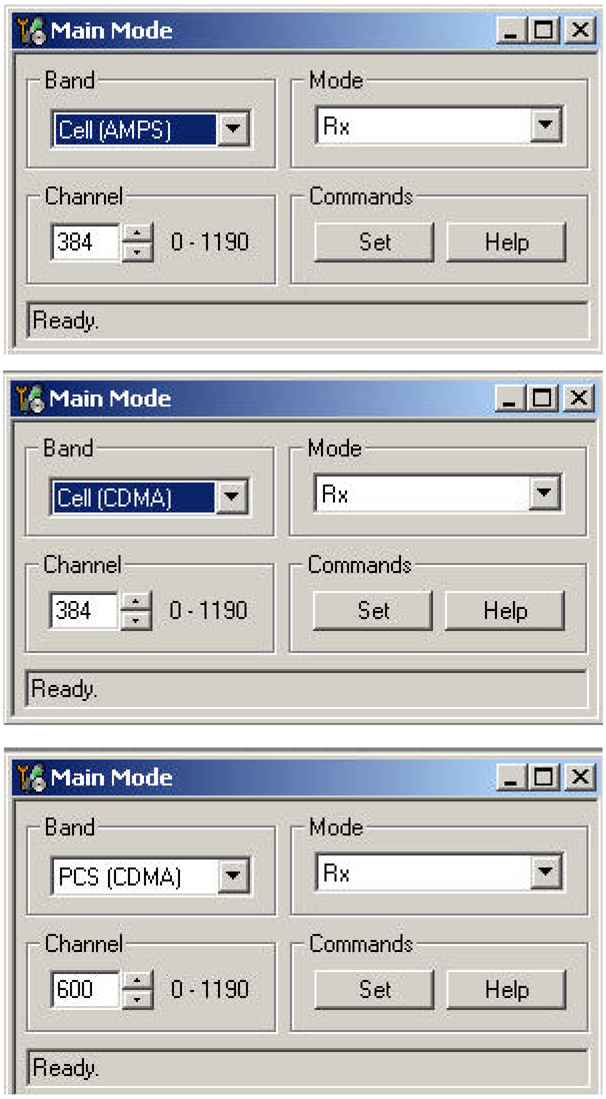


Figure 24: RF Main Mode dialog box for AMPS (top), Cell (middle), and PCS (bottom)

Switching the Rx Gain States

Use the **RF Gen I/O** dialog box to switch the gain state (Hi and Lo) for CDMA and AMPS modes.

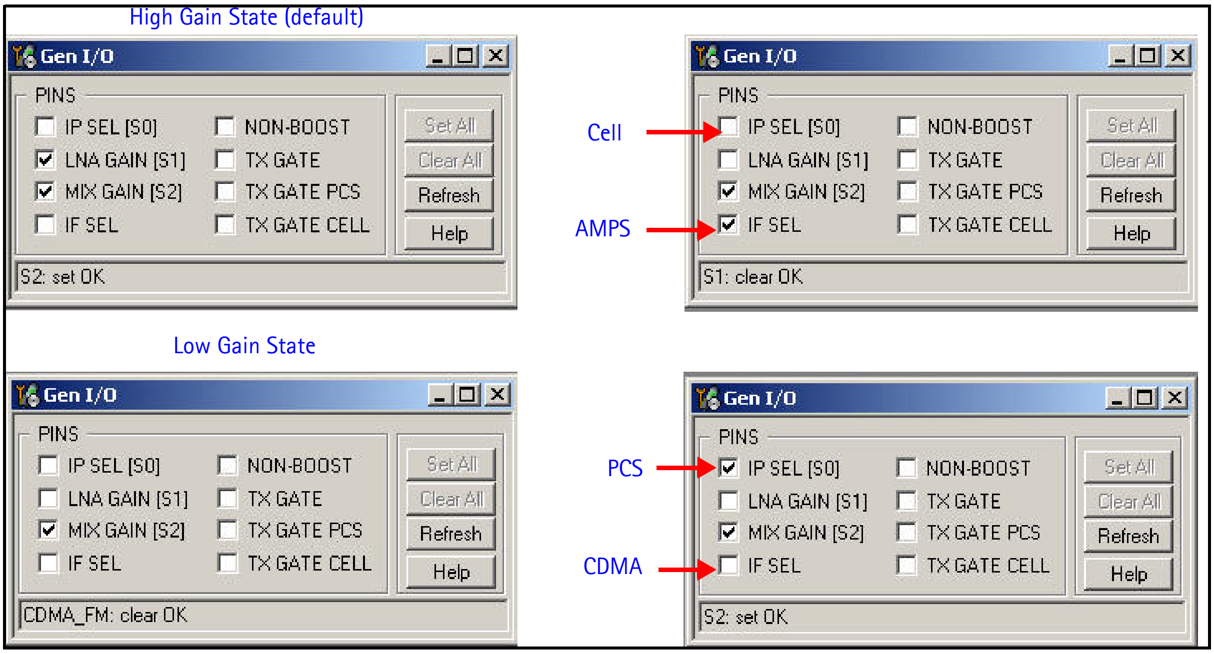


Figure 25: RF Gen I/O dialog box

Checking AMPS from RF to IQ

Use the following steps to check the AMPS receiver functionality from RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 881.53MHz (i.e. 10kHz offset from 881.52MHz).
3. Measure a 10kHz tone on the analyzer. You should see a typical -20Bm IQ tone for AMPS.

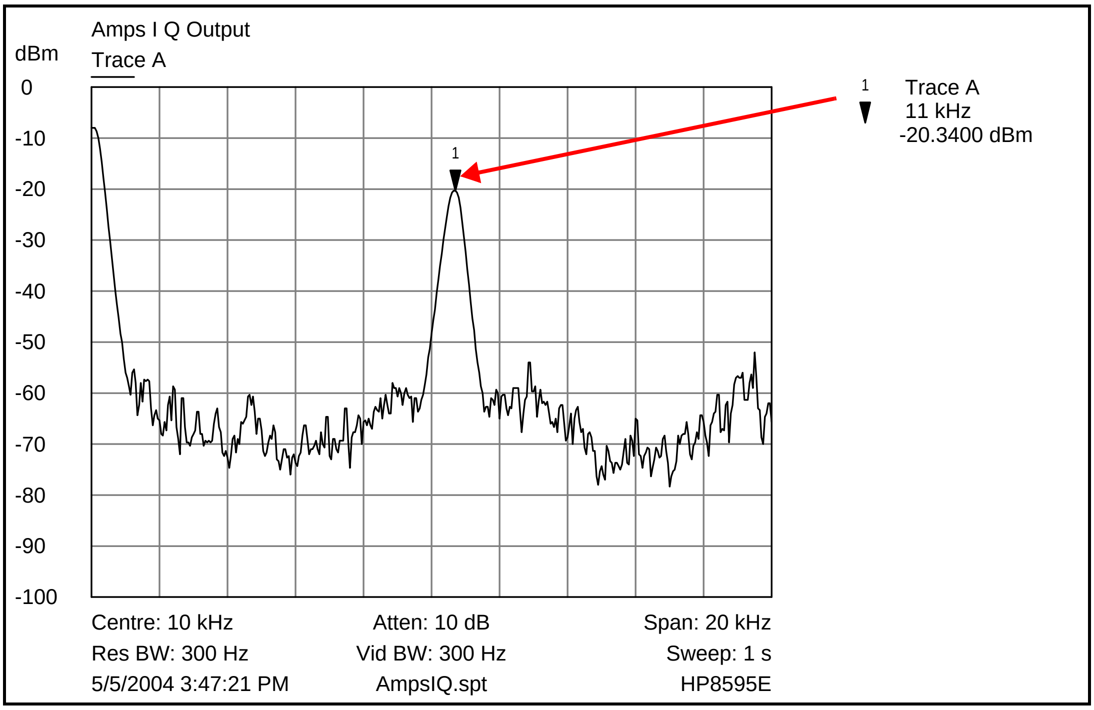


Figure 26: Receiver IQ Level on AMPS band

Figure 27 shows the AMPS spectrum and the test points located on the top side of the PWB. All four test points should be approximately equal. *WARNING: Direct current is* *present on these test points.*

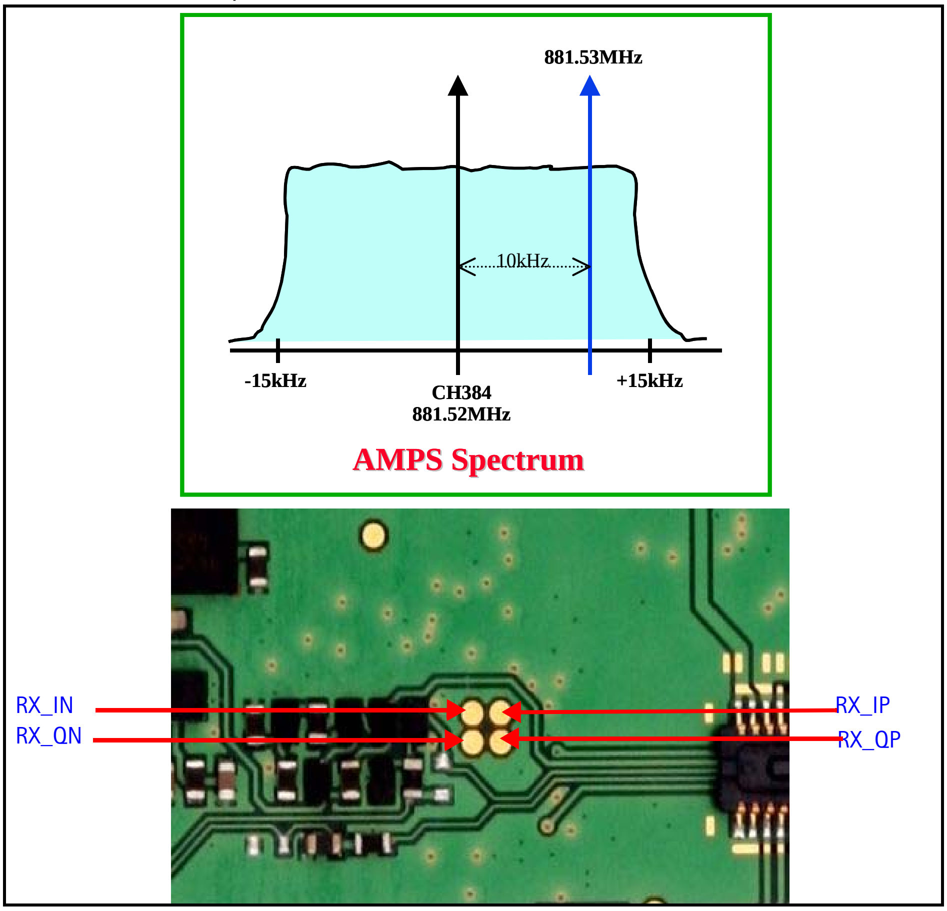


Figure 27: AMPS spectrum and the test points on the top side of the PWB

Checking CDMA CELL Receiver from RF to IQ

Use the following values to check the Cell receiver functionality RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 881.82MHz (i.e. 300kHz offset from 881.52MHz or 10 channels away).
3. Measure a 300kHz tone on the analyzer. You should see a typical -21dBm IQ tone for CDMA Cell.

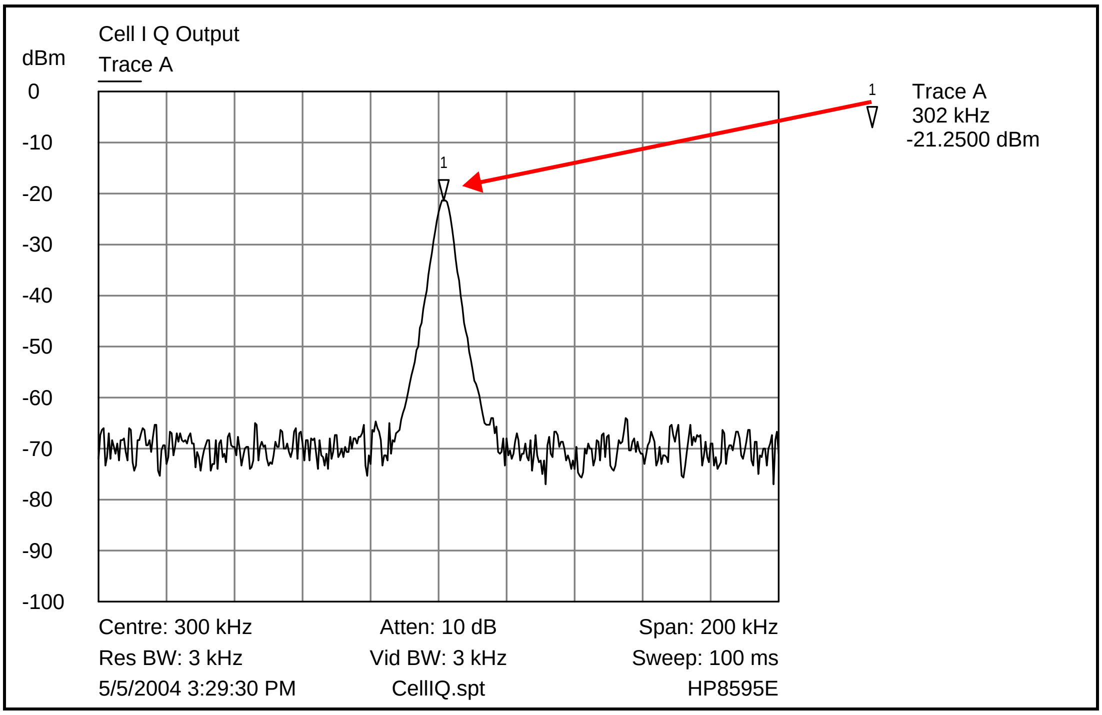


Figure 28: Receiver IQ level on Cell band

Figure 29 shows the Cell spectrum and the test points located on the top side of the PWB. All four test points should be approximately equal. *WARNING: Direct current is present on these test points.*

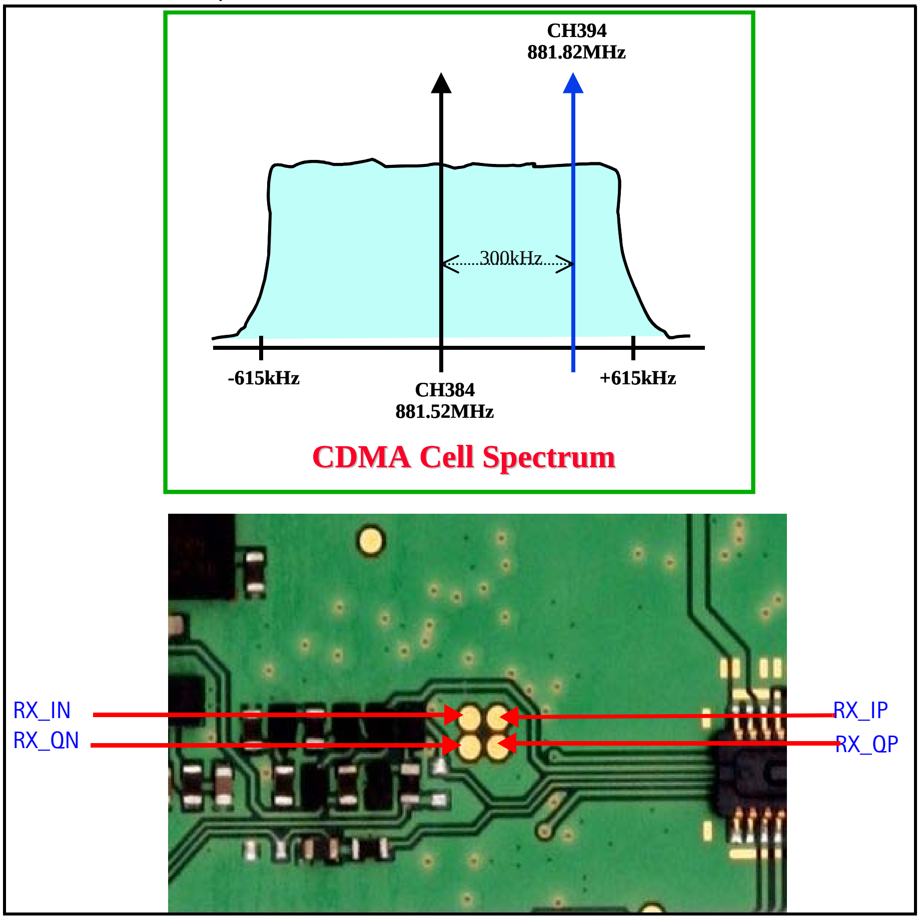


Figure 29: Cell spectrum and test points on the top side of the main PWB

Checking CDMA PCS Receiver from RF to IQ

Use the following values to check the PCS receiver functionality from RF to IQ output.

1. Start Phoenix in Local Mode with only the Rx path turned on.
2. Inject a –75dBm CW signal of 1960.5MHz (i.e. 500kHz offset from 1960MHz or 10 channels away).
3. Measure a 500kHz tone on the analyzer. You should see a typical -22dBm IQ tone for CDMA PCS.

   Note: If 300kHz tone works but 500kHz doesn't, problem is in BB filter, possibly not set by Phoenix.

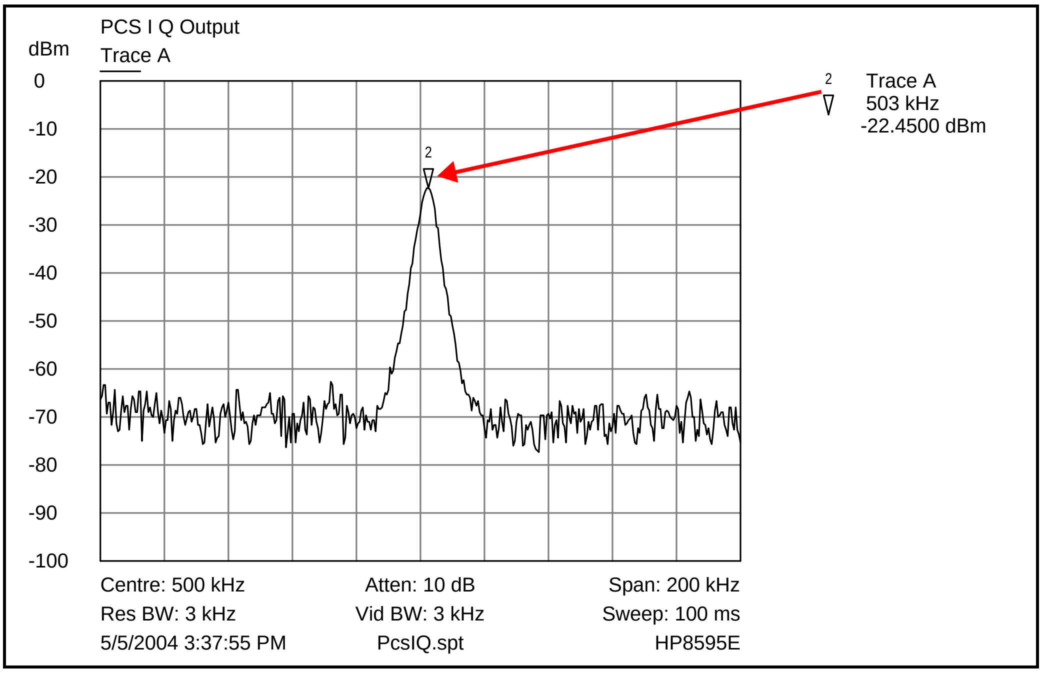


Figure 30: Receiver IQ Level on PCS Band

Figure 31 shows the PCS spectrum and the test points of the PWB. All four test points should be approximately equal. *WARNING: Direct current is present on these test points.*

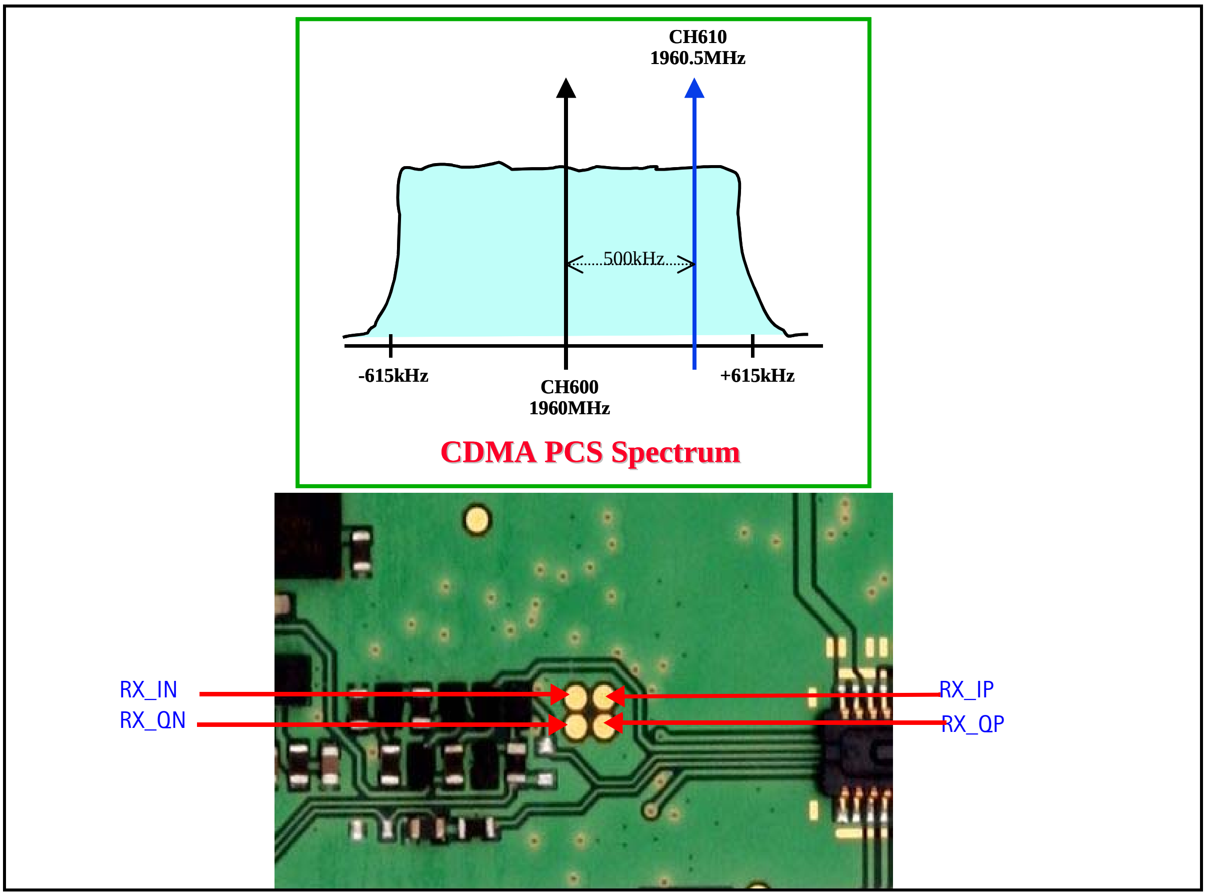


Figure 31: PCS spectrum and the test points on the top side of the main PWB

Receiver Diagnostic Signal Tracing

Use the following steps to trace the receiver signal.

1. Inject an external signal source of –25dBm to the RF input. An RF signal generator is recommended, however an Agilent call box 8960 can also be used.
2. Press the Call Setup button, press the Active Cell soft button, and select CW.
3. Inject a CW signal for PCS (1960MHz) or Cell/AMPS (881.52MHz) at a fixed -25dBm power level.
4. Use an AAS-10 probe to take measurements. Signal levels are approximate, and accuracy may be +/- 2dB or more depending on the position and grounding of the probe.

Receiver RF Test Points

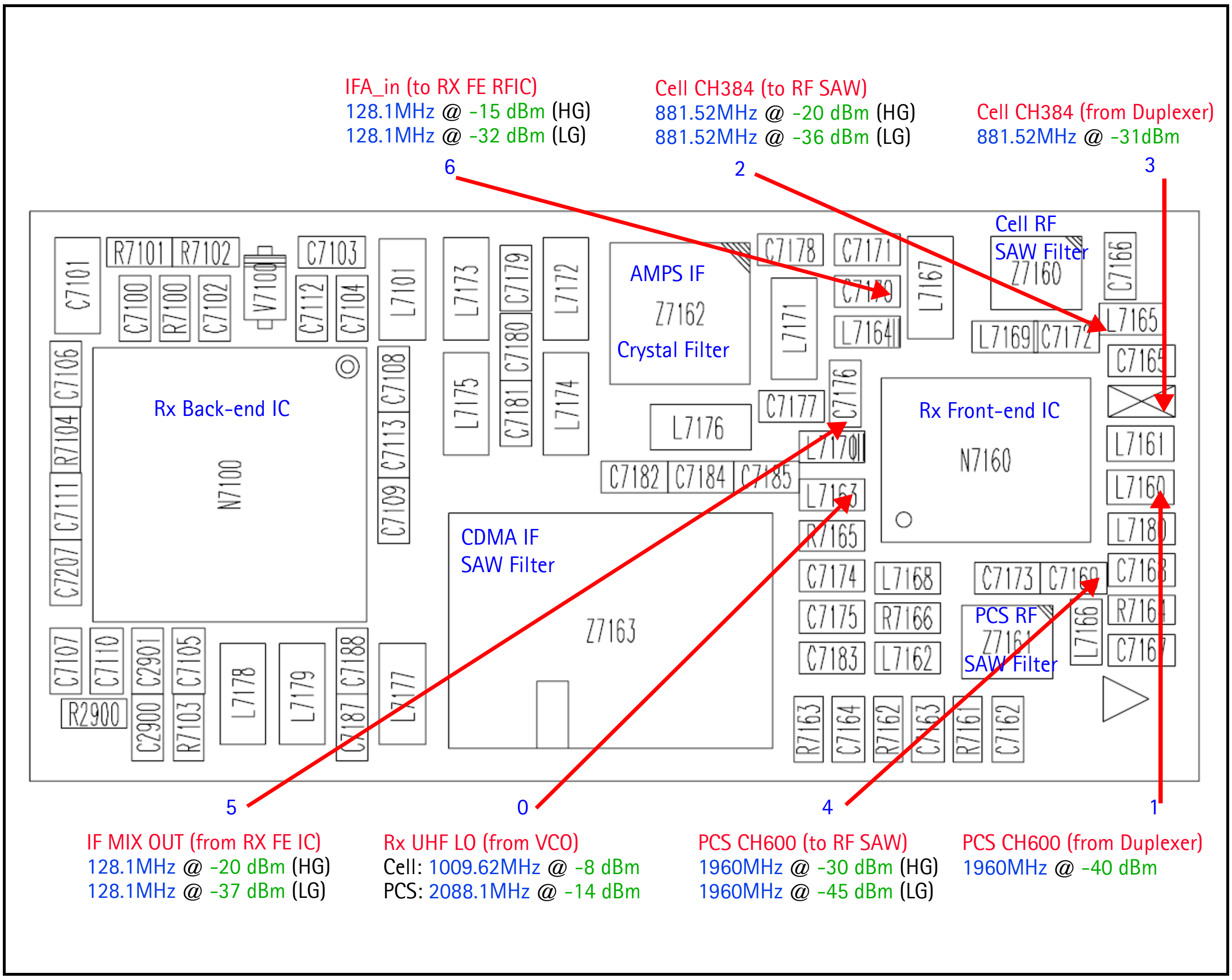


Figure 32: Receiver RF troubleshooting test points

Receiver IF Test Points

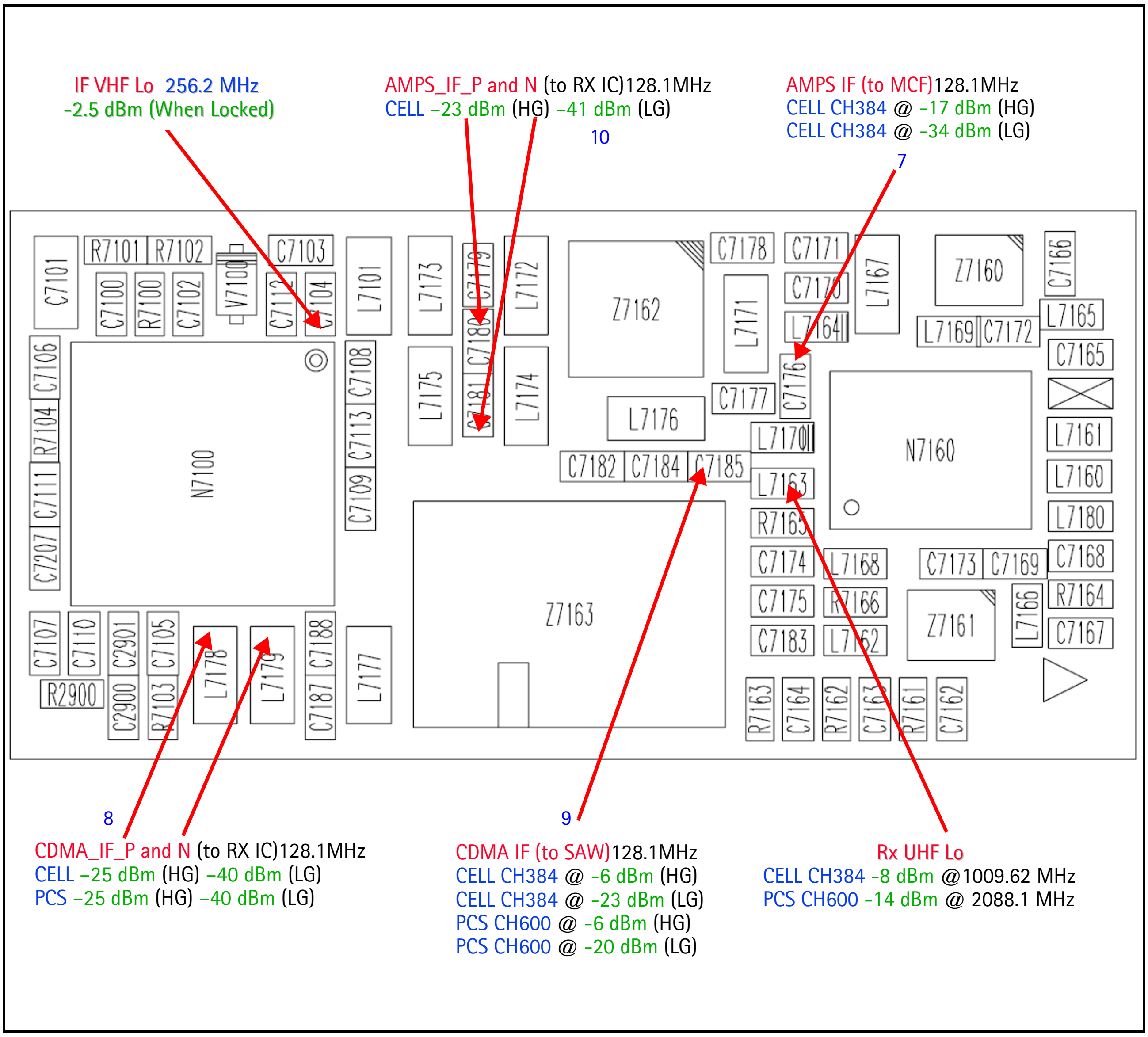


Figure 33: Rx RF test points

Receiver DC Test Points

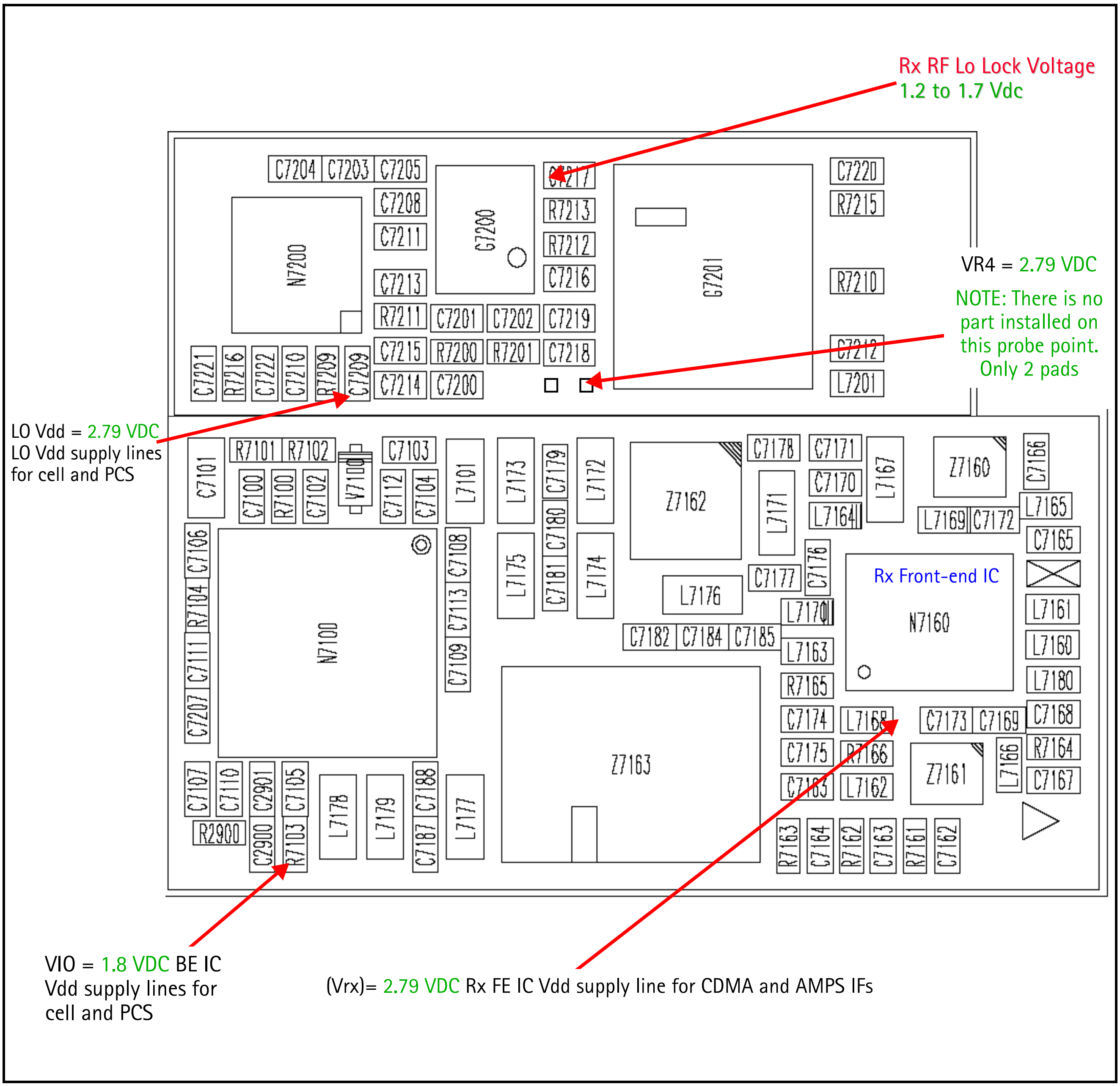


Figure 34: Rx DC test points

Receiver Logic Input Voltages

Measure logic levels for Rx Front-End (N7160). Figure 35 shows the receiver logic input voltages.

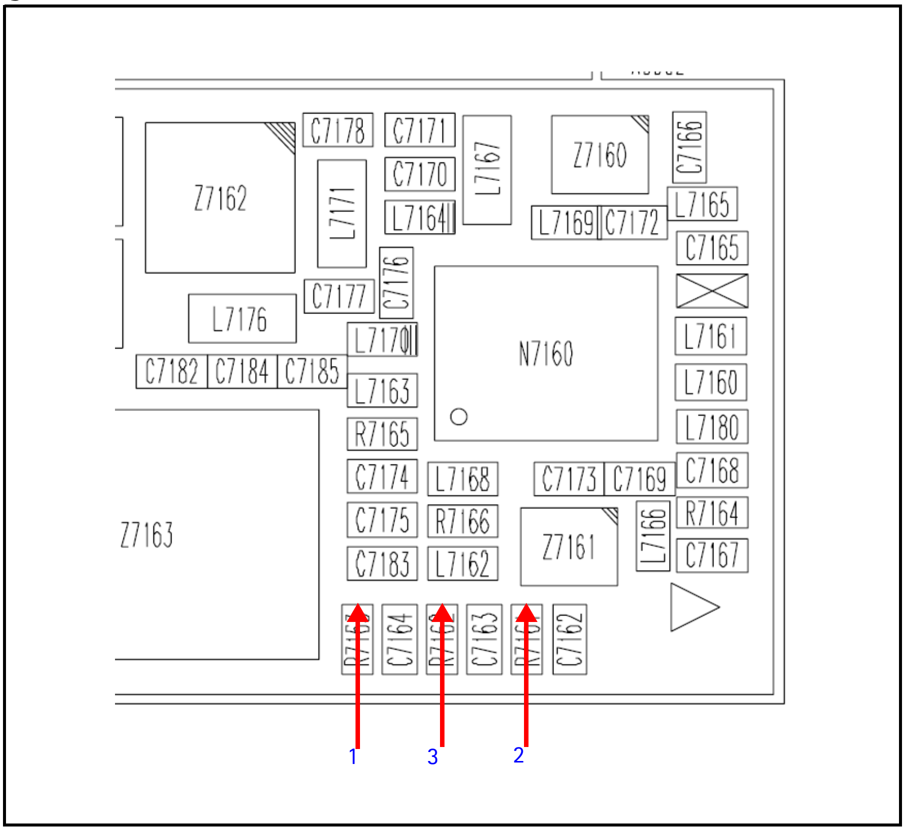


Figure 35: Receiver logic input voltage test points

Table 6 includes the logic levels for the N7160.

Table 6: Rx Front-end (N7160) Logic Levels

Modes	Logic Input Voltages		
	1 IF_SEL	2 BAND	3 GAIN_CTL
AMPS High Gain	2.76 V	0.1 V	2.75 V
AMPS Low Gain	2.76 V	0.1 V	0 V
Cell CDMA High Gain	0 V	0.1 V	2.75 V
Cell CDMA Low Gain	0 V	0.1 V	0 V
PCS CDMA High Gain	0 V	2.68 V	2.68 V
PCS CDMA Low Gain	0 V	2.75 V	0 V

If the logic levels are significantly off (+/- 0.2V), replace Back-End IC (N7100), then or if still bad, then replace the Rx Front-End IC (N7160) and re-measure. If the voltages are still out of specifications, refer to the *Baseband Troubleshooting* chapter.

Rx Front-End Receiver Troubleshooting

Keep the following points in mind regarding the Rx Front-end receiver:

- There is a separate LNA for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- There is a separate RFA (inside Rx Front-end IC) for 800MHz (Cell and AMPS) and 1900MHz (PCS).
- After the 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 128.1MHz at L7163, ensure that IF_SEL is working. If it is, then replace the Rx Front-end IC due to a bad RFA.

  If Cell and AMPS are working but PCS is not, look at the band select line and the PCS LNA before replacing the Rx Front-end IC.

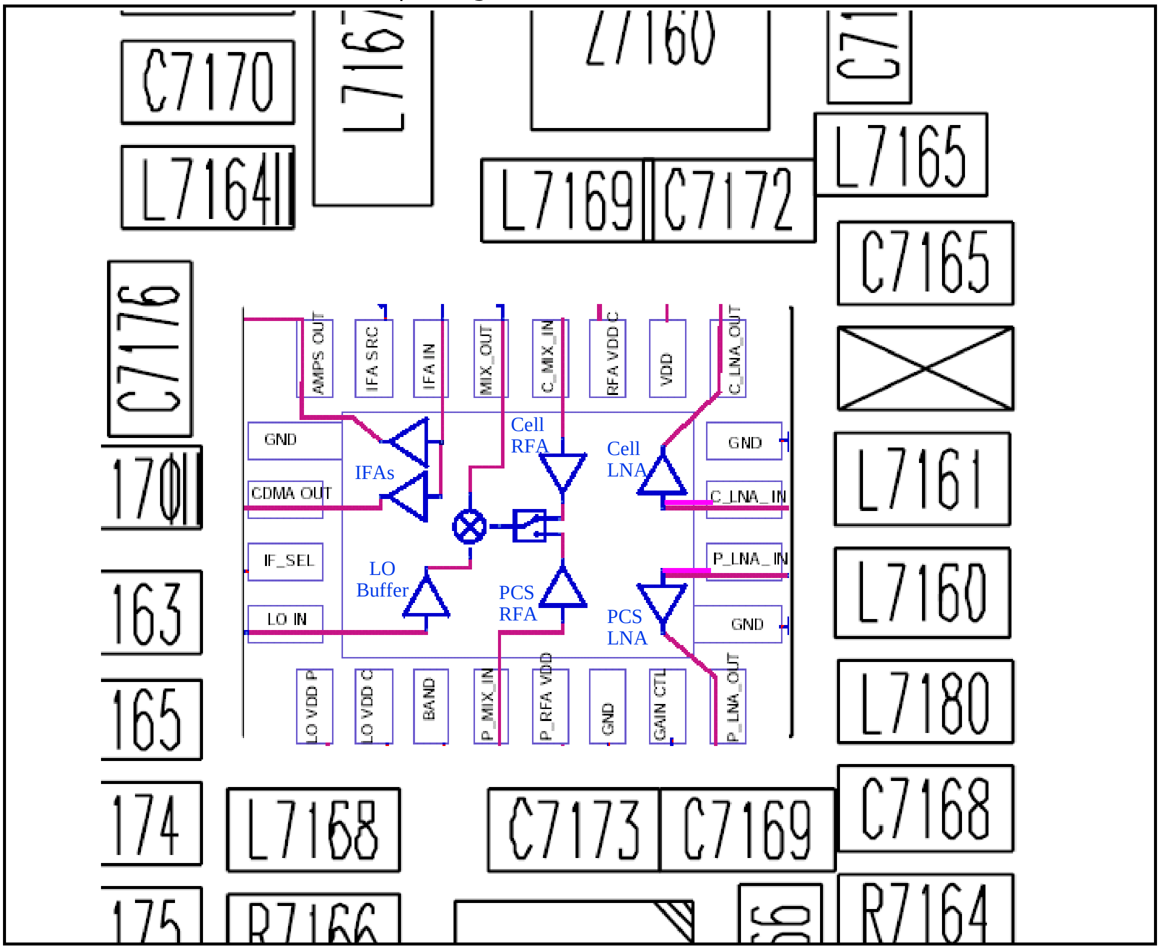


Figure 36: N7160 receiver

There are two common explanations for a Rx Front-end IC failure consisting of high current in Local Mode with just the Rx turned on:

- No presence of a LO signal
- Input impedance drop is 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 "UHF Synthesizer Troubleshooting" on page 56. If you have a significant supply voltage drop on one of the supply pins, then replace the Rx Front-end IC.

Table 7: Rx Front-end IC Conditions and Supply Currents

Condition: Local Mode, Set Rx Only in RF Main Mode	Supply Current (From Power Supply)
Good mobile terminal	100mA
No UHF LO signal present	254mA
Pin 13 shorted	255mA

Synthesizer Troubleshooting

Faulty synthesizers can cause both Rx and Tx failures during tuning, in addition to the VCTCXO tuning. However, first check for the presence of various LO signals and their proper levels. If everything fails, it may be necessary to check the reference clock (19.2MHz) which is needed for the mobile terminal to power up. The 19.2MHz signal is also important because the D2800 is sensitive enough to pick up a very weak 19.2MHz clock, resulting in intermittent problems such as a constant mobile terminal reset.

Following are the synthesizers used in the mobile terminal:

- Dual-band UHF (1009.62MHz for channel 384 in Cell and AMPS bands, and 2088.1MHz for channel 600 in PCS band) with a separate LMX2310 PLL IC
- Rx VHF (256.2MHz for Cell, AMPS, and PCS) with PLL inside the Rx Front-End IC
- Tx UHF (3296.16MHz~3395.88 for Cell and AMPS, 3700~3819.9MHz for PCS) with PLL inside the Tx IC

Synthesizer Block Diagram

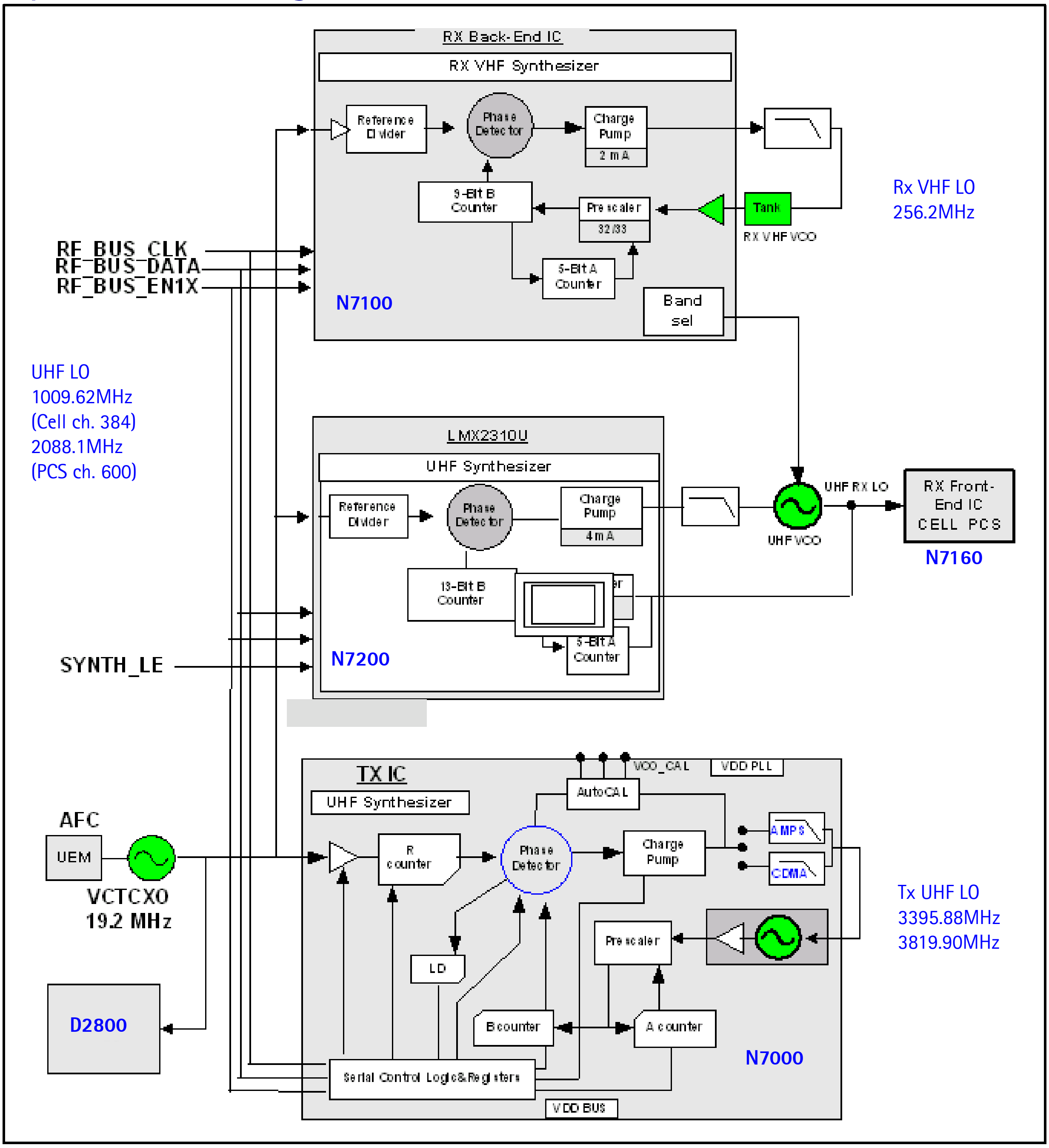


Figure 37: Synthesizer block diagram

Synthesizer Schematics

The following schematics are for general reference only. See the *Schematics* chapter for detailed versions.

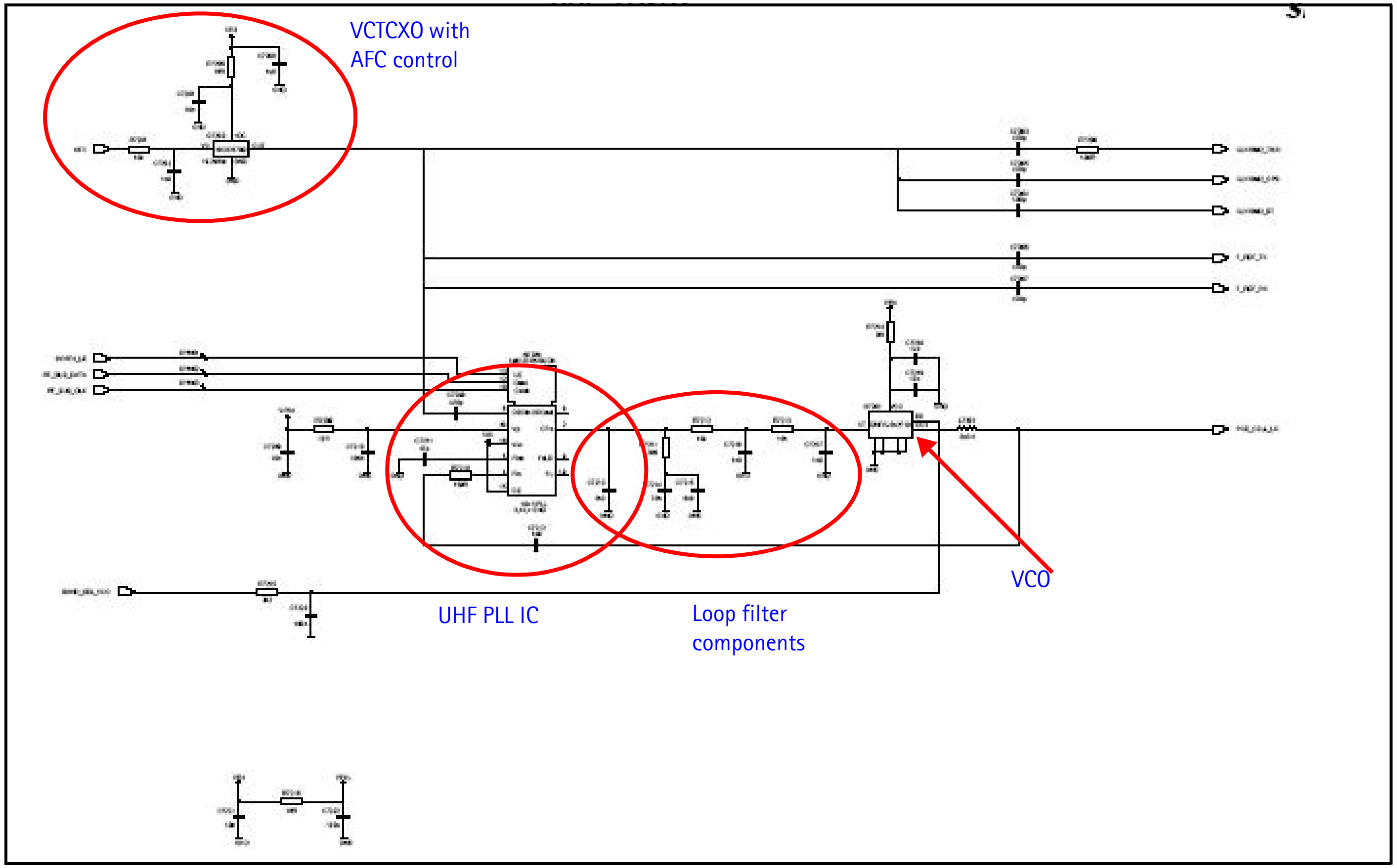


Figure 38: Synthesizer schematic

Synthesizer Troubleshooting Setup

Use the following steps to troubleshoot the synthesizer using Phoenix:

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode.

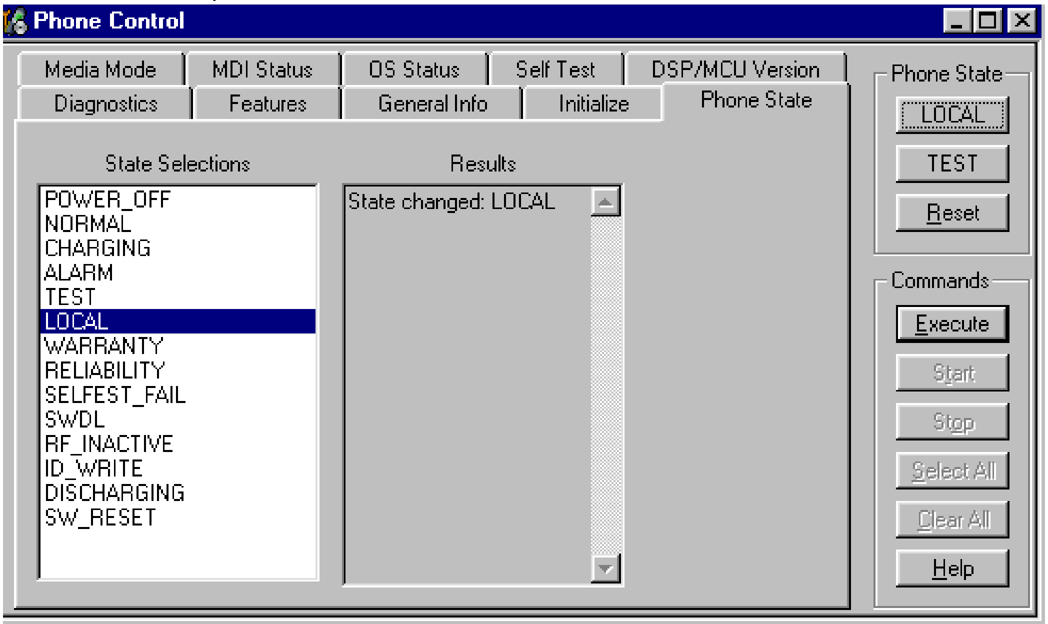


Figure 39: Phone Control dialog box

2. Select the following values on the **RF Main Mode** dialog box as shown below:.

Table 8: RF Main Mode Dialog Box Settings

Synthesizer	Band	Mode	Channel
UHF	Cell	Rx/Tx	384
	PCS	Rx/Tx	600
Rx VHF	(one band is enough)	Rx	
Tx VHF	Cell	Rx/Tx	384
	PCS	Rx/Tx	600

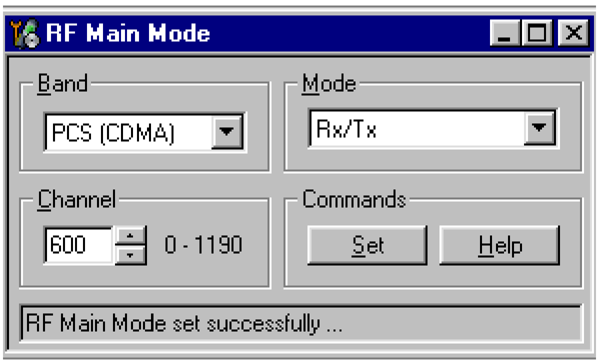


Figure 40: Phone Control dialog box

Incorrect PLL Frequencies

Following are some possible causes for incorrect PLL frequencies:

- Power supplies to PLL portion
- Control line to VCO
- Loop filter or resonator components missing or incorrectly installed
- 19.2MHz reference clock missing or low
- Component failure (PLL IC, Rx Front-End IC, Tx IC, VCO, or VCTCXO)

VCTCXO Troubleshooting

- VCTCXO frequency is 19.2MHz. Without 19.2MHz, the mobile terminal does not power up. This signal goes to the N7100, N7000, D2800, and the UHF PLL. Check the test points in Figure 41 for the presence of the 19.2MHz signal.
- Check for the presence of the signal at the following points:
    - F_REF_TX, clock reference to TX RFIC, should be ~-9 dBm
    - F_REF_RX, clock reference to RX RFIC, should be ~-9 dBm
    - CLK19M2_TIKU, clock reference for BB, should be ~-9 dBm
    - ~2 dB less in the other side of R7206.
- If there is no VCTCXO signal at any of these points, check the voltage at VR3. The main supply line for VCTCXO should be 2.78VDC.
- The AFC voltage should be between 1 and 3 Volts and should be adjustable with the AFC slider on the RF PDM Control in Phoenix.
- If the AFC voltage is missing, check the UEMEK.

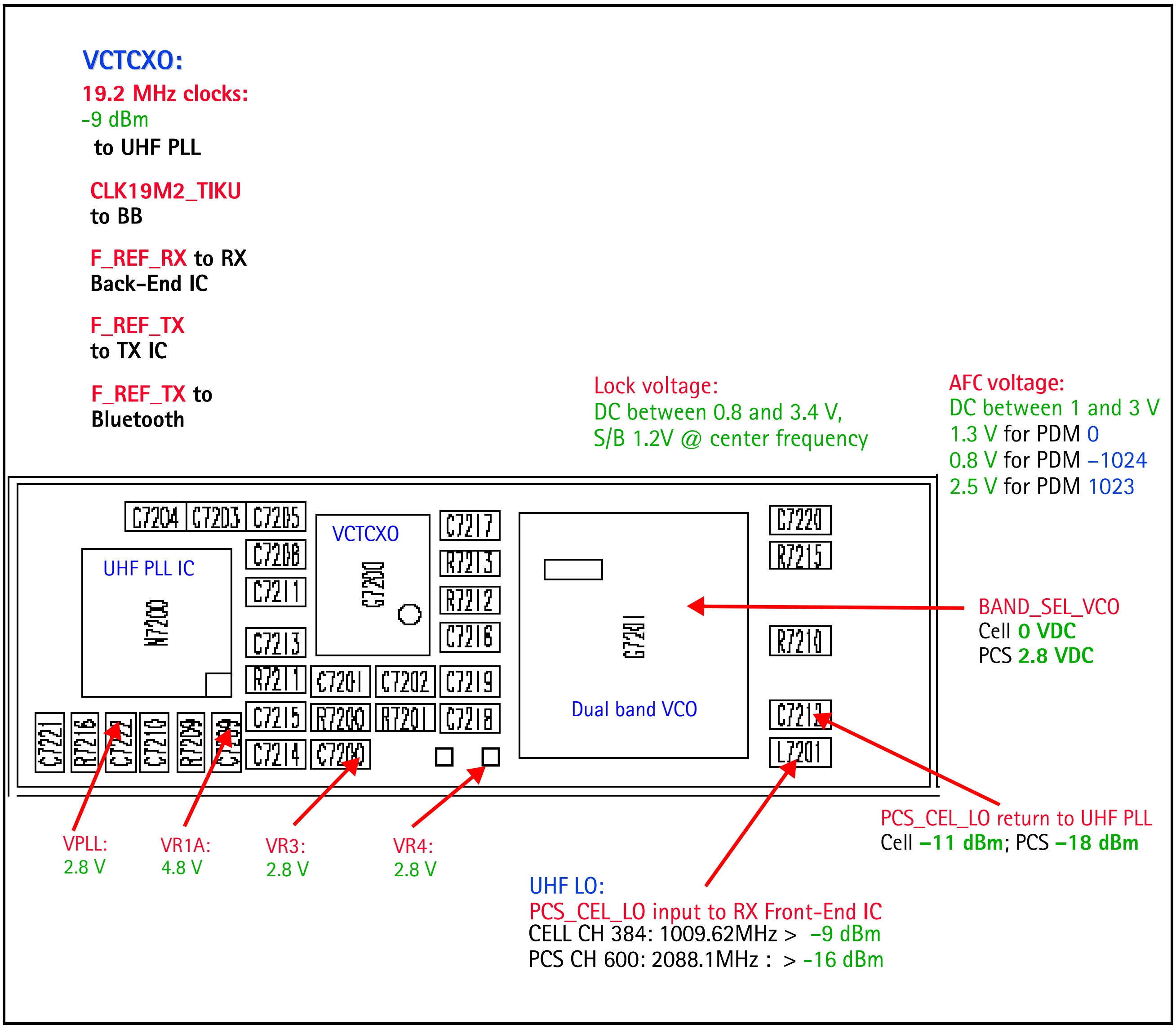


Figure 41: VCTCXO and UHF Synthesizer test points

AFC Voltage Troubleshooting

Use the following steps to monitor the AFC voltage.

1. In Phoenix, open the **RF PDM** dialog box.

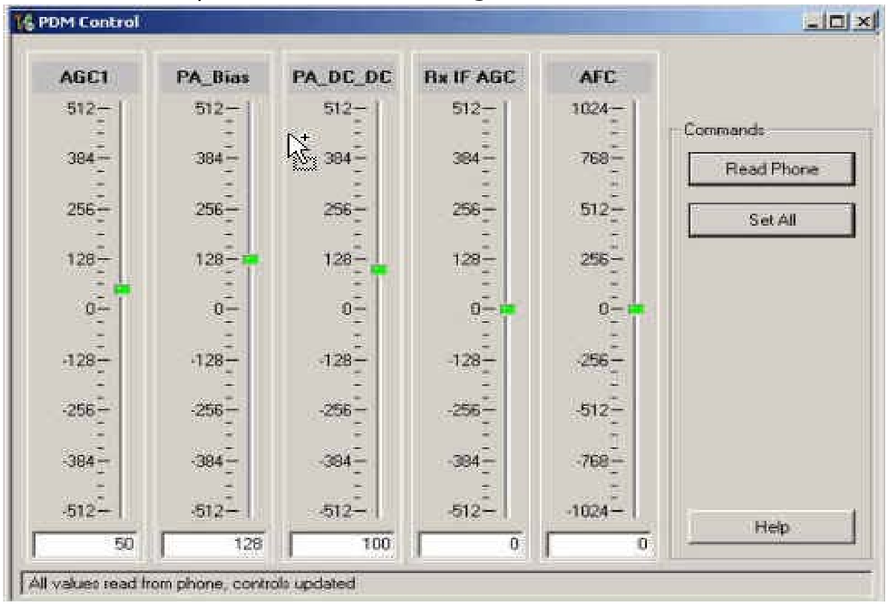


Figure 42: RF PDM dialog box for AFC troubleshooting

Figure 43 shows a partial schematic of the R7201.

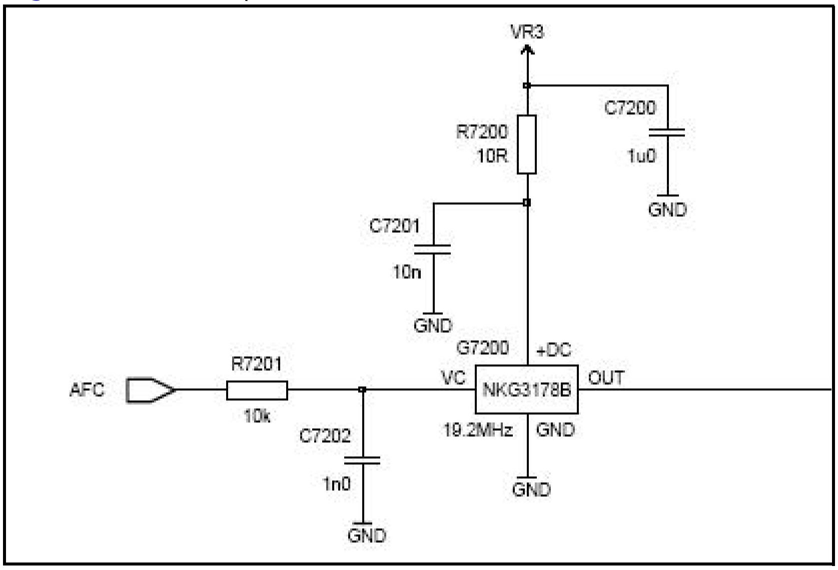


Figure 43: Partial schematic showing the R7201

2. Measure the DC voltage at R7201. The following typical voltages are observed.

- AFC PDM[0]=1.3V
- AFC PDM[-1024]=0.8V
- AFC PDM[1023]=2.5V

VCTCXO Manual Tuning

The VCTCXO can be manually tuned to verify when a mobile terminal is tuned incorrectly or if mobile terminal cannot make a call. Monitor the RF signal at the mobile terminal's output.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 13 for an example of the **Phone Control** dialog box.)
2. Click the **Execute** button.
3. On the **AMPS Control** dialog box, set the **Set Channel** field to 384, the **Power Level** field to 5, and select the **Transmitter ON** check box. (See Figure 8 on page 13 for an example of the **AMPS Control** dialog box.)
4. Click the **Rx RFI** tab, make sure the **AFC Control** check box is cleared, and click **Execute**.
5. The frequency accuracy of the VCTCXO can be measured using an HP8960 callbox in AMPS mode or a spectrum analyzer at the output of the transmit chain.
   - If using a spectrum analyzer, set the center frequency to 836.52MHz and the span to 2MHz initially. Establish a marker at 836.52Mhz.
   - If using an HP8960, set the callbox System Type to AMPS, and set the ACC channel to 384. Use the Frequency Stability measurement to center the VCTCXO (minimum Frequency Error).
6. Use the RF PDM component to adjust the AFC to center the VCTCXO. The tuning range is approximately +/-10kHz.
7. Adjust the AFC so that the output signal is within +/-150MHz. If using a spectrum analyzer, narrow the span to 1kHz or less.
8. Replace the UEMEK if the VCTCXO does not tune correctly.

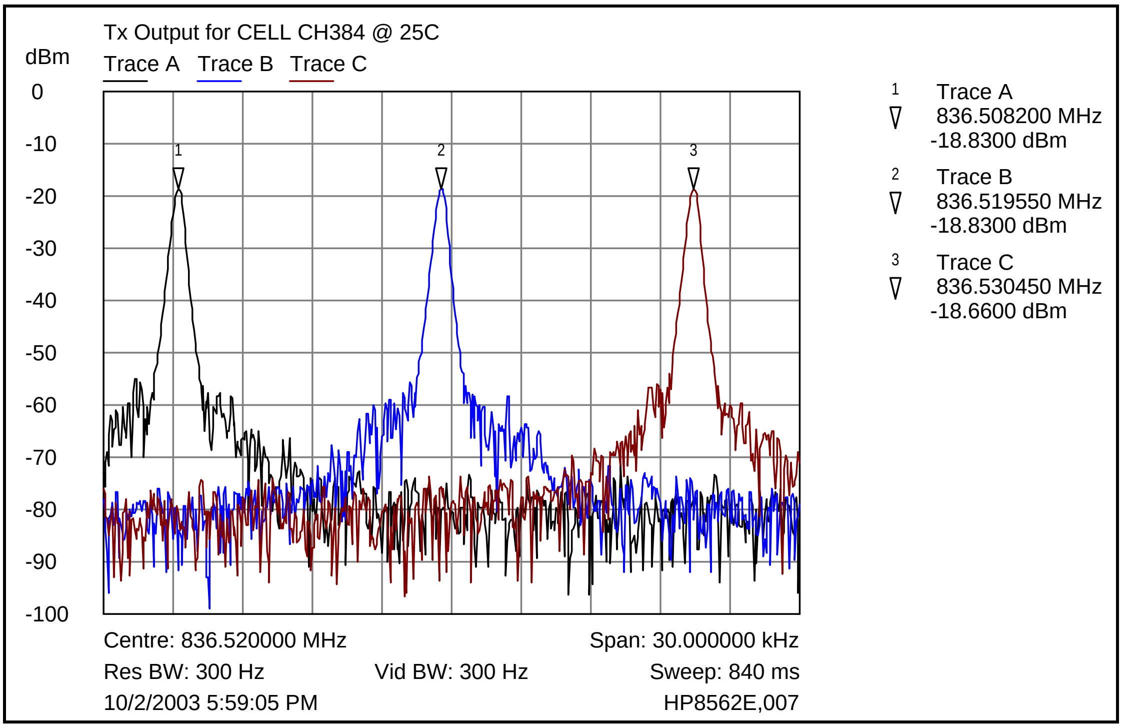


Figure 44: Tx Output for CELL channel 384 @ 25C

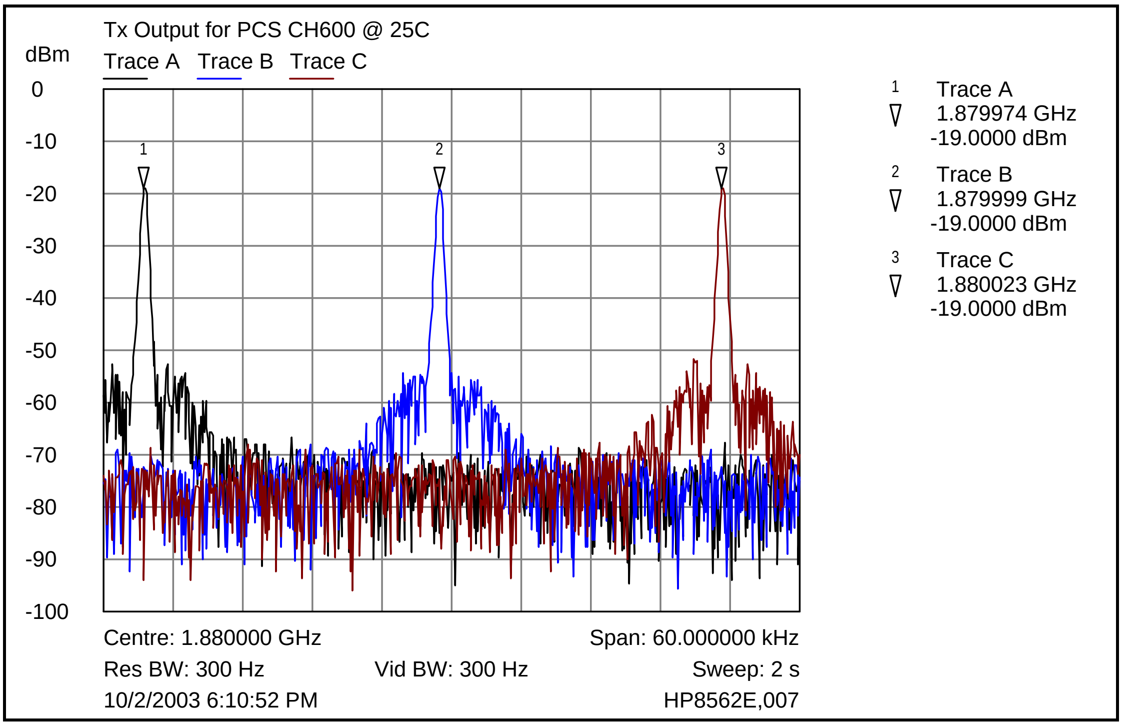


Figure 45: Tx Output for PCS channel 600 @ 25C

UHF Synthesizer Schematic

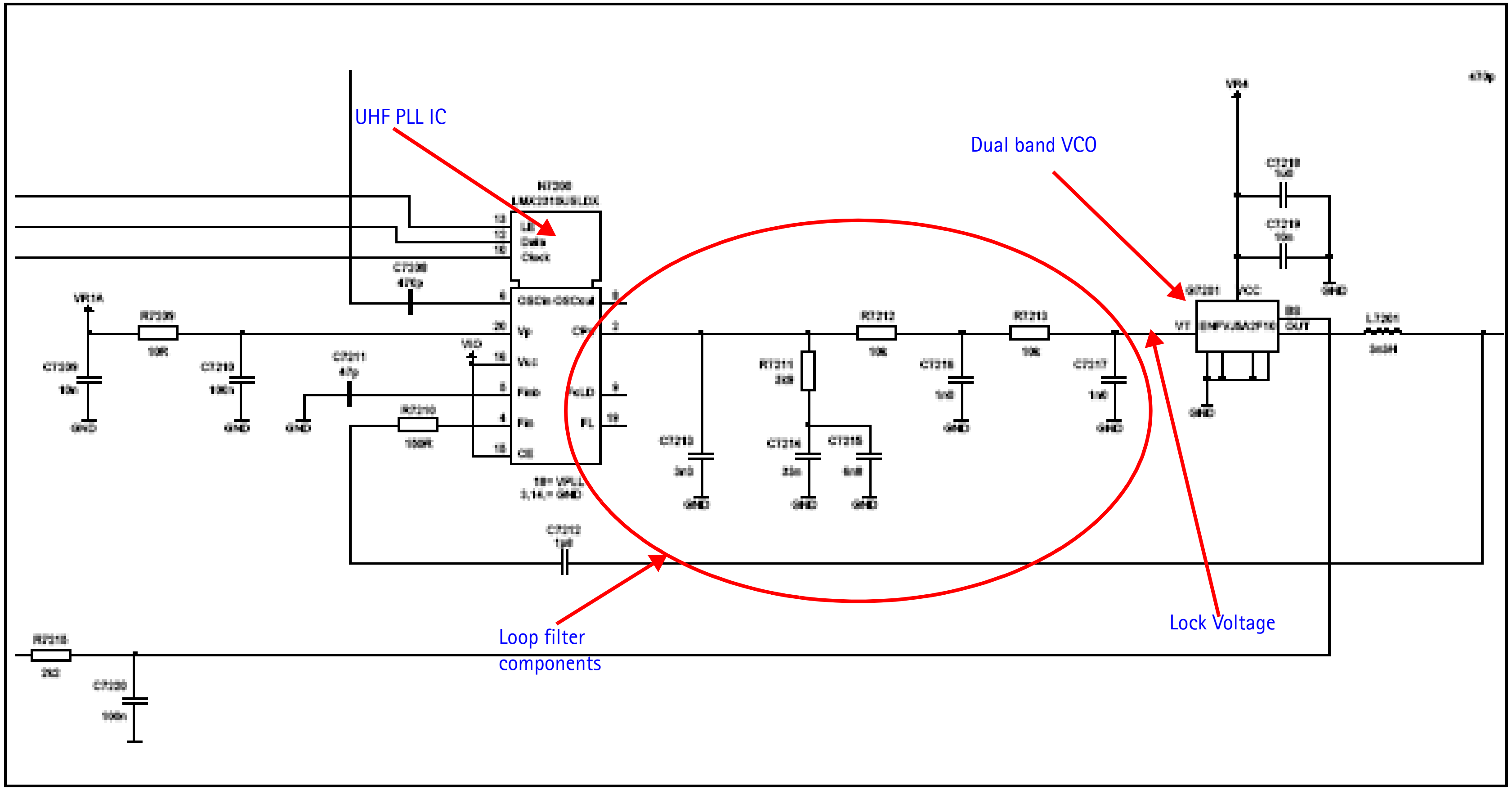


Figure 46: UHF Synthesizer Schematic

UHF Synthesizer Troubleshooting

The UHF LO frequency varies with the channel and can be calculated using the Frequency Calculator dialog box in the Phoenix RF component. Use the following steps to troubleshoot the UHF LO frequency.

1. Ensure that the LO is locked. Set a channel and check the output of the UHF LO at L7201 within a very narrow span of 100KHz. The LO must be virtually immobile.
2. Measure the nominal UHF LO signal levels (see "VCTCXO and UHF Synthesizer test points" on page 51).
3. If you do not see the presence of any LOs, check the DC voltages at the following:
   - R7216, VR1A, supply line for UHF PLL IC = 4.76VDC
   - R7200, VR4, supply line for VCO IC = 2.76VDC
4. Ensure that the lock voltage at C7217 is between 1V and 3V.
5. Check the RF return at R7210.

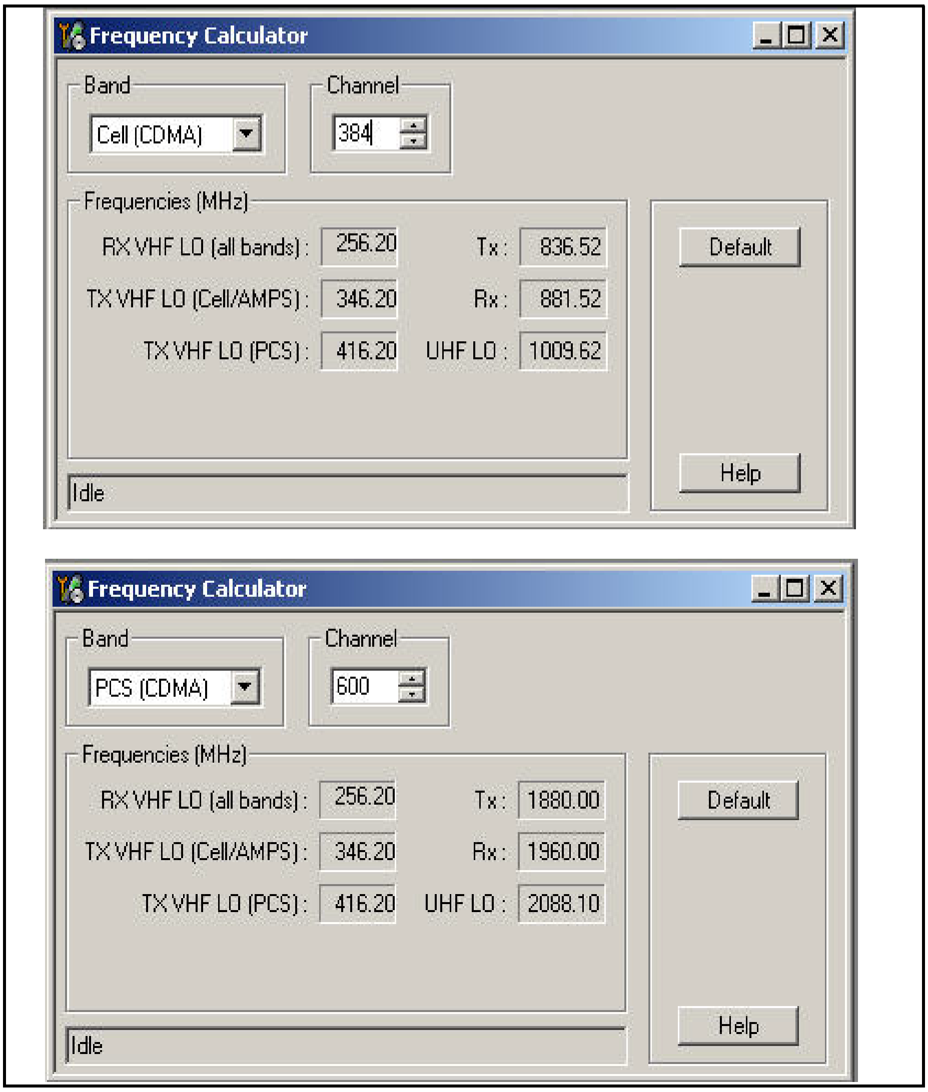


Figure 47: Frequency calculator in Phoenix

PCS UHF LO CH600 Typical Spectrum

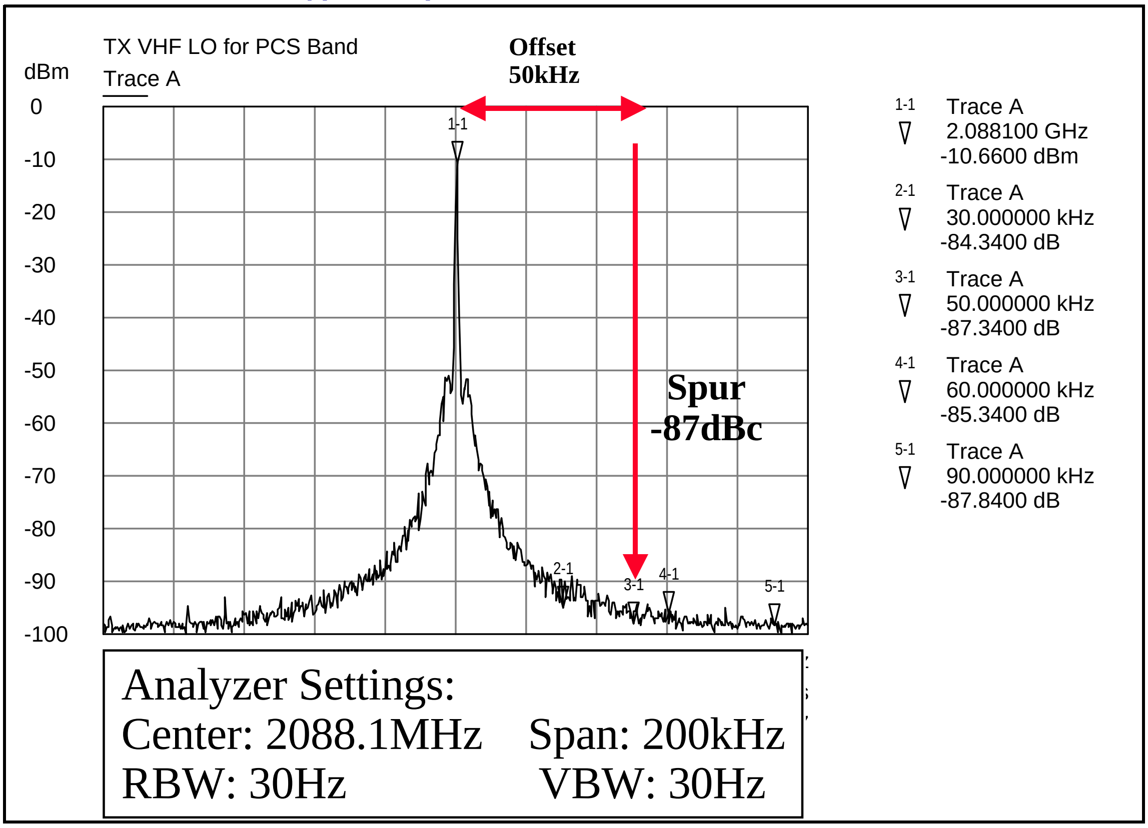


Figure 48: PCS UHF LO Typical Spectrum

Rho and UHF LO

Measure the signal purity of the UHF LO, checking the spur level offset from the carrier. Also check the VCO, PLL IC, loop filter and power supply decoupling.

Following are the keys observations:

- Clean and spur-free signal
- 30kHz offset –84dBc
- 50kHz offset –87dBc
- 60kHz offset –85dBc
- 90kHz offset –88dBc

Note: A High Impedance probe and high dynamic range spectrum analyzer are required for Figure 48.

CELL UHF LO CH384 Typical Spectrum

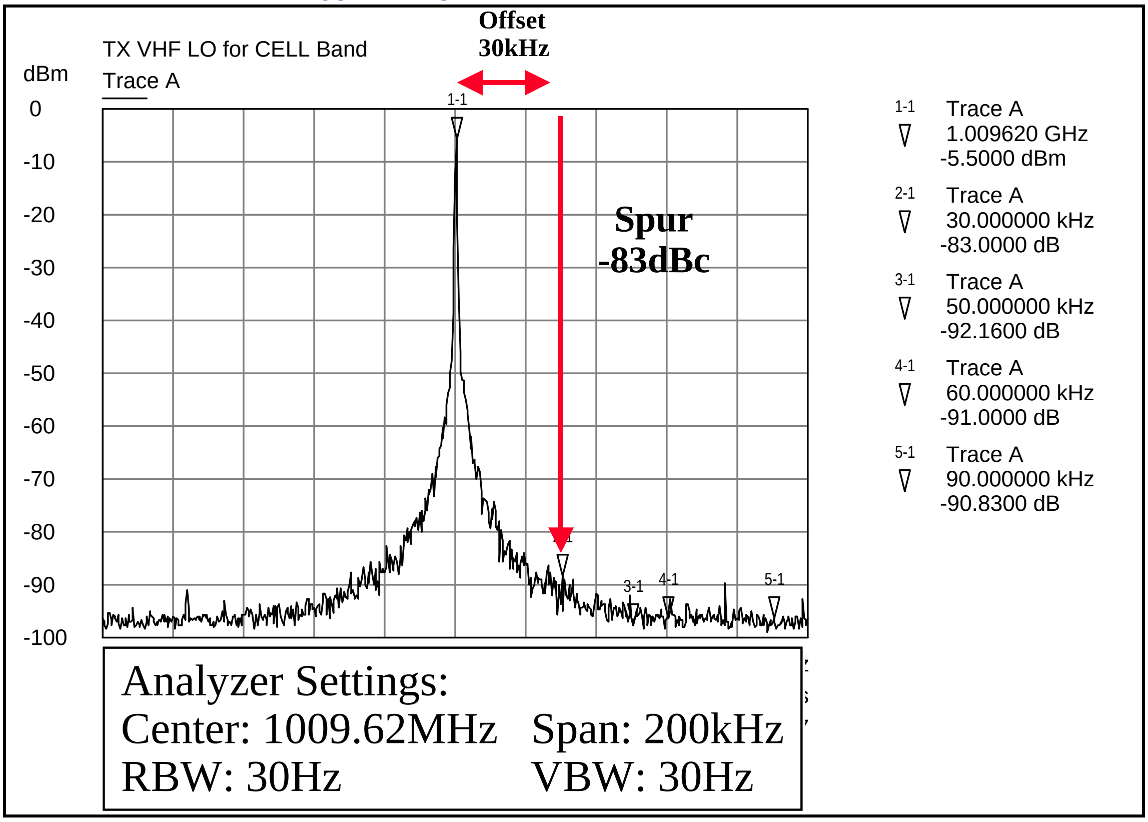


Figure 49: CELL UHF LO Typical Spectrum

Rho and UHF LO

First measure the signal purity of the UHF LO, look at spur level offset from the carrier. Also check the VCO, PLL IC, loop filter and power supply decoupling.

Following are the keys observations:

- Clean and spur-free signal
- 30kHz offset –83dBc
- 50kHz offset –92dBc
- 60kHz offset –91dBc
- 90kHz offset –91dBc

Note: A High Impedance probe and high dynamic range spectrum analyzer are required for Figure 49.

Rx VHF LO (Rx Back-End IC) Schematic

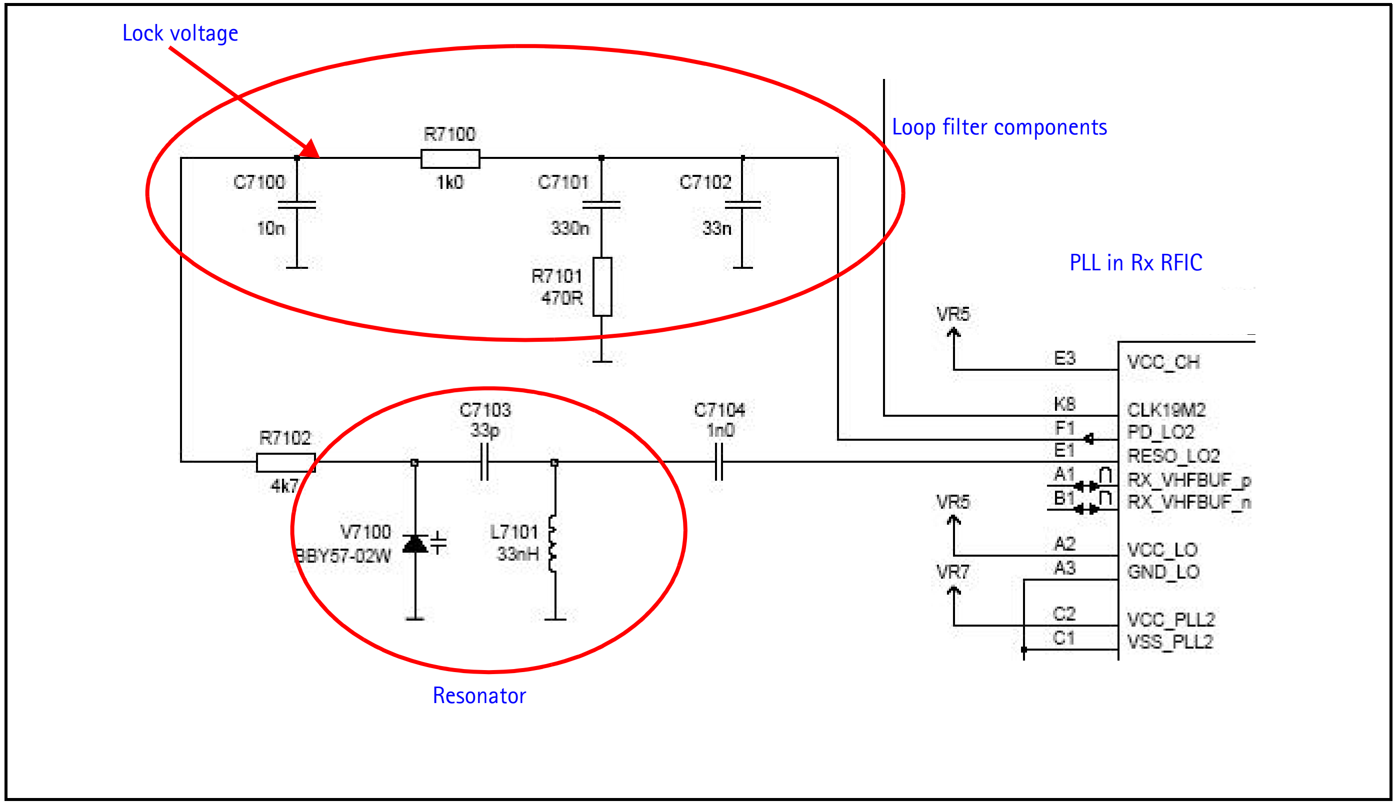


Figure 50: Rx UHF LO (Rx Front-End) schematic

Rx VHF LO (Rx Back-End IC) Troubleshooting

The VHF LO operates at a fixed frequency of 256.2MHz. It is the second LO for down-conversion to I and Q for baseband processing. Use the following steps to troubleshoot the VHF LO.

1. Monitor the test point at C7102 for Rx back-end IC LO. Ensure that a locked and stable 256.2MHz with amplitude ~ –60dBm is present on the spectrum analyzer (or, with a high impedance probe, ~ -2dBm at C7100).
2. Monitor the control voltage at C7100. The control voltage at a locked state must be between 1.2 and 1.7 Vdc for the proper operation of the Rx RFIC LO.

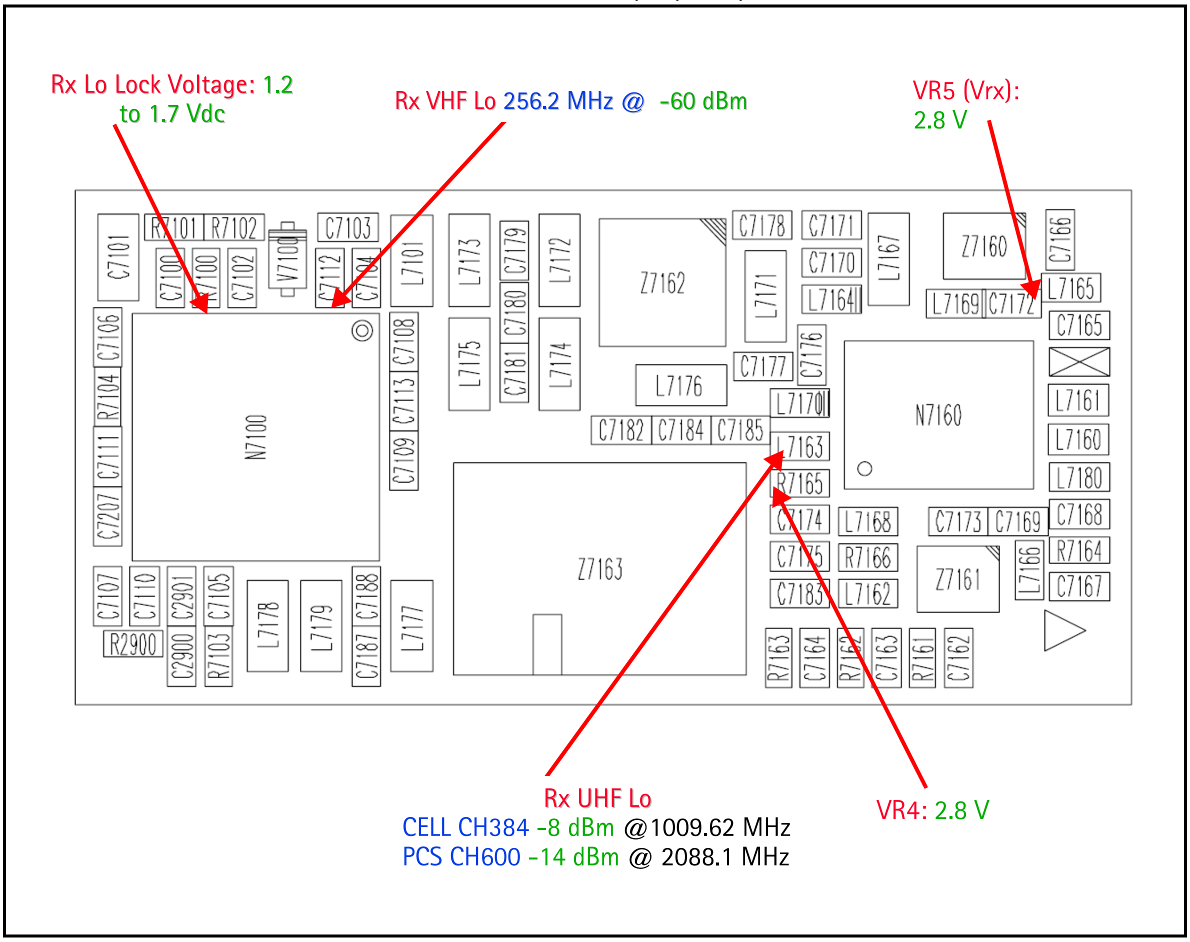


Figure 51: Rx synthesizer LO test points

Tx UHF LO Schematic

The following partial schematic is for general reference only. See the *Schematics* chapter for complete detailed versions.

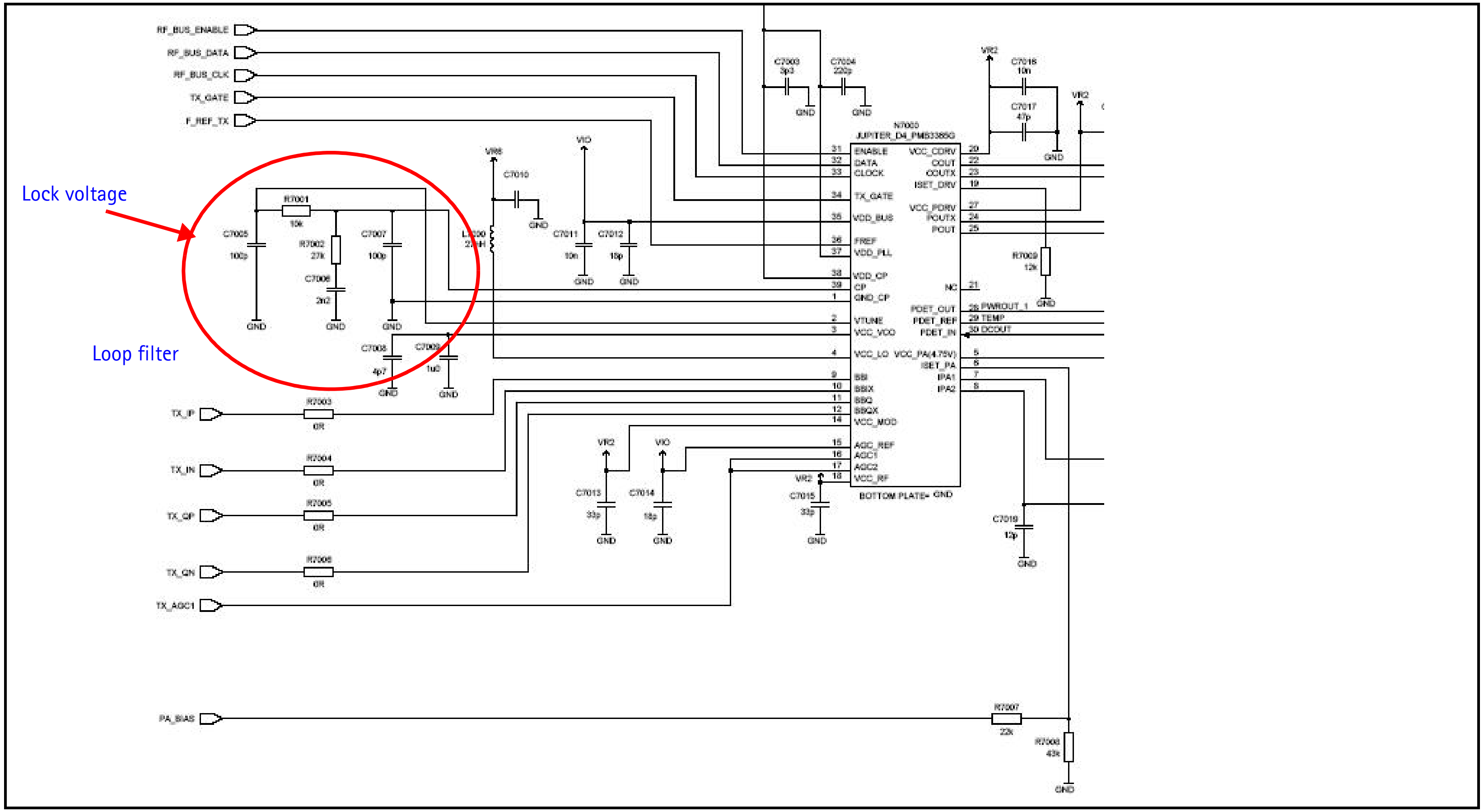


Figure 52: Tx UHF LO schematic

Tx UHF LO (Tx IC) Troubleshooting

There are two fixed LOs, 3296.16~3395.88MHz for cell band and 3700~3819.90MHz for PCS band. This is the first LO for up-conversion. Be sure to monitor the control voltage at R7001. When the N7000 LO is locked, this control voltage should be between 1.2 and 1.8Vdc.

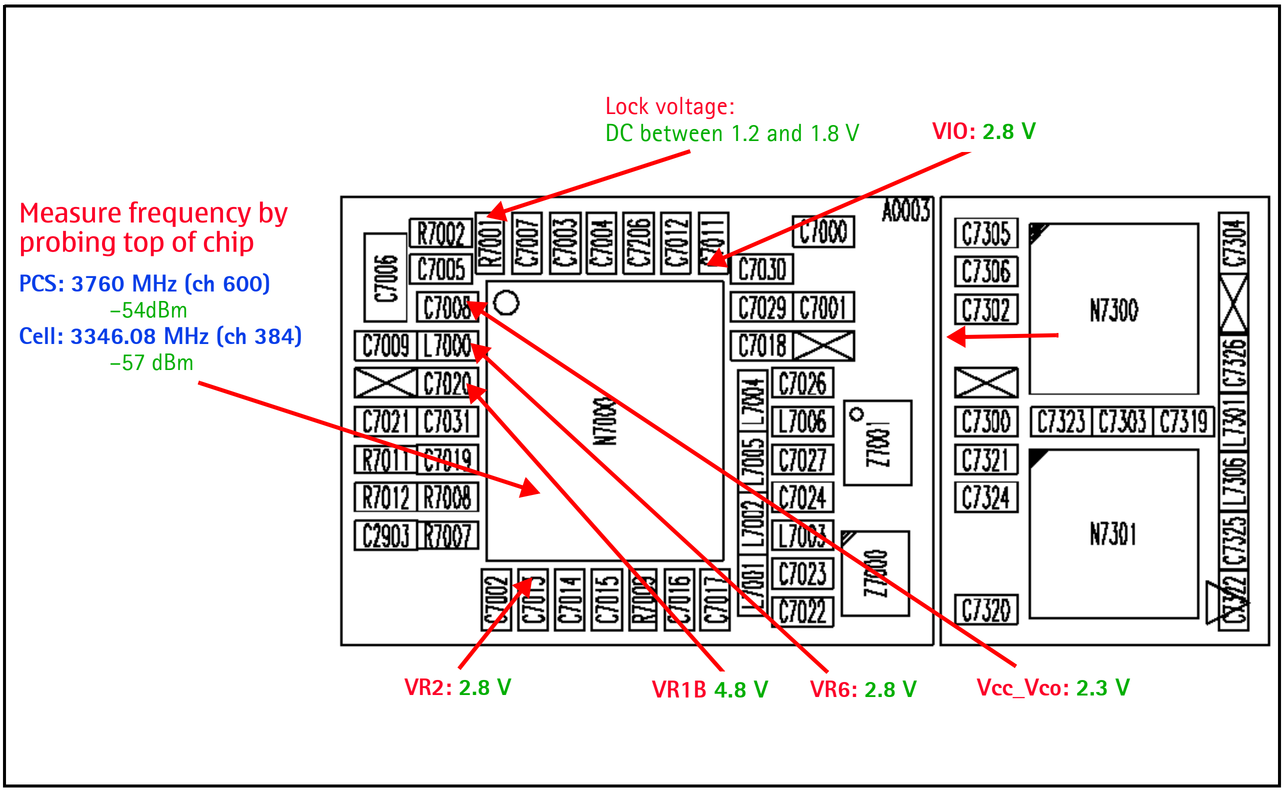


Figure 53: Tx UHF LO layout and test points

UHF PCS Tx LO (3700 ~ 3819.90)/2MHz Typical Spectrum

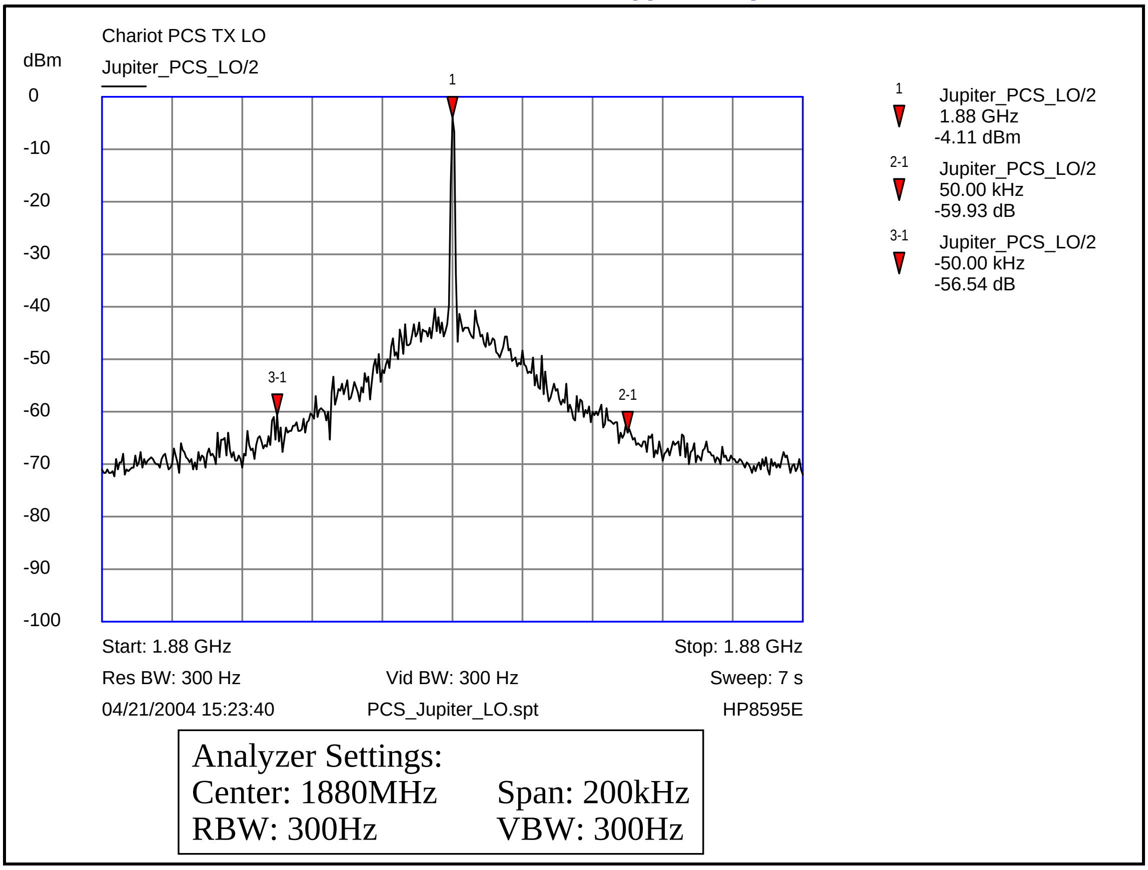


Figure 54: UHF PCS Tx LO Typical Spectrum

Following are the keys observations:

- The following Ref Spurs
- 50kHz offset –59dBc

UHF CELL Tx LO (3296.16 ~ 3395.88)/4MHz Typical Spectrum

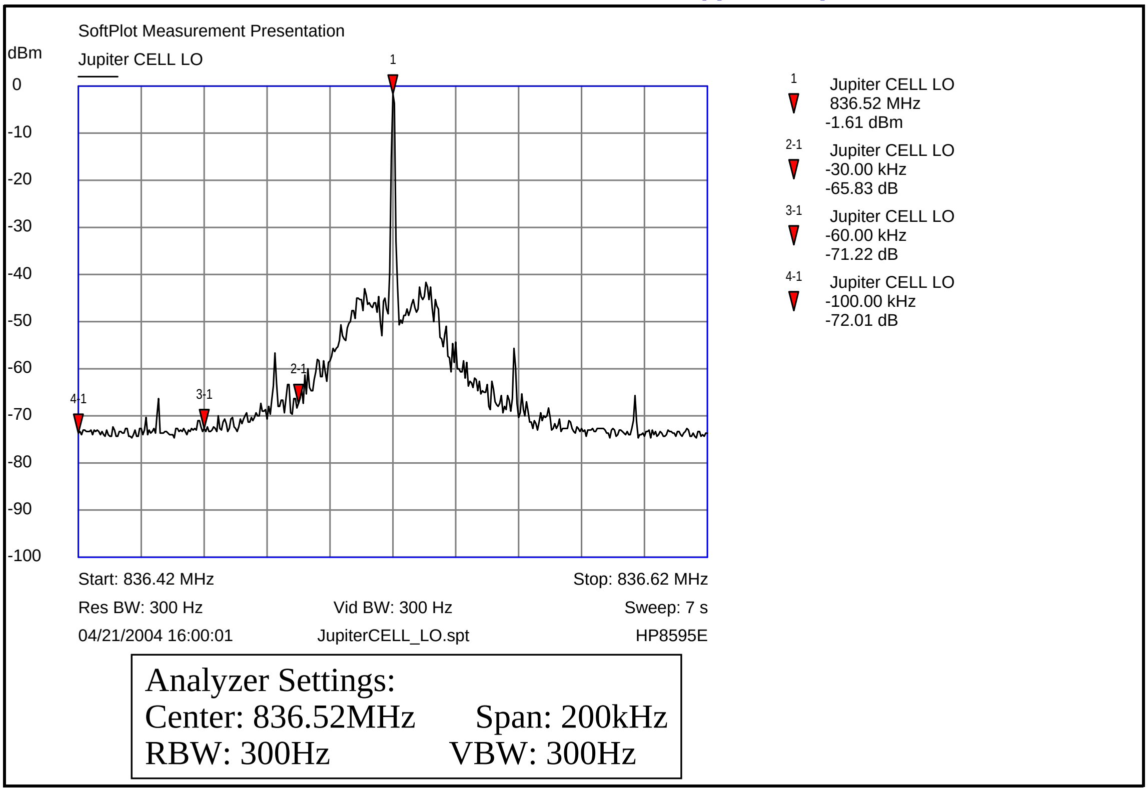


Figure 55: UHF CELL Tx LO Typical Spectrum

Following are the keys observations:

- The following Ref Spurs
- 30kHz offset –65dBc

GPS Troubleshooting

GPS RF Block Diagram

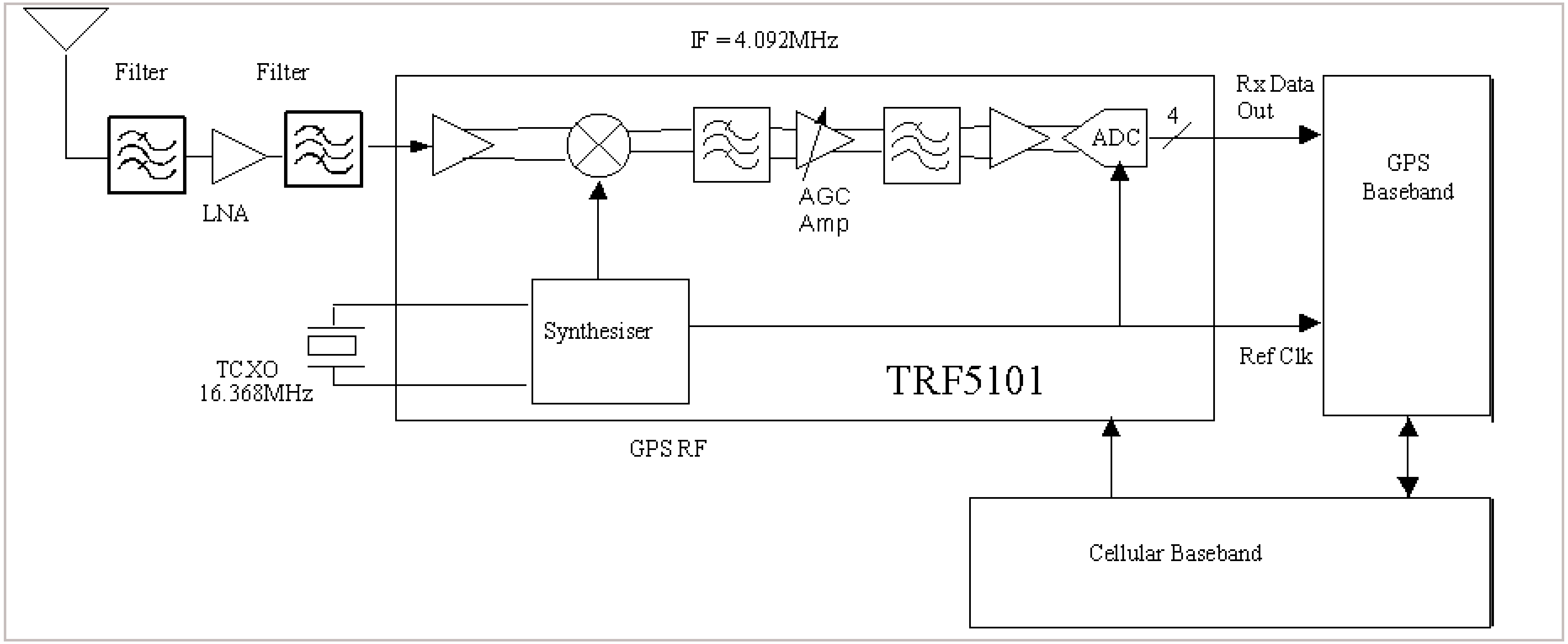


Figure 56: GPS block diagram

GPS RF Schematic

The following schematic is for general reference only. See the *Schematics* chapter for a detailed version.

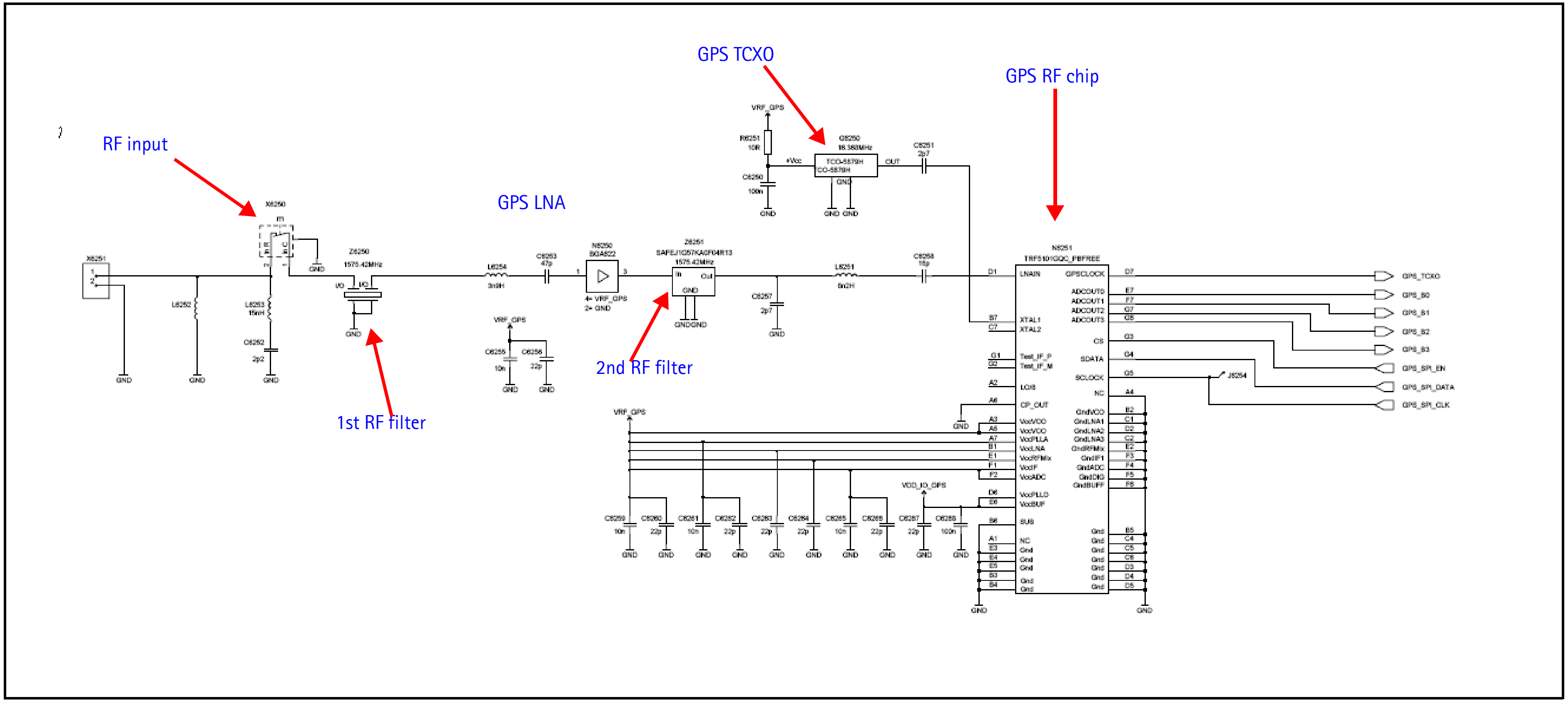


Figure 57: GPS RF schematic

GPS Troubleshooting Setup

Use the following steps to set up GPS signal using Phoenix.

1. On the **Phone Control** dialog box, click the **LOCAL** button in the **Phone State** area to put the mobile terminal into Local Mode. (See Figure 7 on page 13 for an example of the **Phone Control** dialog box.)
2. Click the **Execute** button.
3. Inject a -110dBm tone at 1575.52MHz at the GPS connector (X6250) with a signal generator or call box.

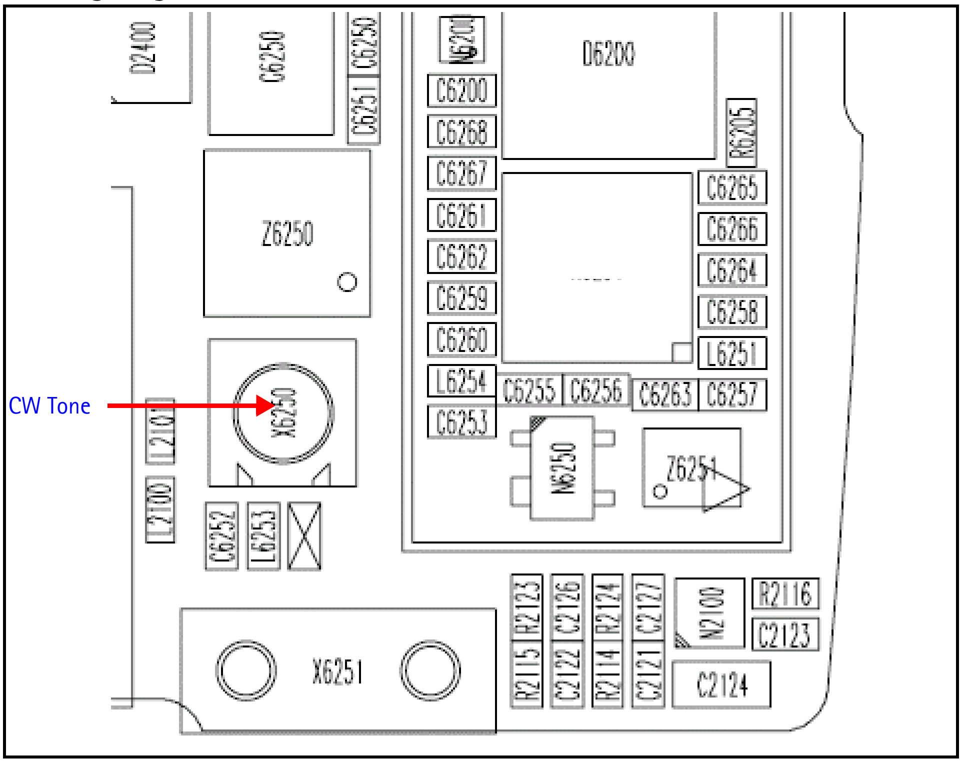


Figure 58: GPS connector (X6250)

4. Open the **Troubleshooting** menu, and click **GPS Quick Test**. The **GPS Control** dialog box appears

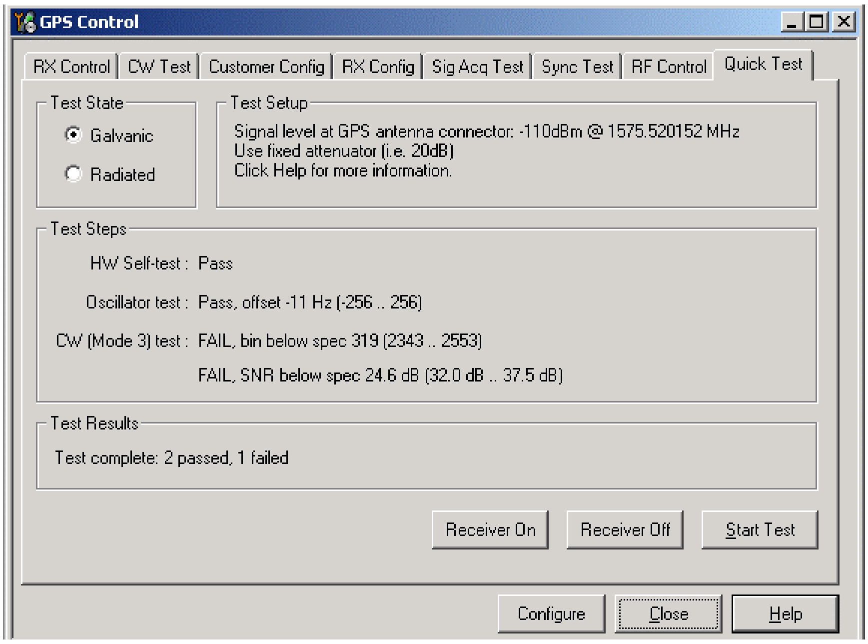


Figure 59: GPS Control dialog box

5. In the **Test State** field, ensure that **Galvanic** is selected.
6. Click select **Start test**.

HW Self Test Failure

If the test fails, repeat steps 1—6. If the test fails again, continue with the following self-test failure troubleshooting:

1. Verify the DC voltages at VRF_GPS and VDD_IO_GPS.
2. Inspect all GPS circuit elements around the GPS BB chip (D6200).
3. If the elements pass a visual inspection, replace the N6200.

Oscillator Test Failure

1. Inspect all GPS circuit elements around the GPS RF chip (G6250).
2. If the elements pass a visual inspection, replace the G6250.

CW (Mode 3) Test Failure

1. Check that the signal generator is on and sourcing a signal to the GPS RF input port (X6250).
2. Inspect all GPS RF Circuit elements
3. Inspect all GPS Circuit elements around N6251.
4. If the elements pass a visual inspection and the RF is good, replace the GPS RF IC (N6251).

GPS DC Test Points

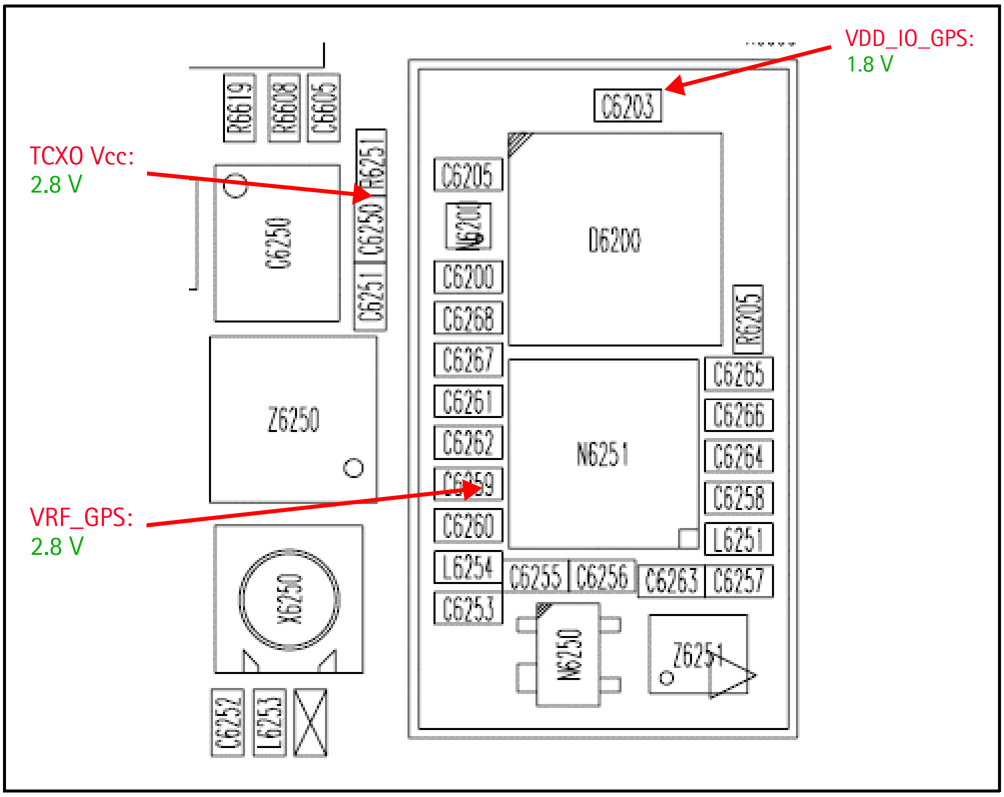


Figure 60: GPS DC test points

GPS RF Troubleshooting Setup

Use the following steps to troubleshoot the GPS receiver.

1. On the **GPS Control** dialog box, select **Receiver On**.
2. Click **Execute**.

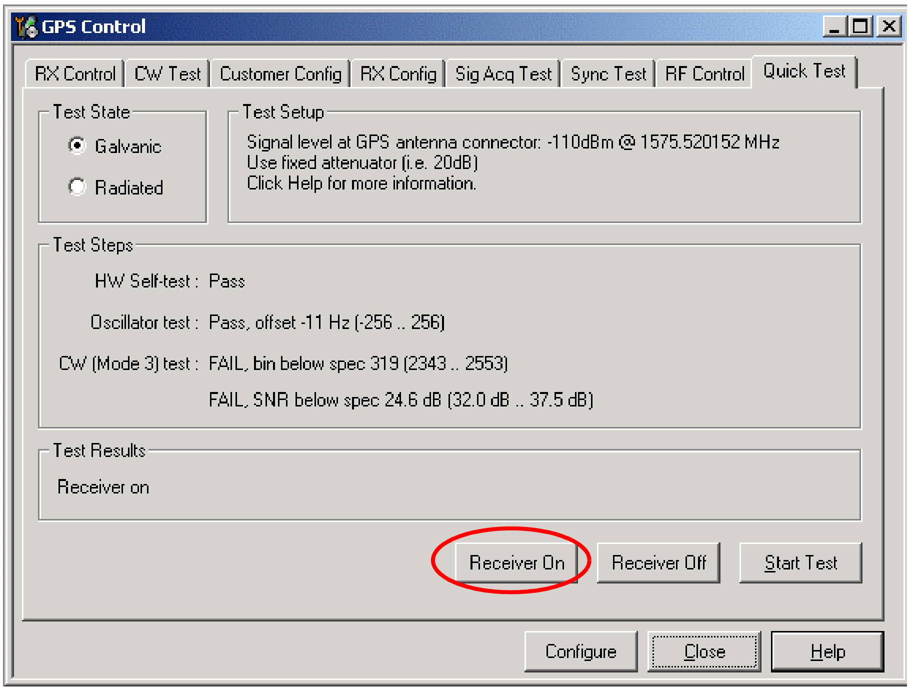


Figure 61: Turning on the GPS receiver on the GPS Control dialog box

3. Inject a -50dBm tone at 1575.52MHz at the GPS connector (X6250) with a signal generator or a call box. (See Figure 58.)
4. Measure the test points with an AAS-10B probe and spectrum analyzer set at center frequency 1575.25MHz (span = 500kHz), or with a voltmeter as required. (See Figure 62.)

GPS RF Test Points

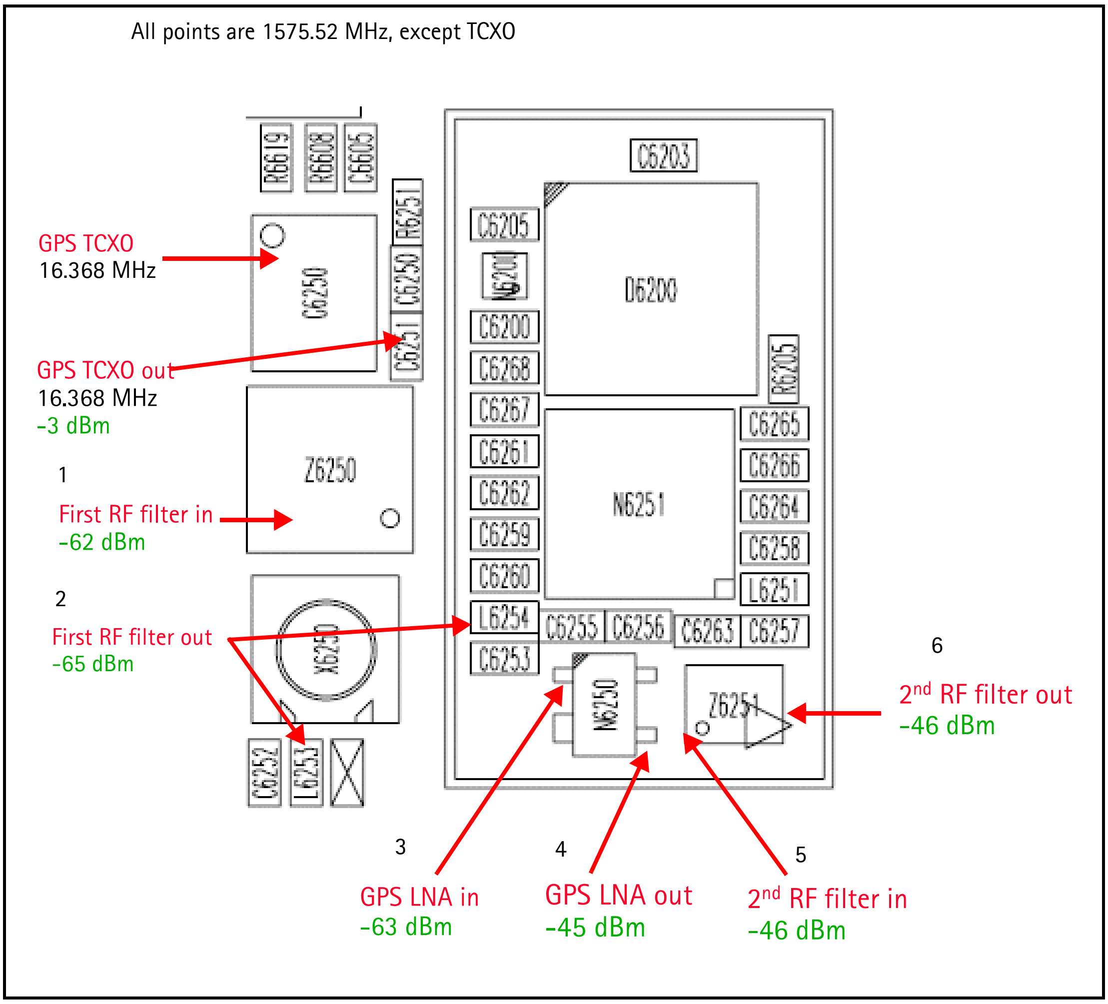


Figure 62: GPS RF Test points

FM Radio Troubleshooting

FM Radio Schematic

The following schematic is for general reference only. See the *Schematics* chapter for a detailed version.

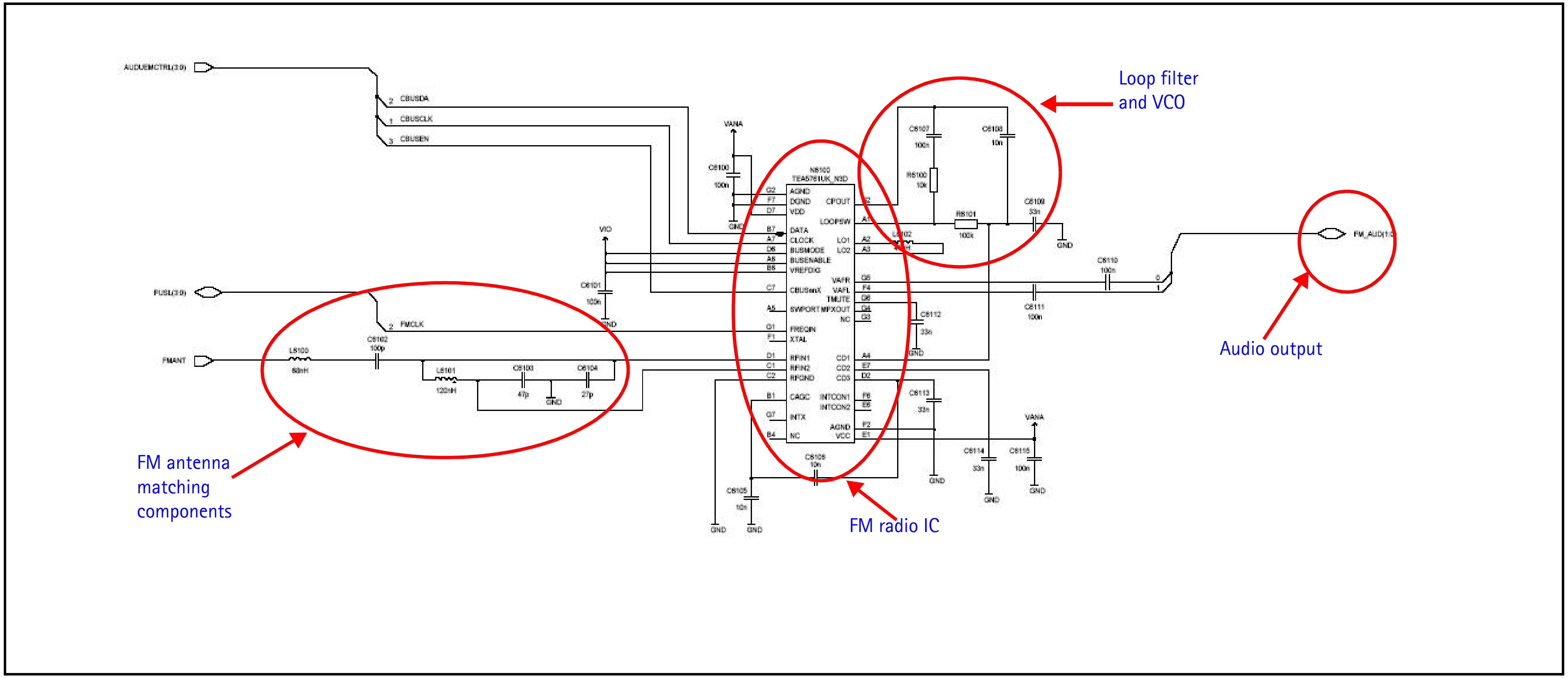


Figure 63: FM radio schematic

FM Radio Testing – Pop-port™ Headset and UHJ Headset

Use the following steps to troubleshoot the FM radio while using a Pop-port™ headset.

1. Connect the Pop-port™ headset (HDS-3) to the Pop-port™ connector (bottom connector).
2. Select the **Menu** > **Media** > **Radio** from the mobile terminal user interface.
3. In an FM radio broadcast coverage area, set a local radio channel by scanning automatically using the **Automatic tuning** option. (Scanning up and down the channels by pressing the "Up" and "Down" key respectively).
4. If no channel could be found, inspect all the components in the FM radio circuitry.
   - If no problem is found visually, check for the LO signal at L6102 (LO frequency range is 150 to 217 MHz).
   - If no LO is found, replace the FM radio IC.
5. Listen for sound out of the headset.
   - If there is a signal present, continue to step 6.
   - If there is no static sound present, inspect all FM Radio circuits on the PCB and refer to the "Audio" section of the *Baseband Description and Troubleshooting* chapter for more information.
6. Disconnect the Pop-port™ headset and connect the universal headset to the UHJ (top connector).
7. With the universal headset connected, repeat steps 1—5.
   - If there is a signal present, the FM Radio is working properly.
   - If there is no static sound present, refer to the "Audio" section of the *Baseband Description and Troubleshooting* chapter for more information.

FM Radio Parts Layouts

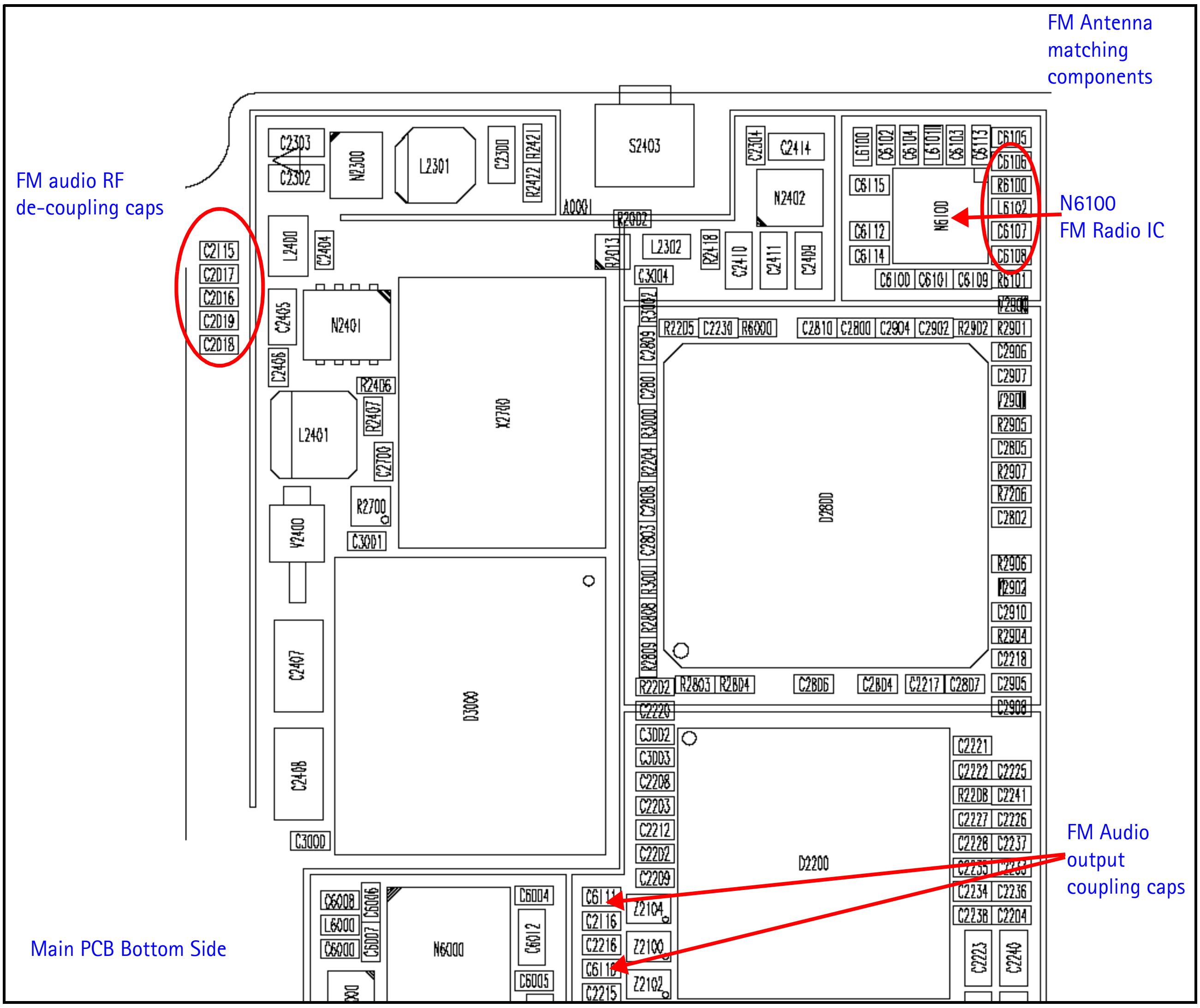


Figure 64: FM radio parts layout

FM Radio Test Points

Use the following values when probing the LO near the VCO of the FM radio IC (N6100). See Figure 65 for the location of the N6100.

Table 9: FM Radio Test Point Values

Description	Value
LO frequency	(Rx frequency + IF frequency) x 2
IF frequency	225kHz

For example, if the Rx frequency is 87.5 and the IF frequency is 225kHz, the LO equals 175.45MHz [(87.5+0.225)*2 = 175.45MHz].

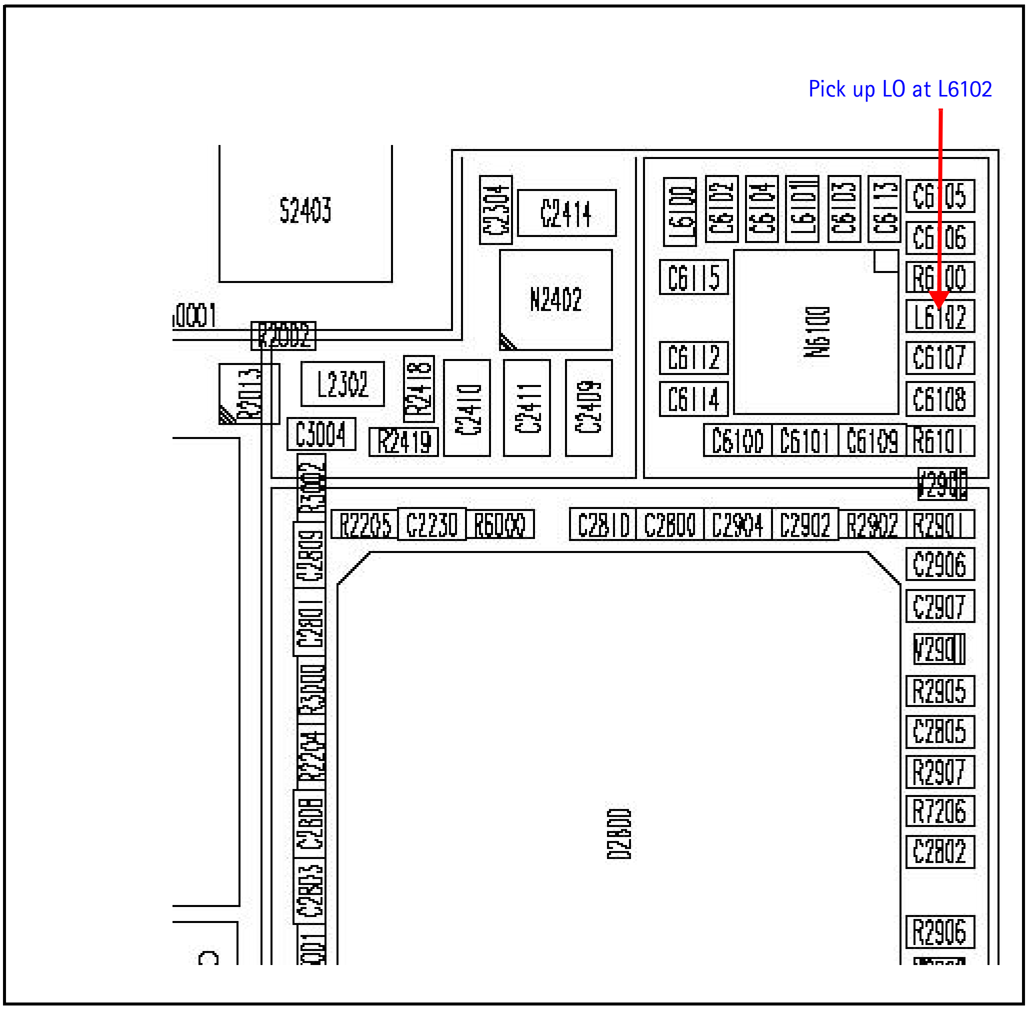


Figure 65: FM radio test points on the bottom side of the main PWB

Bluetooth Troubleshooting

Bluetooth Schematic

The following schematic is for general reference only. See the *Schematics* chapter for a detailed version.

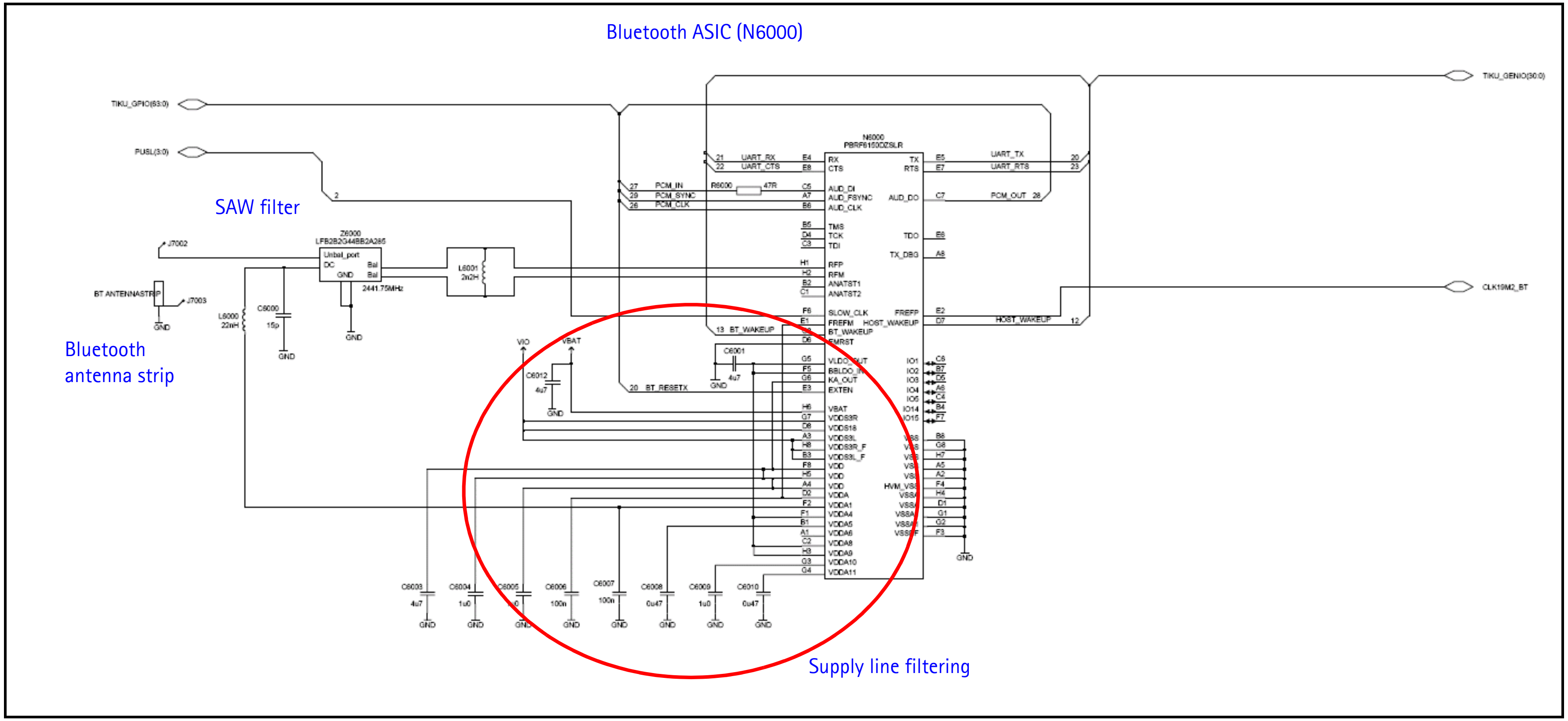


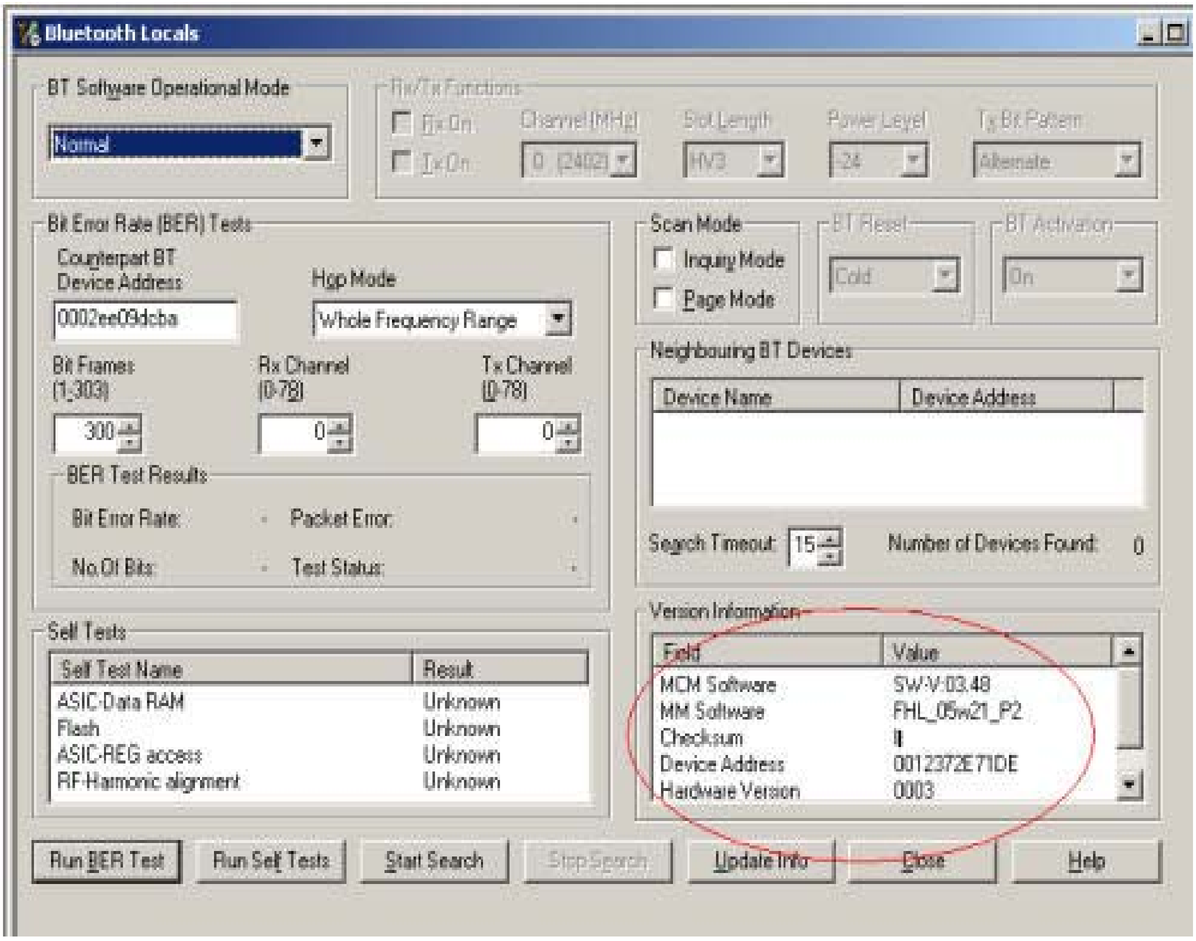
Figure 66: Bluetooth schematic

Bluetooth Troubleshooting

Use the following test steps to troubleshoot the Bluetooth component in Phoenix:

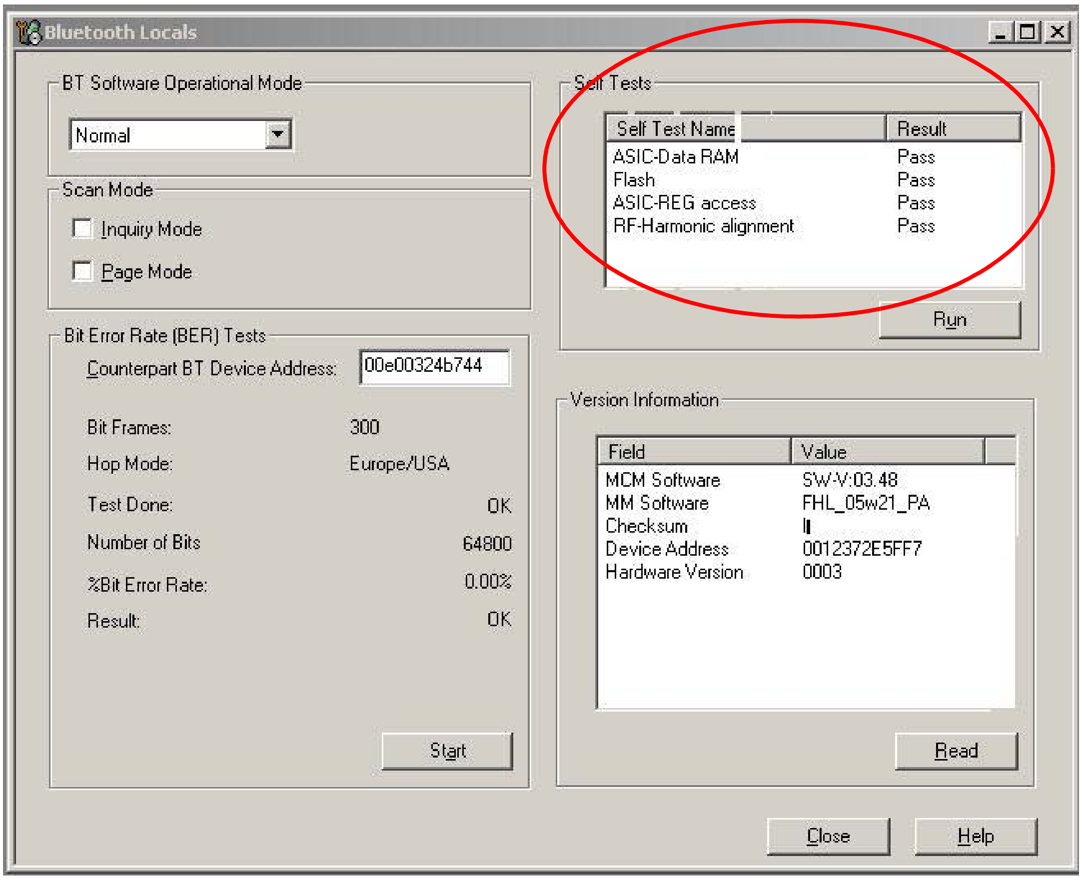
Test Setup 1

- Under the **BT/WLAN** menu, select **Bluetooth Locals**.
- If the Phoenix connection to the mobile terminal's BT ASIC is ok, text such as "MCM Software", "MM Software" is displayed in the **Version Information** window.
- If "No version information available" is displayed in the **Version Information** window, there may be a Phoenix connection problem, a connection problem between the D2800 processor and the BT ASIC or the BT ASIC is not working. See item 1 in "Bluetooth flowchart" on page 82.



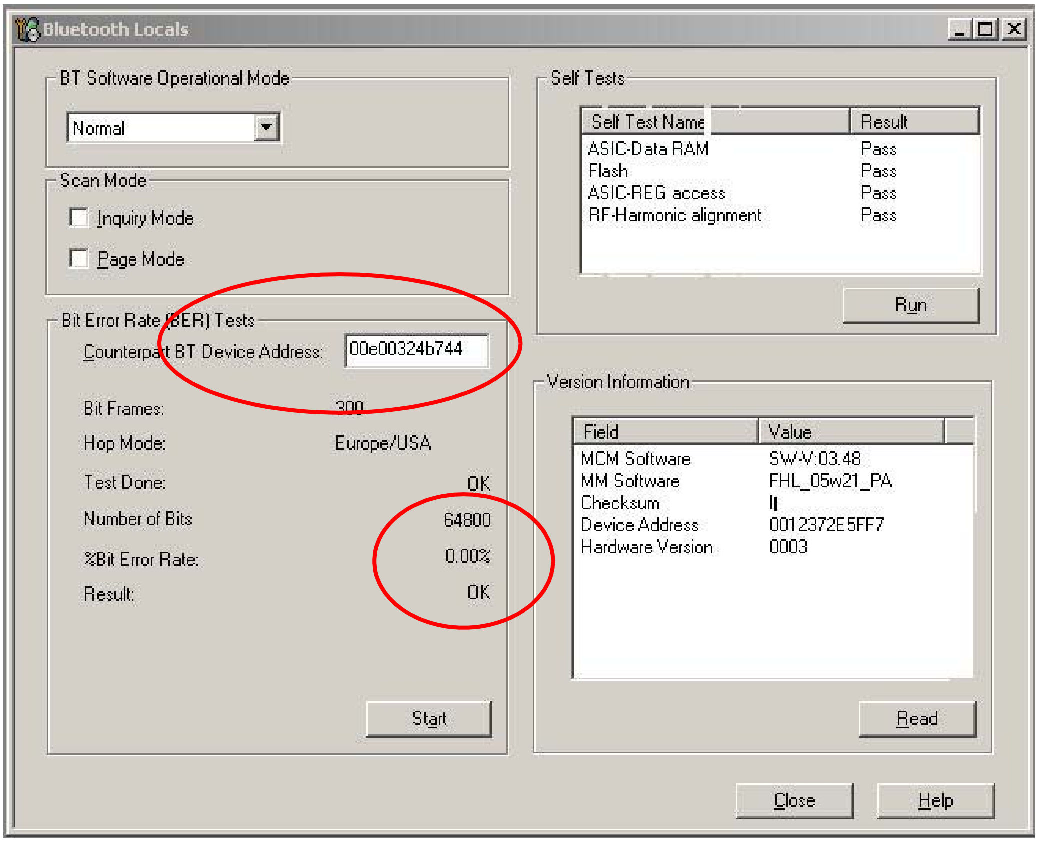
Test Setup 2

- After obtaining the version information, select **Run** to do a quick check on the BT ASIC.
- The results of each self-test is displayed in the **Self Tests** window. If any test fails, BT ASIC is not working properly. Change the BT ASIC.



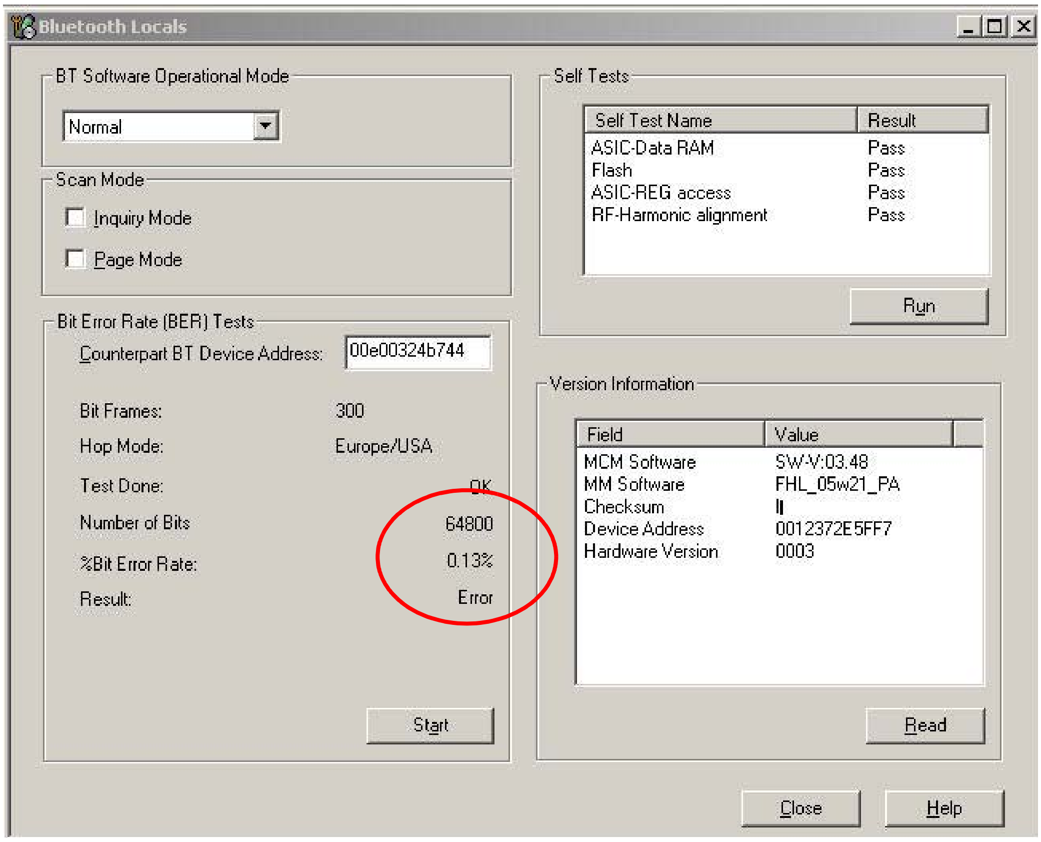
Test Setup 3

- After passing the self-test, setup the JBT-3, JBT-9 or a later version BT box.
- Key in the BT box's Device address into the **Counterpart BT Device Address** window.
- Select **Run BER Test** to run the BER loopback test. The BER result is visible in the **BER Test Results** window.
- Since this is a "go-no-go" testing, make sure the test-jig/coupler is setup correctly. It is recommended to run couple "good" mobile terminals in order to get better correlation. The acceptance criteria is BER<0.1%.



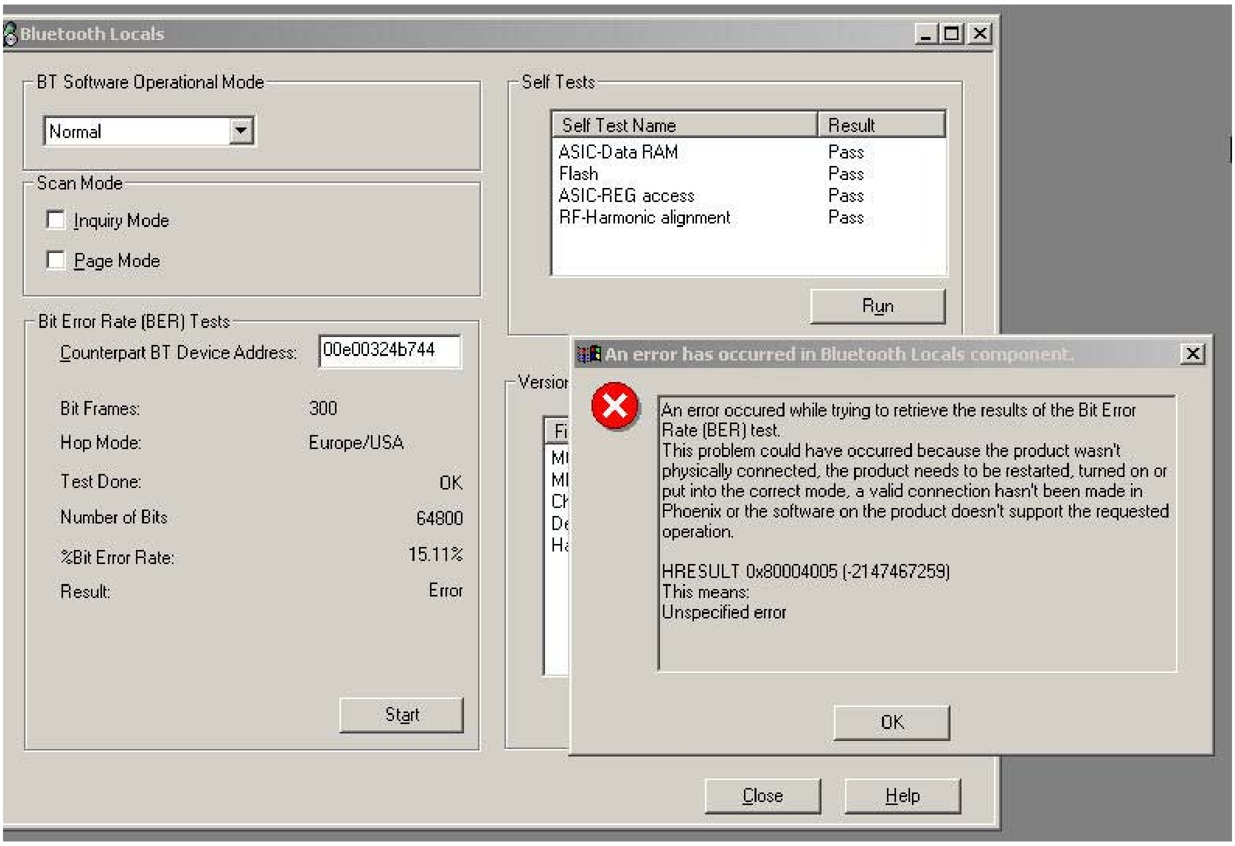
Test Setup 4

- If the mobile terminal's BT sensitivity is not good or the setup is not calibrated (correlated) correctly, the %BER > 0.1% which results in an error.
- Make sure the setup is good (correlated with a golden mobile terminal), then see Item 2 in "Bluetooth flowchart" on page 82.



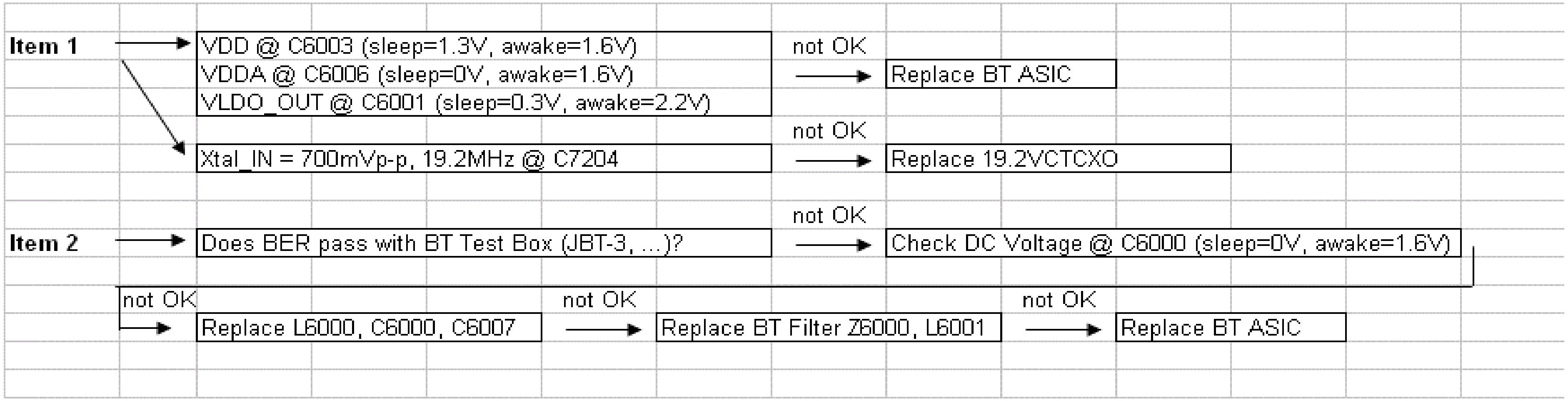
Test Setup 5

If the mobile terminal is placed too far or the BT Tx or the Rx has problem, one of the following error messages is visible. (See Item 2 of "Bluetooth flowchart" on page 82).



Bluetooth Troubleshooting Flowchart

Replace BT ASIC (N6000) when a particular row is still not ok at the end of a branch.



C7204 is on the synthesizer block

Figure 67: Bluetooth flowchart

Bluetooth DC and RF Test Points

Figure 68 shows the bluetooth DC and RF test points.

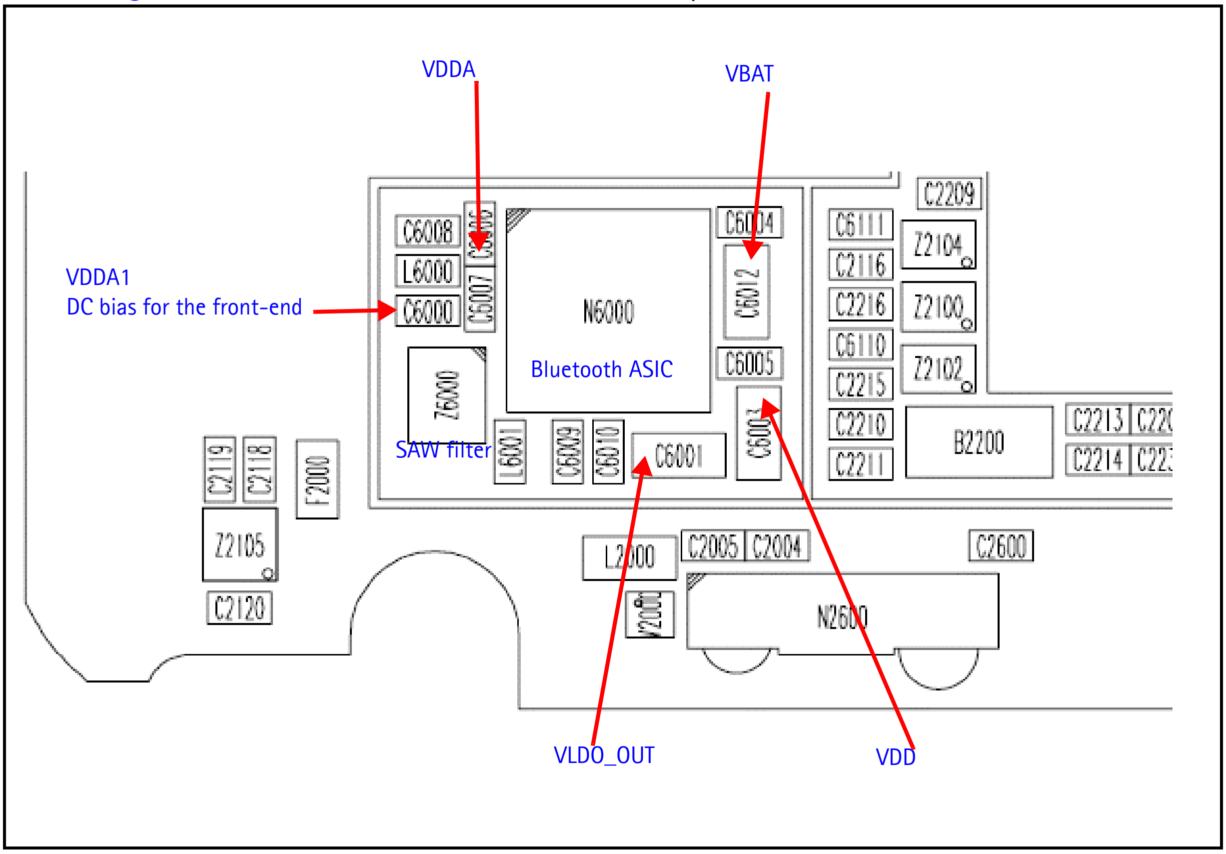


Figure 68: Bluetooth DC and RF test points

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