Troubleshooting — RF

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RF Troubleshooting

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42	TN TX IF AGC CELL Po(2)	6.5	20.5	dBm
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57	TN GnSwchPnts Init RF GD AMPS	25	44.99	

58	TN GnSwchPnts RF GD AMPS	0	100	
59	TN GnSwchPnts Init RF GD CELL	25	44.99	
60	TN GnSwchPnts RF GD CELL	0	100	
61	TN TX Gain Comp CELL Po MD	-8.25	-7.75	dBm
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64	TN TX Gain Comp CELL Po ML	-11.0	-4.0	dBm
65	TN TX Gain Comp CELL Po MH	-10	-3	dBm
66	TN TX Gain Comp CELL Po HM	-10	-2	dBm
67	TN TX Gain Comp CELL Po HI	-13.5	-5	dBm
68	TN G_Offset_CELL_MD	2600	8000	
69	TN TX LIM Po IS95 CELL LO	23.3	23.5	dBm
70	TN TX LIM Po IS95 CELL LM	23.6	23.8	dBm
71	TN TX LIM Po IS95 CELL ML	24.0	24.2	dBm
72	TN TX LIM Po IS95 CELL MD	24.4	24.6	dBm
73	TN TX LIM Po IS95 CELL MH	24.3	24.5	dBm
74	TN TX LIM Po IS95 CELL HM	24.2	24.4	dBm
75	TN TX LIM Po IS95 CELL HI	24.1	24.3	dBm
76	TN TX LIM Po IS2K CELL LO	23.3	23.5	dBm
77	TN TX LIM Po IS2K CELL LM	23.6	23.8	dBm
78	TN TX LIM Po IS2K CELL ML	24	24.2	dBm
79	TN TX LIM Po IS2K CELL MD	24.4	24.6	dBm
80	TN TX LIM Po IS2K CELL MH	24.3	24.5	dBm
81	TN TX LIM Po IS2K CELL HM	24.2	24.4	dBm
82	TN TX LIM Po IS2K CELL HI	24.1	24.3	dBm
83	TN TX LIM Loops CELL LO	0	10	
84	TN TX LIM Loops CELL LM	0	10	
85	TN TX LIM Loops CELL ML	0	10	
86	TN TX LIM Loops CELL MD	0	10	
87	TN TX LIM Loops CELL MH	0	10	
88	TN TX LIM Loops CELL HM	0	10	
89	TN TX LIM Loops CELL HI	0	10	
90	TN TX LIM Loops CELL IS2K LO	0	10	
91	TN TX LIM Loops CELL IS2K LM	0	10	

92	TN TX LIM Loops CELL IS2K ML	0	10	
93	TN TX LIM Loops CELL IS2K MD	0	10	
94	TN TX LIM Loops CELL IS2K MH	0	10	
95	TN TX LIM Loops CELL IS2K HM	0	10	
96	TN TX LIM Loops CELL IS2K HI	0	10	
97	TS TX LIM MeasCount CELL	0	500	
98	TS TX LIM TXdBCtr Delta CELL	–32767	32767	
99	TS TX LIM IS95 ADC CELL MD	550	850	
100	TS ACPR CELL High Offset	44	75	dB
101	TS ACPR CELL Low Offset	44	75	dB
102	TS TX LIM Current CELL	600	1000	mA
103	TN AMPS PL2 Po LO	23.3	23.4	dBm
104	TN AMPS PL2 Po LM	23.6	23.8	dBm
105	TN AMPS PL2 Po ML	24.0	24.2	dBm
106	TN AMPS PL2 Po MD	24.4	24.6	dBm
107	TN AMPS PL2 Po MH	24.3	24.5	dBm
108	TN AMPS PL2 Po HM	24.2	24.4	dBm
109	TN AMPS PL2 Po HI	24.1	24.3	dBm
110	TN AMPS PL2 MeasCount	0	500	
111	TN AMPS PL3 Po	23.3	24.1	dBm
112	TN AMPS PL4 Po	19.1	20.9	dBm
113	TN AMPS PL5 Po	15.1	16.9	dBm
114	TN AMPS PL6 Po	11.1	12.9	dBm
115	TN AMPS PL7 Po	7.3	8.7	dBm
116	TN AMPS PL8 Po ADC Data	4.5	7.5	
117	TN AMPS Low PL MeasCount	0	500	
118	TN TX DC Offset CarrierSup	35	120	dB
119	TN TX DC Offset Ref Po	–30	30	dBm
120	TN TX DC Offset MeasCount	0	500	
121	TN RX IF AGC RXdBCtr(0)	23584	30848	
122	TN RX IF AGC RXdBCtr(1)	14000	18000	
123	TN RX IF AGC RXdBCtr(2)	5900	8900	
124	TN LNA AMPS LowGain	298	3652	
125	TN LNA AMPS HighGain	4359	7713	

126	TN LNA CELL LO LowGain	-601	4289	
127	TN LNA CELL LM LowGain	-601	4289	
128	TN LNA CELL ML LowGain	-601	4289	
129	TN LNA CELL MD LowGain	423	3777	
130	TN LNA CELL MH LowGain	-601	4289	
131	TN LNA CELL HM LowGain	-601	4289	
132	TN LNA CELL HI LowGain	-601	4289	
133	TN LNA CELL LO HighGain	3475	8365	
134	TN LNA CELL LM HighGain	3475	8365	
135	TN LNA CELL ML HighGain	3475	8365	
136	TN LNA CELL MD HighGain	4499	7853	
137	TN LNA CELL MH HighGain	3475	8365	
138	TN LNA CELL HM HighGain	3475	8365	
139	TN LNA CELL HI HighGain	3475	8365	
140	NVD Write RF Params			Pass/Fail-Test
141	NVD Write Non RF Params			Pass/Fail-Test

Troubleshooting Summary

If TX power is low, turn on transmitter in local mode using Phoenix. Check:

1. Current (0.7 - 1 A for max power, mode and channel dependent),
2. Perform visual inspection of PWB under microscope to check proper placement, rotation, and soldering of components.
3. Look for presence of TX signal on spectrum analyzer at the correct frequency. If signal is not on frequency, check in 100 MHz span. If signal is present but off frequency, check synthesizer. If signal is not present, or present but low in amplitude, use probing Tables 1 through 7 to determine where in the chain the fault occurs, with AGC PDMs set for known transmit power as listed in Table 1.
4. Check that AGC PDMs are set for desired TX power according to Table 1 and ensure AGC voltages are correct.
5. According to Tables 2 and 3 (cell/AMPs), check the LOs for proper frequency and amplitude.
6. Ensure power supplies to transmitter have correct voltage, as per Table 13.

If Receiver is not working properly, turn on receiver in local mode using Phoenix and check:

1 Turn on receiver with Phoenix, inject a signal into the receiver.

2 Check the RSSI level and AGC PDM according to Table 8.

3 Perform a visual inspection of the PWB under a microscope to check proper placement, rotation, and soldering of components.

4 Use probing Tables 8 through 12 to measure signal levels of various points in the chain and determine where in the chain the fault lies.

5 According to Tables 9, 10, and 12 check the LOs for proper frequency and amplitude.

6 Ensure power supplies to receiver have correct voltage as per Table 13.

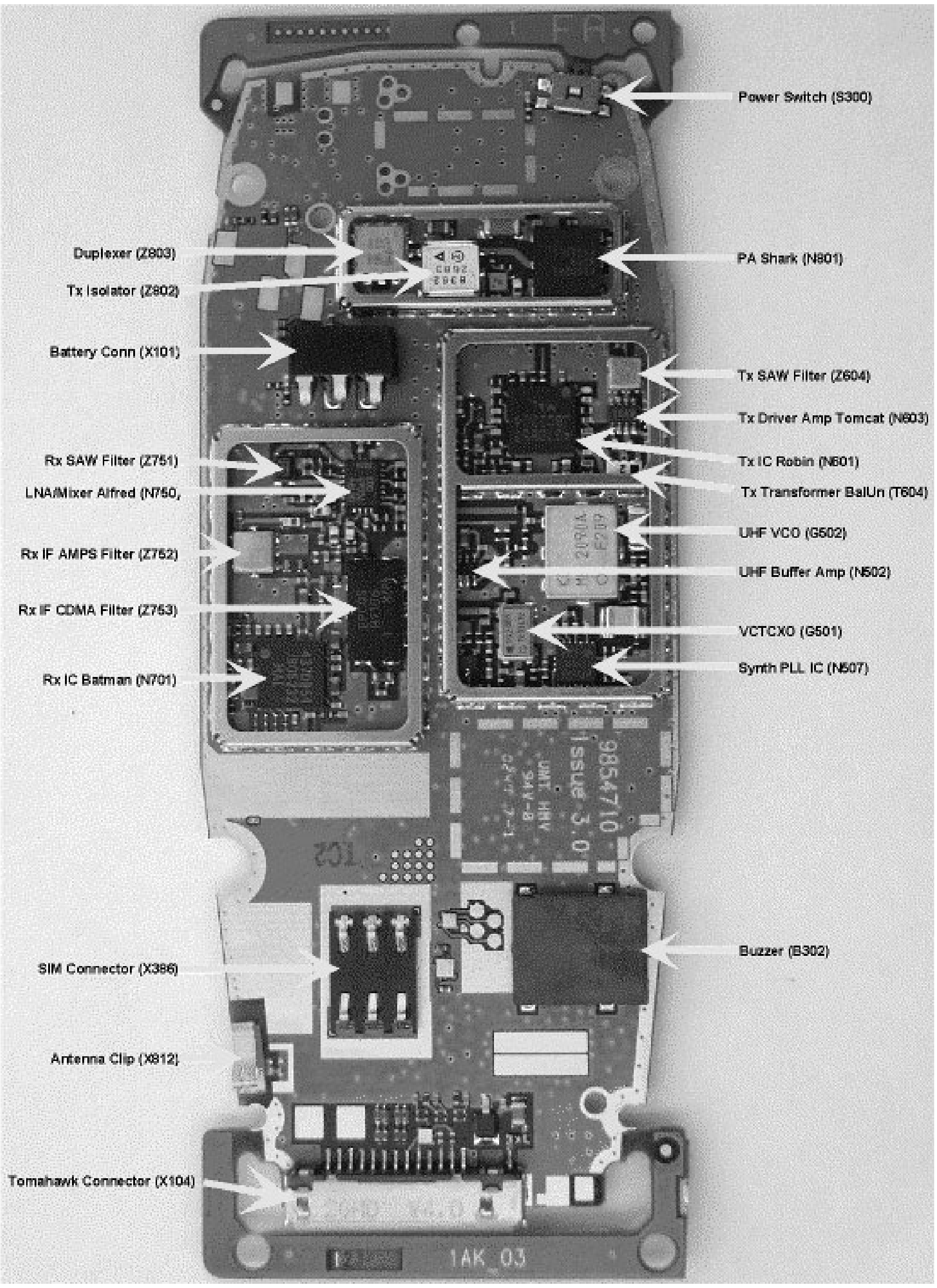


Figure 1: RH-17 PWB bottom (general placement)

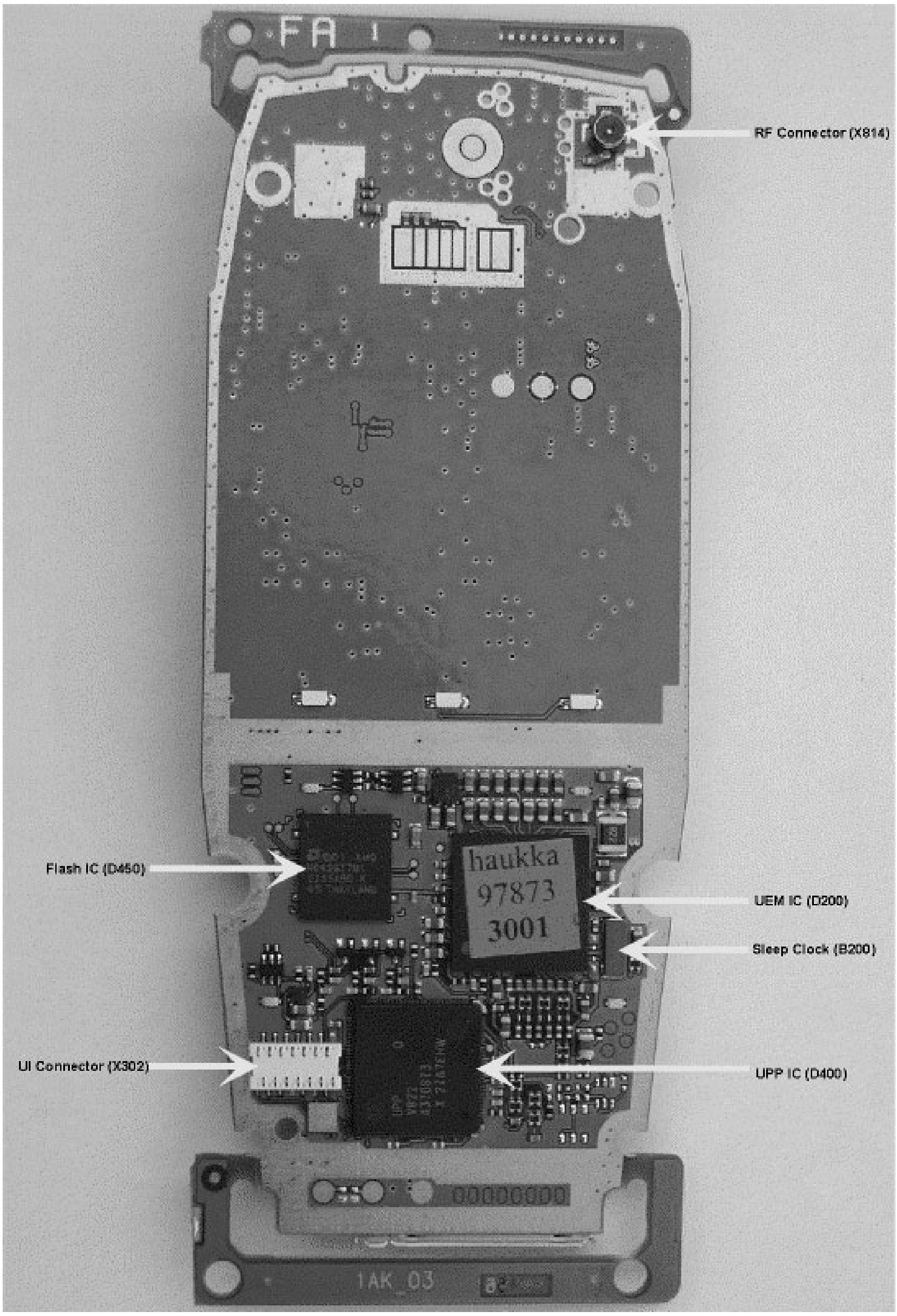


Figure 2: RH-17 PWB top (general placement)

Tuning Description

Test 1 TS Initial Current

Description

Check initial current consumption at start-up to make sure phone is consuming correct amount of current.

Explanation of Result

Phones current consumption is measured and should be between 5mA and 100 mA.

Manual Verification

Check using Power Supply and Multimeter, example follows. Power Off phone and follow setup below to verify if phone's current consumption is correct.

1 Positive Banana connector on Test Fixture to Power Supply +

2 Ground Banana connector on Test Fixture to | on Multimeter

3 Jumper cable between Power Supply (-) and Multimeter (input low)

4 Set Multimeter to measure current (DC|)

5 Multimeter should have an initial reading, this is the current being drawn by the Text Fixture. Null out the Multimeter to Zero the reading.

6 Place phone in Test Fixture

7 Press Power key to turn phone on

8 Observe current draw at Multimeter. It should be between 5.0mA and 100.0mA.

Troubleshooting

If phone drains all available current:

Check VBAT and do a visual inspection of all baseband ICs including orientation. VBAT supplies the D200 (UEM), N603 (Tomcat), N801 (PA), X101, N100, B302, M300, N300, and X470.

If the phone has initial current consumption at start-up then powers down:

If, after a few seconds, all circuits power down, it is normally caused because the watchdog signal between UEM (200) and UPP (D400) has expired. Watchdog is used by the phone for fault detection.

- Check voltage regulators for correct voltage. If voltage is low or not present, check for shorts.

VCORE - 1.50V @ C403

VIO - 1.8V @ C242

VANA - 2.8V @ C264

VFLASH1 - 2.8V @ C239

VR3 - 2.8V @ C256

- Check logic signals and clocks:

Power_OnX @ R301

UEMint - 2.80 Vdc @ test point J405

PURX - 2.80 Vdc @ test point J402

SleepX - 1.80 Vdc @ test point J403

Clk 19M2_UPP-19.2MHz @ C524

SleepClk - 32.768kHz @ J404

Test 2 BB Flash Phone

Description

The purpose of this test is to verify that the phone software was downloaded at panel flash. If download was not successful, phone will try and flash for a second time.

Explanation of Result

Pass or Fail

Manual Verification

Manual flashing using Prommer Box and Phoenix at bench.

1. Make sure correct connection is configured at FPS-8. First, set up FPS-8 with serial (AXS-4) and parallel cables. Next, power up box with 6-volt supply and place communication cable XCS-4 between FPS-8 and Flash Adapter (FLA-44), FLAL Fixture MJS-82, or JBV-1 (with adapter MJF-28).

2. Make sure that Phoenix's connection is correct. In Phoenix, select File>Manage Connections>Add>Mode to manual>Media to FBUS>Port NUM 1 or 2 (this is dependent on Local PC com port selection)>Bit Rate to 115200>COMBOXDEF_MEDIA to FBUS; then Apply.

3. Check that Prommer Box FPS-8 is correctly configured. In Phoenix, go to Flashing>FPS-8/FPS-8C Maintenance. Make sure current version is A2.10.

4 Next, try and flash phone using correct SW version. In Phoenix: Flashing>FPS-8 Flash>Press Flash. Next select OK from pop-up screen. Under next screen, Flash File Selection, choose Image File "set". In correct directory where you store your flash files (usually programs, then Nokia, Phoenix, Flash) select correct Flash SW xxxxxxx.nep (if not sure what correct SW to use, file name should match SW in a known good phone. To check this, take good phone in Phoenix and go Product>Phone Information and check MCU SW Version). Once correct SW file is found, select OK. You will be prompted to save settings, select "yes". Flashing should begin at this point. For first time, set up of prommer this could take a few minutes due to PC loading file to prommer RAM first. After first use, prommer stores this in internal RAM and should proceed faster with subsequent phones downloading of flash software. If phone passes, then more than likely a false fail. If phone fails, read prommer failure code and use Code Sheet in TS.

Troubleshooting

Make sure phone has PSN and SW version is correct by checking Phone Information. Reference the following guides to TS flash problem: Haukka BB Operation doc, Prommer Codes, and Flash Block Diagram.

Test 5 ST DBUS

Description

The purpose of this test is to verify that the connections between the DSP inside the UPP and the UEM, via the DBUS, are intact. The DSP will write an arbitrary value to DBUS General Control register in UEM; then DSP will read DBUS from General Control register in UEM and valid repeatability.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select ST_UEM_DBUS_TEST, then Run.

Troubleshooting

Connections tested at UPP: DBUSDA (pad L3) check test point J414, DBUSCLK (pad K3) check test point J413, DBUSEN1X (pad J3) check test point J415. At UEM: DBUSDA (pad A11), DBUSCLK (pad D10), and DBUSENX (pad B10). Bus interface name is RFCONVCTRL(2:0).

Test 6 ST CBUS

Description

The purpose of this test is to verify that the connections between the MCU inside the UPP and the UEM, via the CBUS, are intact. The MCU will read CBusADCR register and verify UEM chip version is valid.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode; next, BB Self Tests - select ST_UEM_CBUS_IF_TEST, then Run.

Troubleshooting

Connections tested at UPP: CBUSDA (pad G2) check test point J407, CBUSCLK (padG1) check test point J406, CBUSENX (pad F3) check test point J408. At UEM: CBUSDA (pad B7), CBUSCLK (pad A8), and CBUSENX (pad C8). Bus interface name is AUDUEMCTRL (3:0).

Test 7 ST Aux DA

Description

The purpose of this test is to verify the AUXD and UEMINT data connections between the UPP and the UEM are intact. MCU will set the UEM looptest mode by programming the Loop Test bit in the CBUS General Control 2 register. Next, DSP will write a word to AuxD register, thus causing a rising edge on the AuxD line. MCU will verify that UEMInt occurs.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode; next BB Self Tests - select ST_AUX_DA_LOOP_TEST; then Run.

Troubleshooting

Connections tested: 1) UPP: AUXDA (pad L2) via bus interface RFCONVDA(5) to UEM: AUXDA (pad D11). 2) UPP: UEMINT (pad J2) check test point J405, via bus interface AUDUEMCTRL(0) to UEM; UEMINT (pad A10).

Test 8 ST EAR Data

Description

The purpose of this test is to verify the EAR and MIC data connections between the UPP and the UEM are intact. MCU will set the UEM looptest mode by programming the Loop Test bit in the CBUS General Control 2 register. Next, DSP will write an arbitrary pattern to CodexRx register and then read the data from the Codec Tx register.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select

ST_EAR_DATA_LOOP_TEST, then Run.

Troubleshooting

Connections tested at UPP: EARDATA (pad B6), MICDATA (pad A6), and at UEM: EARDATA (pad E2), MICDATA (pad F2). Bus interface name is AUDIODATA (1:0).

Test 9 ST SleeepX

Description

The purpose of this test is to verify the Sleep connection between the UPP and the UEM is intact. This function tests the connection of pin_out and pin_in signals between UPP and UEM. The result depends on functionality of UEM loopback modes and condition of signal lines. The MCU will set UEM in looptest mode by programming via CBUS. MCU will then read sleep clock counter registers and store value. MCU then toggles SleepX signal High then Low and reads counters again. Expected value is 1 higher than previous count.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select ST_SLEEP_X_LOOP_TEST, then Run.

Troubleshooting

Connections tested are CBUS see Test 6, Sleepclock (J404) at UEM (D9) to UPP (H3). SleepX (J403) at UEM (pad B11) from UPP (pad L1). Bus interface between UPP and UEM is PUSL (2:0). Check also at UEM the OSCCAP (C234).

Test 10 ST TX / DP

Description

To verify that the Tx/Rx | lines between UPP and UEM are intact. MCU will set UEM into Looptest mode by programming the Loop Test bit via CBUS General Control 2 register. DSP will set Parallel-series bypass switches for both Rx and Tx in the MFI block of the UPP by programming the TxBypass and RxBypass bits in the MFI Control Register. DSP will write arbitrary value to TxRam of MFI, then DSP will read this data from RxRAM of the MFI.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select ST_TX_IDP_LOOP_TEST, then Run.

Troubleshooting

Connections tested are CBUS see Test 6, Connections tested at UPP: RXID (pad L4), TXID (pad M2) and at UEM: RXID (pad C11), TXID (pad A12). Bus interface name is RFCONVDA (5:0).

Test 11 ST TX Q DP

Description

To verify that the Tx/Rx Q lines between UPP and UEM are intact.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select ST_TX_IQ_DP_LOOP_TEST, then Run.

Troubleshooting

Connections tested are CBUS see Test 7. Connections tested at UPP: RXQD (pad N4), TXQD (pad N2), and at UEM: RXQD (pad A14), TXQD (pad B12). Bus interface name is RFCONVDA (5:0).

Test 12 ST MIF Loopback

Description

The purpose of this test is to verify that the Tx/Rx IQ paths inside the MFI block of the UPP are intact. DSP will swt IQSTWrap in MFI Control Register. Next, DSP will set six of the TX and Rx buffers to be the same. Sets Serial-Parallel bypass switches On. DSP will write a varying pattern to both halves of the Tx buffer, then read Rx buffer and verify data written is data received.

NOTE: This test does not test the connectivity between any two points in the HW (nodes inside of a chip do not qualify for connectivity). This test ascertains the cause of the UEM IQ Loopback Selftest failure, and determines whether the UPP or the UEM or the connection between them caused the UEM IQ to Loopback Selftest fail.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local mode: Next, BB Self Tests - select ST_MFI_IQ_LOOPBACK_TEST, then Run.

Troubleshooting

Connections tested are UPP only. If this test passes and Test 11 fails, then the problem is in UEM. If both Test 11 and Test 12 fail, the problem is in UPP.

Test 13 ST Sleep Clock

Description

The purpose of this test is to verify connections from 32kHz oscillator to the UEM, then from UEM to SleepClk to the UPP. Also tested is AFCOUT of the UEM to the VCTCXO, and from VCTCXO to RF clock to UPP are intact. UPP sets AFCR for UEM to set AFCOUT to mid range. Next, DSP will measure how many 19.2MHz clock cycles are present in 1024 cycles of the 32kHz clock. Next, AFCOUT is set to maximum value by writing to AFCR in UEM. Again measurement is taken as previously mentioned. The two measurements are subtracted. Then, AFCOUT is set to minimum value and again measured and compared to mid-value results. Expected values are validated by pass or fail.

Explanation of Result

Pass or Fail

Manual Verification

In Phoenix, put phone in Local Mode. Next, BB Self Tests - select ST_APOLL_SLEEP_CLK_TEST, then Run.

Troubleshooting

Connections tested are DBUS (see Test 5), VCTCXO circuit including AFC control voltage from UEM, Sleepclock at UEM, and also RFCLK to UPP via V500 and C524. Check also at UEM the OSCCAP (C234).

Test 14 ST Batman VHFPLL

Description

This is one of the phone's self tests which gives either a pass or fail result only. The VHF PLL is inside the Batman IC. The phone checks the VHFPLL's lock detect bit. If this bit indicates that the PLL is unlocked, the test will fail.

Explanation of Result

Pass or Fail

Manual Verification

Turn on the Cell receiver to any channel and probe at C702 (probing point TP49 in Table 10 using an RF probe connected to a spectrum analyzer tuned to 256.2MHz. If the PLL is locked, it will be stable in frequency. If it is unlocked, you may have to use a wide span, so see if it may be far off frequency.

Troubleshooting

First check that V701 has the proper orientation, then check C701, C714, R703, R702, C715, R704, C716, L701, and C702. Also, check power supplies to Batman, particularly check for 2.7v on VR5 at C710, and on VR7 at C708, and check for 1.8v on VIO. Next check if CLK 19M2_B (C512) the reference frequency for PLL is at 19.2MHz. If no fault is found, replace N701 (Batman).

Test 15 ST Robin VHF PLL CELL

Description

This is one of the phone's self-tests which gives either a pass or fail result. The VHFPLL is inside the Robin IC. The phone checks the VHFPLL's lock detect bit. If this bit indicates that the PLL is unlocked, the test will fail.

Explanation of Result

Pass or Fail

Manual Verification

Turn on the Cell CDMA transmitter to any channel and probe at C638 (probing point TP27 in Table 2) using an RF probe connected to a spectrum analyzer tuned to 345.2MHz. If th PLL is locked, it will be stable in frequency. If it is unlocked, you may have to use a wide span to see it since it may be far off frequency.

Troubleshooting

First, check that V601 and V602 have the proper orientation, then check C612, C613, R607, R605, C632, R606, C638, L611, C631, C630, C629, C637, R609, C618, and R613. Check power supplies to N601 (Robin) and ensure there is 2.7v on VR3 and VR6, and 1.8v on VIO (Table 13). Next, check if CLK 19M2_R (C513) the reference frequency for PLL is at 19.2MHz. If no problems are found, replace Robin.

Test 16 ST TX Detector CELL

Description

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 value is changed individually.

Explanation of Result

Pass or Fail

Manual Verification

Using Main Mode: turn on the Cell CDMA TX with channel set to 384, and turn on IS95 modulation using CDMA control.

Using the PDM window, set:

TX_IF_AGC to -100

TX_RF_AGC to -512

PA_AGC to +511

Record the TX signal power from the antenna connector using a spectrum analyzer centered at 836.52Mhz. (The self-test measures the power detector reading instead, but at the present time this cannot be done with Phoenix, therefore an easy way to check functionality without removing the covers is to check transmitted power. If the covers are removed, the voltage on PWR_OUT, at probing point J603 can be measured.) Transmitted power should be greater than 24dBm. (PWR_OUT greater than 1.91v, which corresponds to the power detector ADC=700).

For each of the next three cases, TX power should be less than 24dBm (less than 1.91v on PWR_OUT.

1. TX_IF_AGC to -80
   TX_RF_AGC to -512,
   PA_AGC to -512

2. TX_IF_AGC to +511,
   TX_RF_AGC to -512,
   PA_AGC to +511

3. TX_IF_AGC to -80
   TX_RF_AGC to +511
   PA_AGC to +511.

Troubleshooting

If there is a failure associated with only some of the cases above, check the AGC voltages and components of the associated PDMs as described in Table 1. For problems with the IF or RF AGC, also check Robin 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 as described in Probing/Troubleshooting Tables. 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). This can be verified by measuring the voltage on the PWROUT probing point J603, the limit is 1.64v. If the voltages are wrong, then check the power detector at R801, L801, R805, and C807, and also Robin. If the voltages are correct and it still fails, check the UEM (D200).

Test 17 SN CELL PA Temp

Description

This is one of the phone's self-tunings, which reads the ADC voltage of a thermistor R808, and checks to make sure the phone is at room temperature. The reason for this is that we don't want to tune a phone while it is hot or cold.

Explanation of Result

The phone reports the ADC voltage value of the thermistor, and it should be within the limits.

Manual Verification

Ensure the phone is cool by letting it cool down for several minutes, and retest, keeping in mind that if there is a short circuit on the board, then it will get hot very quickly. In Phoenix, go to ADC readings and verify Power Amplifier Temperature, ADC value will go down as Temperature goes up.

Troubleshooting

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 R808, C231, R207, and D200. If a short is suspected, check the PA (N801).

Test 18 SN CELL RX BB Filter

Description

This is one of the phone's self-tunings, which tunes the lowpass filter in the Batman IC (N701), in cell CDMA mode.

Explanation of Result

This self-tuning returns one of the filters tuned parameters, which should be within the limits.

Manual Verification

Use Batch Tuning window in Phoenix, select RF Tunings and check value.

Troubleshooting

Check Batman (N701) and supporting components.

Test 19 and 20 SN Cell RX DC Offset I (or Q)

Description

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.

Explanation of Result

The DC offset is returned for I (or Q).

Manual Verification

Use Batch Tuning window in Phoenix, select RF Tunings and check value.

Troubleshooting

In Phoenix, put phone in local mode, then CDMA RX. Check voltage at Batman (N701) at test points TP45-TP48 and supporting components at Batman IC.

Test 22 SN AMPS RX BB Filter

Description

This is one of the phone's self-tunings, which tunes the lowpass filter in the Batman IC

(N701) in AMPS mode.

Explanation of Result

Use Batch Tuning window in Phoenix, select RF Tunings and check value.

Manual Verification

Use RF Tuning window in Phoenix, set mode to “self tune” and choose this tuning.

Troubleshooting

Check Batman (N701) and supporting components.

Test 23 and 24 SN AMPS RX DC Offset I (or Q)

Description

This is one of the phone’s self-tunings which measures and adjusts the cell band AMPS receiver DC offsets until they are within the limits.

Explanation of Result

The DC offset is returned for I (or Q).

Manual Verification

Use Batch Tuning window in Phoenix, select RF Tunings and check value.

Troubleshooting

In Phoenix, put phone in local mode, then AMPS RX. Check voltage at Batman (N701) at test points TP45-TP48 and supporting components at Batman IC.

Test 25 – 27 BB Cal ADC Gain

Description

This calibration trains the BB ADC to two known voltage inputs. Because of the inaccuracy of an analog-to-digital converter, it must be calibrated using known values. Once values are established, phone will be able to calculate the other ADC calibrations accurately. Converter gain and offset parameters are calculated by measuring a voltage input on BSI line of 0.7 Vdc and 2.1 Vdc. Also, some calibrations use the reference voltage V^{REF}. It is calculated from offset and gain: V^{REF} = offset + 1023 x gain.

Explanation of Result

ADC Gain, Offset and Vref values

Manual Verification

In Phoenix, set phone to local mode then EM Calibration. Press read from phone. Gain factor is 0.0001 mV/bit, Offset is measured in mV.

Troubleshooting

Check the BSI components X101, C109, C230, R206, and R203. Check that VFLASH voltage is at 2.80 Vdc. Baseband components D200, D400, and D450 are soldered and aligned correctly.

NOTE: All BB calibrations must be performed whenever UEM (D200) is replaced. In other words, alignment is necessary at ATE.

Test 28 BB Cal BSI Gain

Description

This baseband calibration teaches the ADC what a 68k ohms emerges at the BSI pin.

Explanation of Result

BSI Gain ADC factor

Manual Verification

In Phoenix, set phone to local mode, then EM Calibration. Press read from phone.

Troubleshooting

BSI resistor value varies, dependent on fixture being used (e.g., JBV-1 (with adapter MJF-28), FLA-44 or MJS-82. Check the BSI components X101, C109, C230, R206, and R203. Check that VFLASH voltage is at 2.80Vdc. Baseband components D200, D400, and D450 are soldered and aligned correctly.

Test 29 BB Cal VBAT Gain

Description

This baseband calibration teaches the ADC what two different voltage inputs look like. Lower known voltage input is 3.1 Vdc and higher input is 4.2 Vdc. This voltage-scaler circuit is used to form the voltage into the proper range.

Explanation of Result

The gain factor is a result of scaled value and the global value determined in Test 25 and used to calculate VBAT Gain.

Manual Verification

In Phoenix, set phone to local mode, then EM Calibration. Press read from phone.

Troubleshooting

Check Battery Connector X101, baseband components D200, D400, and D450 are soldered and aligned correctly. Remember that this gain factor is determined using Test 25 as a reference. Make sure it was within limits also.

Test 30 BB Cal VBAT Offset

Description

This baseband calibration teaches the ADC what two different voltage inputs look like. Lower known voltage input is 3.1 Vdc and higher input is 4.2 Vdc. This voltage-scaler circuit is used to form the voltage into the proper range.

Explanation of Result

The offset is a result of scaled value and global value determined in Test 26 and used to calculate VBAT Offset.

Manual Verification

In Phoenix, set phone to local mode then EM Calibration. Press read from phone.

Troubleshooting

Check Battery Connector X101, baseband components D200, D400, and D450 are soldered and aligned correctly. Remember that this gain factor is determined using Test 26 as a reference. Make sure it was within limits too.

Test 31 BB Cal VCHAR Gain

Description:

This baseband calibration teaches the ADC what two different voltage inputs look like. Lower known voltage input is 3.0 Vdc and higher input is 8.4 Vdc.

Explanation of Result:

The gain factor is a result of the two voltages and the global value determined in Test 25 and used to calculate VCHAR Gain.

Manual Verification:

In Phoenix set phone to local mode then EM Calibration. Press read from phone.

Troubleshooting:

For production the VCHAR voltage is sent to galvanic pads on the PWB. Check for solder bridge on X104, fuse F100, L100, C106 and V100. Remember that this gain factor is determined using Test 25 as a reference, make sure it was within limits also.

Test 32 BB Cal VCHAR Offset

Description

This baseband calibration teaches the ADC what two different voltage inputs look like. Lower known voltage input is 3.0 Vdc and higher input is 8.4 Vdc.

Explanation of Result:

The offset is a result of the two current limit values and the global value determined in Test 26 and used to calculate VCHAR offset.

Manual Verification:

In Phoenix set phone to local mode then EM Calibration. Press read from phone.

Troubleshooting:

For production the VCHAR voltage is sent to galvanic pads on the PWB. Check for solder bridge on X104, fuse F100, L100, C106 and V100. Remember that this gain factor is determined using Test 26 as a reference, make sure it was within limits also.

Test 33 BB Cal ICHAR Gain

Description:

This baseband calibration teaches the ADC what two different charger current inputs look like. Voltage input is at 6.0 Vdc at two different current limits, lower being limited to 200 mA, higher current limit is set at 800 mA. Then PCI command to instruct phone to turn on charger circuitry.

Explanation of Result:

The gain factor is a result of the two current limits along with global value determined in Test 25 which is then used to calculate ICHAR Gain.

Manual Verification:

In Phoenix set phone to local mode then EM Calibration. Press read from phone.

Troubleshooting:

For production the VCHAR voltage is sent to galvanic pads on the PWB. Check current sensing resistor R200 then D200, where the charging circuitry resides. Remember that this gain factor is determined using Test 25 as a reference, make sure it was within limits also.

Test 34 BB Cal ICHAR Offset

Description:

This baseband calibration teaches the ADC what two different charger current inputs look like. Voltage input is at 6.0 Vdc at two different current limits, lower being limited to 200 mA, higher current limit is set at 800 mA. Then PCI command to instruct phone to turn on charger circuitry.

Explanation of Result:

The offset is a result of the two current limits along with global value determined in Test 26 which is then used to calculate ICHAR offset.

Manual Verification:

In Phoenix set phone to local mode then EM Calibration. Press read from phone.

Troubleshooting:

For production the VCHAR voltage is sent to galvanic pads on the PWB. Check current sensing resistor R200 then D200, where the charging circuitry resides. Remember that this gain factor is determined using Test 26 as a reference, make sure it was within limits also.

Test 35 BB Cal BTEMP Gain

Description

Explanation of Result

Manual Verification

Troubleshooting

Test 36 Test TX Start up Amplitude Limits [5,20]

Description:

This test turns on the AMPS 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 tuned yet.

Explanation of Result:

Amplitude of TX signal.

Manual Verification:

Set the phone to local mode and turn on the AMPS transmitter set to channel 384. Set the PDM values as listed in Table 1 for AMPS Power Level 5. Look for an output signal at 836.52 MHz with an amplitude within the limits. The frequency of the signal may not be accurate since the VCTCXO has not been tuned yet.

Troubleshooting:

Check proper placement, rotation and soldering of the components in the TX chain. Check for the presence of LO tones as listed in Table 2. Check for presence of a TX signal at each point in the TX chain, probing according to Table 2.

Test 38 Test TX Start up Current Limits [300,600]

Description:

This test turns on the AMPS transmitter and measures current of the whole phone, which can detect some assembly errors.

Explanation of Result:

Current in milliamps.

Manual Verification:

Set the phone to local mode and turn on the AMPS transmitter PL5. Set the PDM values as listed in Table 1 for AMPS Power Level 5. Read the phone's current on the power supply and check to see that it is within the limits. If the power supply does not display current draw, use a current meter in series with the phone. If the phone powers down when the mode is set, it may be that the phone is drawing more current than the current limit setting on the power supply.

Troubleshooting:

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 shouldn't 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.

Test 39 TN VCTCXO Frequency Limits [-150, 150]

Description:

The purpose of this tuning is to determine what the AFC DAC value needs to be in order to center the VCTCXO frequency. The CDMA 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 836.52 MHz, since it's easier to measure the tolerance of 1 ppm at 836.52 MHz than it is at 19.2 MHz. Additionally the tone at 836.52 MHz can be measured without taking the phone apart.

Explanation of Result:

The result is a frequency offset in Hz of the 836.52 MHz carrier which must be within +/- 150 Hz.

Manual Verification:

Using the RF Main Mode window in Phoenix, turn on the CDMA transmitter, and set it to channel 384. Do not add any modulation(Rho).

Using the RF Batch Tuning window, you can check the VCTCXO tuning value. Look for a transmitted tone on the spectrum analyzer at 836.52 MHz. If no tone is present, proceed to troubleshooting section.

Go to Phoenix PDM Control and follow instructions that follow. Center the carrier to within +/- 150 Hz of 836.52 MHz. (If sidetones are present, be careful to center the carrier and not one of the sidetones, which will probably have a higher amplitude than the carrier.) The values you enter in the "values" edit box are the AFC values which control the VCTCXO frequency. Start with a value of 0, then adjust until it is centered, staying within the limits.

Troubleshooting:

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 2.7 v. 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 CDMA TX chain as described in Tables 2 and 3.

If the carrier is present but it cannot be centered, there is a hardware problem. Check Table 7.

In the following procedure, performing frequency centering on the RF carrier at 836.52 MHz will detect frequency errors due to the VCTCXO and supporting hardware, which will be the majority of the problems, but will not detect frequency errors due to the hardware that uses VCTCXO tone at 19.2 MHz as a reference for VHF PLL's. Check then the VHF and UHF LO's should be at correct frequency. Since 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 Robin IC (N601) and troubleshooting of the cell UHF LO is according to Table 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.

In the case that 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.

Test 40 - 44 TN TX IF AGC Cell Po (0) [or (1), (2), (3), (4), (5), (6)]

Description:

The IF gain curve is characterized by varying the TX_IF_AGC and measuring the transmit power.

Explanation of Result:

The results are TX power readings in dBm of the transmitted signal corresponding to given PDM settings of the Cell TX IF AGC.

C) Manual Verification:

Set the phone in local mode, then program it to Cell CDMA RX/TX mode on channel 384. Set modulation to IS95 voice in CDMA Control.

Set the Cell PA PDM to +218 decimal and the TX RF AGC to -512 decimal using the sliders in the PDM window under the RF menu.

Change the TX_IF_AGC to the settings in the following table, and measure the TX power levels, checking to see that they are within the specified range.

PDM for TX IF AGC	Range for output power, in dBm
(a) +388 decimal	-27.5 - 13.5
(b) +228	-8.0 - 6.0
(c) 163	6.5 - 20.5
(d) 0	6.5 - 20.5

PChange the TX_RF_AGC PDM to +511. Leave the TX_IF_AGC at 0 and the PA_AGC at +218. Measure the output power. Subtract this power from the power measured in (d) above. This is the RF_AGC gain delta.

Leave the PA_AGC and TX_RF_AGC values as is, then enter the values listed below for the TX_IF_AGC. Measure the output power, then add to each the RF_AGC gain delta calculated above. Check that these sums are within the listed ranges.

PDM for TX IF AGC	Range for sum:[output power + RF_AGC gain delta], in dBm
-150	29.0 - 42.0
-300	37.0 - 51.0

Troubleshooting:

Check Robin (N601) and supporting components. Also check D400, which generates the PDM signals. Check AGC PDM voltages according to Table 1. Troubleshoot the rest of the transmitter chain if necessary as described in Table 2.

Test 45 TN TX IF 11 dBm Set CELL Po

Description:

See previous tuning. This is the part of the previous tuning when the TX IF AGC is adjusted so that the output power is +11 dBm

Explanation of Result:

The result is a power in dBm. A perfect result would be +11.00 dBm.

Manual Verification:

See previous tuning.

Troubleshooting:

See previous tuning

Test 46 - 51 TN PA AGC Cal Cell Po (0) [or (1), (2), (3), (4), or (5)]

Description:

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 +11 dBm (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.

Explanation of Result:

The result is the transmitted power in dBm for each of the six PA AGC PDM settings (results labeled 0 through 5).

Manual Verification:

Turn on the cell CDMA transmitter in Phoenix using the RF Main Mode window, and set it to channel 384. Set modulation to IS95 voice in CDMA Control.

In PDM Control window set the TX_IF_AGC PDM to 0 decimal.

Set the PA AGC PDM to +218 decimal.

Set the TX RF AGC PDM to -512 decimal.

Adjust the TX IF AGC PDM so that the transmitted tone at 836.52 MHz measures +11 dBm +/- 0.5 dB on the antenna connector, using a spectrum analyzer (use 0 as a starting point). Note this value as it is needed in other troubleshooting sections.

Write the PDM values listed below into the PA AGC and record the output power. Check to see if the output power is within the ranges listed.

PDM for PA AGC	Range for output power, in dBm
+218 decimal	10.5 - 11.5 Po(5)
-12	7.0 - 13.0 Po(4)
-202	4.0 - 11.5 Po(3)
-268	2.0 - 10.5 Po(2)
-329	1.0 - 8.5 Po(1)
-366	-1.0 - 6.5 Po(0)

Troubleshooting:

If the power readings are low, check the AGC voltages as in Table 1. You can also probe on the PA input as in Table 2 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.

Test 52 - 56 TN TX RF AGC Cell Po (0) [or (1), (2), (3), or (4)]

Description:

This tuning characterizes the RF AGC curve by entering PDM values to the RF AGC and measuring the output power.

Explanation of Result:

The results are TX power readings in dBm of the transmitted signal measured for each of the listed PDM settings of the Cell TX RF AGC.

Manual Verification:

Turn on the Cell CDMA transmitter in Phoenix using the RF Main Mode window, and set it to channel 384. Set modulation to IS95 voice In CDMA Control.

In PDM Control window set the Cell PA PDM to -329.

Set the TX_IF_AGC to the value determined in tuning Test 50 above to give +11 dBm on the output.

Change the TX RF AGC to the settings in the table below, and measure the TX power levels, checking to see that they are within the specified range.

PDM for TX RF AGC	Range for output power, in dBm
-512 decimal	0.5 - 11.5 Po(4)
-67 decimal	-3.5 - 9.5 Po(3)
-22 decimal	-10.5 - 3.5 Po(2)
+418	-23.5 - -7.0 Po(1)
+511	-41.0 - -21.0 Po(0)

Troubleshooting:

Check Robin (N601) according to Table 2 and Table 3. Also check D400, which generates the PDM signals. Check AGC PDM voltages according to Table 1.

Test 61 - 67 TN TX Gain Comp Cell Po MD (or LO, LM, ML, MH, HM, or HI)

Description for this and next tuning:

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 -8.0 dBm, 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. After this is done on the mid channel, the channel is changed to each of the other channels, and output power is reported. (G_offset is not adjusted on the other channels as it was on the center channel, just the output power is recorded).

Explanation of Result:

The result is the transmitted power in dBm, which should be -8.25 to -7.75 dBm.

Manual Verification

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 PDM Control window, adjust Tx RF AGC "values" dialog box until the TX output power (measured on the RF connector with a spectrum analyzer) is equal to -8.25 to -7.75 dBm. Once this is done on the center channel, change to each of the other channels using CDMA Rx/Tx screen, and record the power. Do not adjust Tx RF AGC on the other channels, just record the power. It should be within the limits listed below.

Channel	Cell	Frequency	Range for output power, in dBm
Low	991	824.04 MHz	-11.5 to -4.5
LowMid	107	828.21 MHz	-11.0 to -4.0
MidLow	245	832.35 MHz	-11.0 to -4.0
Mid	384	836.52 MHz	-8.25 to -7.75
MidHigh	512	840.36 MHz	-10.0 to -3.0
HighMid	660	844.80 MHz	-10.0 to -2.0
High	799	848.97 MHz	-13.5 to -5.0

D) Troubleshooting:

If -8 dBm cannot be attained, troubleshoot Cell TX as described in the beginning of this document.

Test 68 TN G_Offset Cell MD

Description:

See description of previous tuning. This step reports G_Offset.

Explanation of Result:

The result is the value of G_Offset which gives -8.0 dBm transmitted power.

Manual Verification:

See previous tuning. This is the value of G_Offset needed to get -8 dBm on the center channel.

Troubleshooting:

If G_Offset is not within the limits, troubleshoot the Cell TX as described in the beginning of this document.

Test 69 - 75 TN TX Limiting PO IS95 Cell, Low channel (or LowMid, MidLow, Mid, MidHigh, HighMid or High channel)

Description:

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 violates the SAR (Specific Absorption Ratio) limit, which is a health and safety specification that limits the amount of radiation near the user's head. The phone is set to transmit and TxdBCtr is adjusted for the maximum transmit power.

Explanation of Result:

The result is a power level in dBm, which is the maximum allowed. This is done on each of the seven channels.

Manual Verification:

Using Phoenix, set the phone to local mode, then turn on the Cell transmitter set to each of the channels in the list below. Set modulation to IS95 voice using CDMA Control.

Using the RF Tuning window, adjust TX RF AGC in PDM Control "value" until the TX power, measured on the RF connector with a spectrum analyzer, is within the limits on each of the channels below.

Channel	Cell	Frequency	Range for output power, in dBm
Low	991	824.04 MHz	23.3 to 23.5 dBm
LowMid	107	828.21 MHz	23.6 to 23.8 dBm
MidLow	245	832.35 MHz	24.0 to 24.2 dBm
Mid	384	836.52 MHz	24.4 to 24.6 dBm
MidHigh	512	840.36 MHz	24.3 to 24.5 dBm
HighMid	660	844.80 MHz	24.2 to 24.4 dBm
High	799	848.97 MHz	24.1 to 24.3 dBm

Troubleshooting:

If the maximum cannot be reached, either a component in the transmitter has too much loss, or not enough gain. Troubleshoot the Cell transmitter Table 2, with the phone set to the same channel as the failed channel.

Test 76 - 82 TN TX Limiting Po IS2K Cell: Low channel (or LowMid, MidLow, Mid, MidHigh, HighMid or High channel)

Description:

This tuning provides an upper limit on the transmit power while in Cell mode with CDMA2000 modulation. The reason for this is to ensure that the phone never violates the SAR (Specific Absorption Ratio) limit, which is a health and safety specification that limits the amount of radiation near the user's head. The phone is set to transmit and TxdBCtr is adjusted for the maximum transmit power.

Explanation of Result:

The result is a power level in dBm, which is the maximum allowed. This is done on each of the seven channels.

Manual Verification:

Using Phoenix, set the phone to local mode, then turn on the Cell transmitter set to each of the channels in the list below. Set modulation to C2k voice using CDMA Control.

Using the RF Tuning window, adjust TX RF AGC in PDM Control "value" until the TX power, measured on the RF connector with a spectrum analyzer, is within the limits on each of the channels below.

Channel	Cell	Frequency	Range for output power, in dB
Low	991	824.04 MHz	23.3 to 23.5 dBm
LowMid	107	828.21 MHz	23.6 to 23.8 dBm
MidLow	245	832.35 MHz	24.0 to 24.2 dBm
Mid	384	836.52 MHz	24.4 to 24.6 dBm
MidHigh	512	840.36 MHz	24.3 to 24.5 dBm
HighMid	660	844.80 MHz	24.2 to 24.4 dBm
High	799	848.97 MHz	24.1 to 24.3 dBm

Troubleshooting:

If the maximum cannot be reached, either a component in the transmitter has too much loss, or not enough gain. Troubleshoot the Cell transmitter Table 2, with the phone set to the same channel as the failed channel.

Test 100 -101 TS ACPR Cell - High(Low) Offset

Description:

ACPR (Adjacent Channel Power Ratio) is a measure of band power in the adjacent channel as compared to the tuned channel, so it is a power delta in dB. Band power is measured at the center tuned frequency and also at an offset lower (higher) than the center frequency, and the difference is ACPR. For this test, the offset is -0.9 MHz (+ 0.9 MHz).

Band power is integrated power over a frequency band, rather than at a single frequency. The bandwidth for the measurement centered at the tuned frequency is the bandwidth of the signal, which for IS95 is 30 kHz.

Explanation of Result:

Result is ACPR (a power delta) in dB.

Manual Verification:

Set the phone in local mode, and turn on the Cell transmitter set to channel 384. Use the TX Limiting function in the RF Tuning window to set the transmit power to the maximum value (within the limits for the "TX Limiting" tuning Test 72). Observe the TX signal on the spectrum analyzer. If the spectrum analyzer being used has a CDMA personality card, then ACPR can be read directly off the screen. If not, then set the bandwidth to 30 kHz, and set the averaging on. Center the marker at 836.52 MHz and note the power in dBm. Use the offset marker to measure the power at an offset of +/- 0.9 MHz.

Troubleshooting:

If one or more of the AGC values needs a value much higher than normal to achieve maximum power, then that would indicate that a component in the chain has less gain (or more loss) than it should, and another component that is compensating for that could be saturating. Use the AGC information as a guide to troubleshoot the Tx chain as described in Table 1a, especially being careful to check all decoupling capacitors C633, C649, C648, C619, C817, C810, C811, and C813. Severely degraded ACPR is detectable just by looking at the shape of the CDMA curve, therefore you can also probe each point in the TX chain to see if ACPR becomes degraded at one point.

Tests 103 - 109 TN AMPS PL2 Po Low (LowMid, MidLow, Mid, MidHigh, HighMid, or High)

Description:

This procedure tunes the AMPS transmit Power Level 0 on seven channels by adjusting TxdBCtr. The channels are: Low= 991, LowMid= 107, MidLow= 245, Mid= 384, MidHigh= 521, HighMid= 660, High=799. The algorithm then interpolates between the measured points for frequency compensation.

Explanation of Result:

The result is measured transmit power in dBm for power level 0 on each of the seven channels.

Manual Verification:

Set the phone to local mode and turn on the AMPS transmitter to the channel which failed on Power Level 2. (adjusting for cable loss).

Troubleshooting:

Troubleshoot the cell transmitter as described in Table 2, setting the TX AGC values to those listed for Power Level 0 in Table 1.

Tests 111 - 115 TN AMPS PL3 (or 4, 5, 6, or 7) Po

Description:

This procedure tunes power levels 3 through 7, all on the center channel. Power level 0 was tuned in the previous test. (Power levels 0, 1 and 2 are the same for this phone.)

Explanation of Result:

The result is measured transmit power in dBm for power levels 3 through 7 on channel 384.

Manual Verification:

Use the same procedure as in previous tuning, but on channel 384 selecting corresponding Power Level. Note that the limits are different from the previous tuning.

Troubleshooting:

Troubleshoot the cell transmitter as described in the beginning of this document, setting the AGCs as in Table 1 for the power level which failed.

Test 118 TN TX DC Offset Carrier Suppression

Description:

The DC offset voltages on the I and Q inputs to the modulator are adjusted for minimal carrier feedthrough (maximum carrier suppression). Initially the DC offsets are set to a nominal value, and the power of a tone offset in frequency 20 kHz from the carrier is measured in dBm and recorded as a reference (in this tuning). Then in the next tuning, the carrier suppression (delta between center tone and tone that is offset 20 kHz) is measured. If it passes, it is reported in that tuning. If not, the DC offsets are adjusted until it passes, and the passing value is reported. This step reports the delta between the reference at 836.52 MHz + 20 kHz, and the minimum carrier level at 836.52 MHz.

Explanation of Result:

The result is a delta in dB between the reference at 836.52 MHz + 20 kHz, and the minimum carrier level at 836.52 MHz, found by adjusting the DC offsets for I and Q individually. The delta should be at least 35 dB.

Manual Verification:

Set up the phone as in the next Test 119 , and record the reference power of the offset tone. Measure the delta between the center and offset tones. If the delta is 35 dB or greater, the phone passes. If less than 35 dB, vary the "I" DC offset on the "values" line in the RF Tuning window, using the below listed values until the minimum carrier maximum delta is found. Leave Q at 0. On the "values" line, you enter "I,Q". The values, in decimal,

-560
-504
-448
-392
-336
-280
-224
-168
-112
-56
0
56
112
168
224
280
336
392
448
504
560

If the minimum is 35 dB or greater, the phone passes. If the minimum is less than 35 dB, then vary Q in the same manner as I using the above values, holding I constant at the minimum value determined above, until the delta is at least 35 dB.

Troubleshooting:

Check Robin (N601), UEM (D200), and associated components. Check TP's 1a - 1d.

Test 119 TN TX DC Offset Reference Power

Description of this and next tuning:

The DC offset voltages on the I and Q inputs to the modulator are adjusted for minimal carrier feedthrough (maximum carrier suppression). Initially the DC offsets are set to a nominal value, and the power of a tone offset in frequency 20 kHz from the carrier is measured in dBm and recorded as a reference (in this tuning). Then in the next tuning, the carrier suppression (delta between center tone and tone that is offset 20 kHz) is measured. If it passes, it is reported in that tuning. If not, the DC offsets are adjusted until it passes, and the passing value is reported.

Explanation of Result:

The reported result is the power in dBm of the tone that is offset 20 kHz from the carrier, as measured on the antenna connector, with the nominal DC offsets applied.

Manual Verification:

In Phoenix, use the RF Main Mode window to set the AMPS transmitter to channel 384.

Using the PDM Control window, set the I and Q DC offsets to 0,0 by entering 0,0 in the "values" edit box.

Center the transmit signal on the spectrum analyzer, set the span to 100 kHz. Lower the bandwidth so that the two sidetones can be differentiated from the carrier. Measure the amplitude of the sidetone at 20 kHz above the carrier. The amplitude of the sidetone will probably be higher than that of the carrier. The amplitude should be within the test limits.

Troubleshooting:

If the carrier is not present, troubleshoot the cell TX chain using the "things to check" list and probing tables/diagrams. If the two tones offset at 20 kHz are not present on the TX signal, check to see if they are on Robin output at L613 at 836.52 MHz + 20 kHz. If not, there is likely a problem with N601 (Robin). Ensure power supplies to Robin (VR2, VR3, VR6 and VIO) are correct. Check components around Robin. If still failing, replace Robin.

Test 121 - 123 TN RX IF AGC RXdBCtr (0) [or (1) or (2)]

Description:

This tuning calibrates the RX IF AGC curve, because the output power of the IF part of the Batman IC is not a linear function of RX_IF_AGC. The tuner injects three known signal power levels into the phone's receiver, and for each one the phone's AGC algorithm adjusts the RX_IF_AGC to get the same amplitude at the output of Batman, although different amplitudes are going in. From these three points, curve fitting is used to interpolate between measurement points.

Explanation of Result:

The result is a value of RxdBCtr (which corresponds to a value of RX_IF_AGC) for each of three CW input powers injected into the receiver:

-87.5 dBm
-57 dBm
-18 dBm

Manual Verification:

With the phone in local mode, use the Main Mode window to turn on the AMPS receiver set to channel 384. Using the RF Tuning window, perform the manual tuning three times, each time injecting the CW signal at the amplitudes listed above, one amplitude per tuning. Each time record RxdBCtr, which is returned by Phoenix during the manual tuning.

Troubleshooting:

While injecting a signal into the receiver, check the values of RSSI and 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. Table 3a lists limits and typical values. The AGC will try to keep the same amplitude on Batman 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.

After checking RSSI and AGC value, if it is still necessary to probe to pinpoint the source of the error, use the AMPS probing Tables 9 through 11.

Test 178 - 179 TN LNA AMPS LowGain (or HighGain)

Description:

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 highgain mode, and again with the LNA in lowgain mode. For AMPS this is done only on the center channel.

Explanation of Result:

The result is a value of RxdBCtr.

Manual Verification:

Using Phoenix, choose this tuning in the RF Tuning window. Inject a CW signal that is 10 kHz offset from the center frequency of the channel that is being tuned. For AMPS, set the amplitude to -65 dBm. Record RxdBCtr, which is returned from Phoenix in the lowest field in the RF Tuning window.

Troubleshooting:

Check Alfred and supporting components, reference Table 9.

Test 126 - 139 TN LNA CELL LowGain (or HighGain) LO (or LM, ML, MD, MH, HM, HI)

Description:

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 highgain mode, and again with the LNA in lowgain mode. For Cell this is done over several channels.

Explanation of Result:

The result is a value of RxdBCtr.

Manual Verification:

Using Phoenix, choose this tuning in the RF Tuning window. Inject a CW signal that is 10 kHz offset from the center frequency of the channel that is being tuned. For Cell set it to -95 dBm. Record RxdBCtr, which is returned from Phoenix in the lowest field in the RF Tuning window.

Channel	Cell
Low	991
LowMid	107

Channel	Cell
MidLow	245
Mid	384
MidHigh	512
HighMid	660
High	799

Troubleshooting:

Check Alfred and supporting components, reference Table 9.

Final UI test: Rho

Rho is a measure of CDMA transmit signal quality which encompasses other transmitter indicators such as phase error and magnitude error. Rho is measured with the phone in a phone call, and is read directly from the call box. Rho is measured with sector power = -75 dBm. If Rho fails, first check the signal purity of the LO's. Check synthesizer components and power supply decoupling. Reference Table 2.

Final UI test: Frame Error Rate (FER)

This measurement, also made in a phone call, measures the frame errors of the receiver in CDMA mode. A low amplitude signal (typically at receiver sensitivity level of -104.0 dBm) is injected into the receiver, and the FER is recorded. FER is measured in percentage, and 0.5 % or lower is passing (w/ 95% confidence). Failures are most often caused by excess loss/insufficient gain in the receiver chain, (and sometimes by excess noise in the receiver). Check for correct signal levels and AGC values/voltages as described in Tables 8-12.

Final UI test: SINAD

SINAD (Signal-to-Noise-and-Distortion) is similar to a sensitivity/FER measurement for CDMA, but is used in AMPS. A low level signal (typically at sensitivity level of -116.0 dBm) is injected into the receiver, and SINAD is read off the call box, with 12 dB as the passing limit. Check Tables 9-11.

Probing/Troubleshooting Tables

When measuring CDMA transmit signals, if the spectrum analyzer does not have a CDMA personality card, then the CDMA signal power can be approximated by setting the Resolution Bandwidth to 1 MHz and using the marker. This is because CDMA signal power is measured by integrating power over a 1.23 MHz bandwidth, and the marker measures power at only one frequency.

In most cases, probing is done in local mode (i.e., not in a call). Situations may arise whereby the troubleshooter may need to probe while in a call, however in some cases probing may disturb the circuit so that the call drops.

Although the tables list power levels for many combinations of AGC values, it is generally only necessary to check one combination. The extra information is provided in case it may be useful in an unexpected situation. Likewise, although probing points and signal level information are given for each point in the receiver and transmitter chains, the troubleshooter is not expected to probe each point on every phone, only the suspected trouble spots.

Absolute power measurements were made with an Anritsu MT8802A using common RF probe. Other probes can be used (but should be high impedance so that the measurement does not load the circuit) but may very well have a different gain, therefore adjust the absolute measurements accordingly. Also, adjust measurements if using a probe attenuator.

Where a range is given for loss, typically the higher loss occurs at the band edges.

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

When testing the CDMA receiver, it is easier to inject a CW tone into the receiver. The gains and losses will be the same for a CW signal as for CDMA.

Transmitter Probing

Table 1: Transmit Output Powers and Associated AGC PDM values and voltages

Channel 384 (Cell) fc= 836.52 MHz				
AMPS				
TX RF AGC	TX IF AGC	Probed RF power on	PA AGC	RF power on RF

PDM value	voltage	PDM value	voltag e	Balun Out	PDM value	voltage	connector
typical	v	typical	v	dBm	typical	v	dBm
-409	0.17	-110	0.68	-15.2 +/- 3 dB	-19	0.85	24.8 **(PL0)**
-409	0.17	-92	0.72	-13.2 +/- 3 dB	-123	0.67	23.7 **(PL3)**
-409	0.17	-76	0.75	-15.4 +/- 3 dB	-310	0.34	21.0 **(PL4)**
-249	0.45	-66	0.77	-19.4 +/- 3 dB	-330	0.31	16.3 **(PL5)**
-104	0.70	-56	0.78	-22.4 +/- 3 dB	-330	0.31	13.5 **(PL6)**
37	0.95	-48	0.80	-27.9 +/- 3 dB	-330	0.31	10.4 **(PL7)**
CELL CDMA							
-403	0.18	-115	0.680	-14 +/- 3 dB	220	1.29	25
-403	0.18	100	1.067	-38 +/- 3 dB	-270	0.41	-2
200	1.25	100	1.067	-56 +/- 3 dB	-331	0.31	-23
450	1.70	105	1.076	-70 +/- 3 dB	-331	0.31	-39
511	1.81	170	1.190	-80 +/- 3 dB	-331	0.31	-50
See Table 3 for test points for AGC.							

IMPORTANT NOTE: AGC PDM values will change (sometimes drastically) as the phone warms up. The table above lists PDM values for when the phone is first turned on. After 10 minutes at full power, PDM values will be different.

Table 2: RF/Analog Probing for Cell/AMPS Transmitter

Probing Point	Probing Location on the board	Probed Absolute Power (dBm), or gain/loss (dB), or voltage (v)	Where to start checking if RF power not correct (soldering, shorts, DC power applied if active, correct voltage of DC signals, otherwise replace)
Robin Tx I/Q input from UEM	TP1a, TP1b, TP1c and TP1d	Check with Osc probe for Input, check also for same dc offset on each point.	Check that UEM and Robin are soldered correctly.

Robin (N601)out=Balun (T604) in	TP2a and TP2b	Nominal loss through Balun = 1 dB, but it will appear as 3-4 dB gain due to impedance difference. On Robin output you may see amplitude imbalance between 2 sides of probing point 2 due to impedance differences.	N601 (ensure VREFRF02 is 1.35v as in TP17. Check AGC voltages/PDMs as in Table 1, T604, L604, L603, C640, C642, C907, N603 (including check for 3.6v on pin 5), D400 (including AGC voltage check in Table 1) Remember to check the state of FAST_AGC should be High in Analog mode TP13.
Balun (T604) out=Tomcat (N603) in	TP3 TP4	See Table 1.	T604, C640, C642, L603, L604(check that VR2 is 2.8 Vdc @ TP14), N601, C907, N603 (including check for 3.6v [Vbat TP15] on pin 5 and 2.7v [enable TP16] on pin 4)
Tomcat (N603) out= TX SAW filter (Z604) in	TP5	Gain=12-16 dB through Tomcat	N603 (also ensure 3.6v on pin 5 and PD_CELL high, N601, C649, C639, Z604, N801 (Vbat)
TX SAW filter (Z604) out= cell PA (N801) in	TP6	Loss=2-3 dB through SAW filter	Z604, N603, C610, N801 (Vbat)
Cell PA (N801) out= cell isolator (Z802) in	TP7, Probing here not recommend unless necessary, best to measure on RF connector.	PA has variable gain, check Iref Cel at C811.	N801 (including: check 3.6v on Vbat TP18), Z802, R805, R801, L801, D400 (including AGC voltage check in Table 1), N601 (check PA_AGC as in Table 1, also check IREF CEL at PA TP19) PA_BOOST not used in Haukka. If gain is insufficient at PA, press on N801 and check if RF output increases at RF connector. If yes, ground connection is incomplete.
Cell isolator (Z802) out= cell duplexer (Z803) in	TP8 Probing here not recommend unless necessary, best to measure on RF connector.	Loss=0.6 dB through isolator. Best to measure on RF connector.	Z802, N801 (Vbat), R805, R801, Z803
Cell duplexer (Z803) out= RF Connector (X814) in.	TP9 Probing here not recommend unless necessary, best to measure on RF connector	Loss=1-3 dB through duplexer	Z803, L750, N750, X814. If no cable connected to X814 then additionally X811.

UHF LO at 1009.62 MHz for channel 384 At N601 Robin	TP20	Power approx.5 dBm. Measured with RF probe	Check to see if LO is present. If no LO is present, check N601, C666, C519, C514, L501 and N502. Check regulator voltages VR2 and VR6 are at 2.78 Vdc. Proceed to Table 5 for further UHF LO troubleshooting.
VHF LO at 346.2 MHz for cell band, any channel	TP27 You can take RF probe and verify presence of LO at R613, but this won't measure amplitude accurately)	Should measure power at ~ -6 to -12 dBm. Measured with RF probe	Check that control voltage at TP28 is at 1.45 Vdc. Check loop filter components C612, C613, R607, R605, C632, R606. Check Resonant components C629, V602, C637, V601, C630, C631, L611, C638 and R613. Check VCO_BAND components R609 and C618, make sure voltage VR3 is present at 2.78 Vdc.
Power Detector	TP33 TP34	Measure according to Table 4	Check N806, L801, R805, R801, C807 and N601.

NOTE: Troubleshooting CDMA transmitter is same as Analog, differences are in PDM settings. See Table 1 for PDM settings.

Table 3: DC probing for Cell/AMPS Transmitter

Item to check	setting	DC probing location on board	DC Voltage	Items to check if voltage incorrect
TX RF AGC	See Table 1	TP10	See Table 1	D400 (UPP), R433, C426, R434, C427, C429, V420, N601, R604
TX IF AGC	See Table 1	TP11	See Table 1	D400 (UPP), R427, C422, R428, C423, C430, V421, N601, R611, C607, R601, Voltage VIO at 1.8 Vdc
PA AGC	See Table 1	TP12	See Table 1	D400 (UPP), R430, C424, R431, C425, C431, V422, N601, R621
PD_CELL	High for TX on, Low for TX off	TP16	High=2.6v Low=0v	N601, C649, N603 (pin 4)
VREFRF02	fixed	TP17	1.35v	D200, C606, N601
IREF_CEL	variable	TP19	2.95v	PA_AGC, C811, N801, N601, R630, R621.

Table 4: RF and DC probing for Power detector AMPS mode

Power Level	P_DET Power measured at L801	DC level measure at C807	PWROUT Dc level measured at J603
PL2	-10.2 dBm	1.42 Vdc	
PL3	-11.5 dBm	1.57 Vdc	
PL4	-16.9 dBm	1.70 Vdc	
PL5	-19.7 dBm	1.83 Vdc	
PL6	-23.4 dBm	1.89 Vdc	
PL7	-27.9 dBm	1.94 Vdc	

VCO Probing

Table 5: UHF LO Troubleshooting

UHF LO at 1009.62 MHz for channel 384 N503 UHF LO Tx Buffer Amplifier	TP21 TP22	Check gain across N502 should be ~ 4dB.	Check Buffer Amp N502 has supply voltage VR6 at pins 4 and 6. Check components L520, R505, R506, R519, R509, C510, C506, L503, R502 and L771.
UHF LO at 1009.62 MHz for channel 384 G502 UHF LO	TP23	Power approx. -2 dBm.	Make sure there is 2.7V at pin 3 of G502 checking components R515, C511 and C501. Check that control voltage is present at pin 1 of G502. If voltage is 2.7V, check TP24 with a RF probe to see if UHF LO is present. Check L520, R506, L516 and C516.
UHF LO at 1009.62 MHz for channel 384 N507 Synth PLL	TP25	Power approx. –21 dBm.	If LO is present but incorrect frequency proceed to TP25 check control voltage when PLL locked should be 2.0 Vdc. Confirm Loop filter components C518, C508, R508, R503, C509, R550, and C550. Pay particular attention to C508, as it is easily damaged. Check supply voltage to N507 at pin 18 is @ 2.78 Vdc(VR4 via R501 is VPLL) and charge pump input voltage VR1A is at 4.75 Vdc at pin 20(check C504, R513 and C521). VIO should be 1.8 Vdc at pins 15 and 16.
UHF LO at 1009.62 MHz for channel 384 N507 VCTCXO input CLK19M2_R at 19.2 MHz	TP26 TP29	19.2 MHz at amplitude of -28.0 dBm	Check that clock is present at TP26 at 19.2 Mhz C519. If not present proceed to Table 6. Check C513

Table 6: VCTCXO Troubleshooting

VCTCXO G501 at 19.2 MHz	TP30	AFC_Volt PDM [0]=2.2V [-1024]=1.4 [+1023]=3.1	Check supply voltage VR3 at G501 is at 2.7 Vdc, verify C520, R512 and C505. Control voltage AFC should be ~ 1.27 Vdc, check R511, R510, C503 make sure VR1A is present at 4.75 Vdc. Check AFC PDM control in local mode using Table 7 as a reference.
CLK19M2_R	TP29	19.2 MHz at amplitude of -24.0 dBm	Check C513
CLK19M2_B	TP32	19.2 MHz at amplitude of -24.0 dBm	Check C512
CLK19M2_UPP	TP31	19.2 MHz at amplitude of -21.0 dBm	Check Buffer Amplifier V500 for correct dc bias voltages via VR3. Emitter = 0.38 Vdc Base = 1.04 Vdc Collector = 1.75 Vdc Check components V500, C502, R520, R521, R522, R517, R518, C523, C525 and C524.

Table 7: AFC PDM (Local Mode) AMPS

AMPS Mode			
PDM Setting	**AFC Voltage**	**Frequency Output @ G501 using Oscilloscope**	**Frequency Output @ G501 using Spectrum Analyzer**
-1024	1370 mV	19.19 MHz	19.199515 MHz
-512	1780 mV	19.21 MHz	19.199735 MHz
0	2.2 V	19.23 MHz	19.199965 MHz
+512	2.65 V	19.23 MHz	19.200000 MHz
+1023	3.1 V	19.23 MHz	19.200220 MHz

Receiver Probing

Table 8: Receiver PDM values

	PDM lower limit	PDM upper limit	PDM Mean	PDM Mean voltage	RX Power in	RSSI
AMPS ch 384 LowGain	2	102	55	0.98	-65 dBm	should be within +/-2 dB of actual RX signal above -104 dBm, +2/-4 below -104
AMPS ch 384 HighGain	127	215	173	1.19	-65 dBm	
CELL ch 384 Low-Gain	-1	106	60	0.99	-65 dBm	
CELL ch 384 High-Gain	-119	-3	-64	0.78	-95 dBm	

- In AMPS, ensure 210 mV on I,Q traces of Batman out, probing points TP45 - 48.
- Use CW signal for AMPS, use CDMA signal for CELL. Call box can generate both.

Table 9: RF Probing for Cell CDMA and AMPS Front End Receiver

Probing point	Probing location on the board	Probed Absolute Power (dBm), or gain/loss (dB)	What to check if RF power not correct (soldering, shorts, DC power applied if active, correct voltage of DC signals, otherwise replace)
RF Connector (X814) out= cell duplexer (Z803) in.	TP9	Loss=0.2 dB through X814	X814, X811, X812, L805, C821 L806 and Z803.
Cell duplexer (Z803) out= Alfred (N750) in	TP35	Loss= 2 to 4dB through duplexer	Z803, L750, N750 (VRX)
Alfred (N750) LNA out= cell RX saw (Z751) in	TP36	Gain=12-15 dB for high gain mode (GAIN_ CTL=high. Use RF AGC status window to monitor state.), Loss=-3 to –5 dB for low gain	N750 (Also ensure IF_SEL low for CDMA and high for AMPS, as in Table 11. Ensure GAIN_CTL is high if RX power is below the LNA switch point.), Z751, C755, L752, C757, R764, C753, R765, C750 and voltage VRX at N750 pin13(2.78 Vdc).

Cell RX saw (Z751) out=Alfred (N750) mixer in	TP37	Loss=1-3 dB through SAW filter	Z751, N750, L757 and C758.
UHF LO at 1009.62 MHz in Cell CDMA/AMPS for channel 384	TP38	Approx. -3 dBm	Check to see if LO is present. If no LO is present, check L771, R505 and L520. Refer to Table 5 for additional UHF LO troubleshooting.
Alfred (N750) Mix_Out= at 128.1 MHz Alfred (N750) IFA_In=	TP39	Rx 1st IF at 128.1 MHz is usually -5.0 to -7.0 dBm less than original Rx input amplitude setting at RF Test Set.	Check LP filter components L753, C759, C766 and L770.

Table 10: RF Probing for AMPS Back End Receiver

Alfred (N750) IFA_In= Alfred (N750) AMPS out=	TP40	This point not 50 ohms. Will measure approx + 3 dB gain from IFA Amplifier. Using results fromTP39 as reference.	Ensure IF_SEL low for CDMA and high for AMPS, as in Table 11), N750, R765, C750, L757 and also reference next step(TP41) to ensure that impedance matching components from N750 to Z752 are correct.
Alfred (N750) AMPS out= Amps RX IF filter(Z752) in=	TP41	Same results as above if matching components are correct	Check Z752, C784, L764, C781, L762, C783, C786, C761, L754, C782 and C767 also ensure dc voltage Vrx is present at L762.
AMPS RX IF filter (Z752) in= AMPS RX IF filter (Z752) out=	TP42	This point not 50 ohms. Will measure Loss of =2-4 dB through Crystal filter	Z752, L765, C777, L766, C778, L768, L767, C779, N701 (VR5, VR7, VIO)
AMPS RX IF filter (Z752) out= Batman (N701) in=	TP43 TP44	You will measure usually –10 dBm less than previous test point.	Z752, L765, C777, L766, C778, L768, L767, C779, N701 (VR5, VR7, VIO)

Batman (N701) out= UEM (D200) in	TP45 TP46 TP47 TP48	Adjust input frequency at RF Test Set so it is offset by 20 kHz. Measure frequency amplitude and voltage peak-peak. Should be 20 kHz signal with 2.75 Vpp. RX_IF_AGCPDM value set to –256.	N701 (VR5, VR7, VIO, ensure 1.35v on VREFRF01 as in Table 11, also check RX_IF_AGC as in Table 11, R706, C704, R705, C706, R435, C428, C435. Check also the control signals to Batman(N701) PURX (J402), RF_BUS_EN1X(J608), RF_BUS_CLK(N507 pin 10) and RF_BUS_DATA(N507 pin 12).
VHF LO at 256.2 MHz	TP49	VHF amplitude is ~ -8 dBm	N701, C701, C714, R703, R702, C715, R704, V701, C716, L701, C702, R705, C706.
CLK19M2_B at 19.2 MHz	TP50	Amplitude of -24.0 dBm	Check C513 If signal not present continue TS using Table 6.

Table 11: DC Probing for Receiver

Item to check	setting	DC probing location on board	DC Voltage	Items to check if voltage incorrect
RX IF AGC	See Table 8 for PDM settings	TP51	See Table 8 for typical voltages	D400, R435, C428, C435, N701
GAIN_CTL	High=LNA high gain, Low=LNA low gain	TP52	High=2.4vmin, Low=0.3v max	N701, N750, R764, C753
IF_SEL	High= AMPS, Low= CDMA	TP53	High=2.4vmin, Low=0.3v max	N701, N750, R765, C750
VREFRF01	fixed	TP54	1.35 v	D200, C706, N701

Table 12: RF Probing for Cell CDMA Back End Receiver

Alfred (N750) IFA_In= Alfred (N750) CDMA out=	TP45a	This point not 50 ohms. Will measure approx + 8 to +12 dB gain from IFA Amplifier. Using results fromTP39 as reference.	Ensure IF_SEL low for CDMA and, as in Table 11), N750, R765, C750, L757 and also reference next step(TP45b) to insure that impedance matching components from N750 to Z753 are correct.
Alfred (N750) CDMA out= CDMA RX IF filter(Z753) in=	TP45b	Same results as above if matching components are correct	Check Z753, C784, L764, C781, L762, C783, C786, C761, L754, C782 and C767 also ensure dc voltage Vrx is present at L754.

CDMA RX IF saw (Z753) out= Batman (N701) in	TP46a TP47a	You will measure a loss that is usually −15 to −17 dBm less than previous test point.	Z753, N750 and supporting components L759, C770, C771, C772, L760, L761, N701
Batman (N701) out= UEM (D200) in	TP45 TP46 TP47 TP48	Measure voltage peak-peak. RX_IF_AGC PDM value set to −256.	N701 (VR5, VR7, VIO, ensure 1.35v on VREFRF01 as in Table 11, also check RX_IF_AGC as in Table 11), R706, C704, R705, C706, R435, C428, C435. Check also the control signals to Batman(N701) PURX (J402), RF_BUS_EN1X(J608), RF_BUS_CLK(N507 pin 10) and RF_BUS_DATA(N507 pin 12).
VHF LO at 256.2 MHz	TP49	VHF amplitude is ~ -7.0 dBm	N701, C701, C714, R703, R702, C715, R704, V701, C716, L701, C702, R705, C706.
CLK19M2_B at 19.2 MHz	TP50	Amplitude of -24.0 dBm	Check C513 If signal not present continue TS using Table 6.

RF Power Supplies

Table 13: DC Supplies for RF circuitry

Supply	Voltage	Supplied Components
VR1A	4.75	VCTCXO, UHF PLL, Charge Pump
VR1B	4.75	Robin
VR2	2.78	Robin, Power Detector
VR3	2.78	Robin, VCTCXO
VR4	2.78	UHF PLL
VR5	2.78	Batman
VR6	2.78	UHF LO Buffer
VR7	2.78	Batman

APPENDIX A: Phoenix Instructions

Phoenix Paths:

Local Mode: Troubleshooting - DSP/MCU - Phone Control - Phone State - Local -- Execute

Normal Mode: Troubleshooting - DSP/MCU - Phone Control - Phone State - Normal -- Execute

Reset Phone: Troubleshooting - DSP/MCU - Phone Control - Phone State - Reset

AMPS Rx: Troubleshooting - RF - Main Mode, Band Cell(AMPS), Mode (Rx), Channel ?, Set.

CDMA Rx: Troubleshooting - RF - Main Mode, Band Cell(CDMA), Mode (Rx), Channel ?, Set.

AMPS Tx: Troubleshooting - DSP/MCU - AMPS Control - Tx Control , Set Channel ?, Power Level (0-7), Check Transmitter On, Execute.

CDMA Tx: Troubleshooting - RF - Main Mode, Band Cell(CDMA), Mode (Rx/Tx), Channel ?, Set.

CDMA Control(Rho): Must set CDMA Tx first, Then DSP/MCU - CDMA Control, State Rho ON, Band Cell, Set default PDM values, Radio Configuration ?.

CDMA Control(Rho): Must set CELL Tx/Rx first, Then DSP/MCU - CDMA Control, State Rho ON, Band CELL, Set default PDM values, Radio Configuration ?.

PDM Control: Troubleshooting - RF - PDM Control, select settings then Set.

Batch Tunings: Troubleshooting - RF - Read Parameters, Load File (template.tun) then open, Read all.

I/Q Offsets: Troubleshooting - RF - Test Tones, slide bar for setting, select SSB-SC, and press Set.

Audio Control: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Audio Test, select Audio Loop, Loop to ON, Do Not select "Set Audio Test Mode".

Buzzer Control: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Audio Test, select Frequency and Strength, then Volume to ON.

ADC Readings: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - ADC Readings, Make Sure Battery Current and Battery Current Fast are not selected, Press read.

BB Self Tests: Set Local Mode First, Testing/Troubleshooting - Baseband Testing -BB Self Tests, Run All.

Display Test: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Display Test, Select test and Pattern.

LED's Test: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Display Test, Select Keypad and/or LCD Lights.

Keyboard Test: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Keyboard Test, Press key on Phone and look at result.

Vibra Test: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - Vibra Test, Vibra State to Enable, Vibra Intensity to ?.

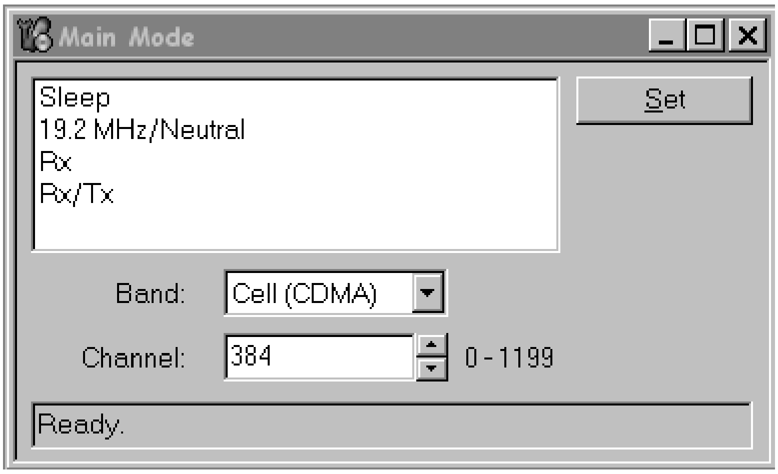
Phone Information: CDMA - Phone Information.

Phone Settings: CDMA - Phone Settings.

EM Calibration: Set Local Mode First, Testing/Troubleshooting - Baseband Testing - EM Calibration.

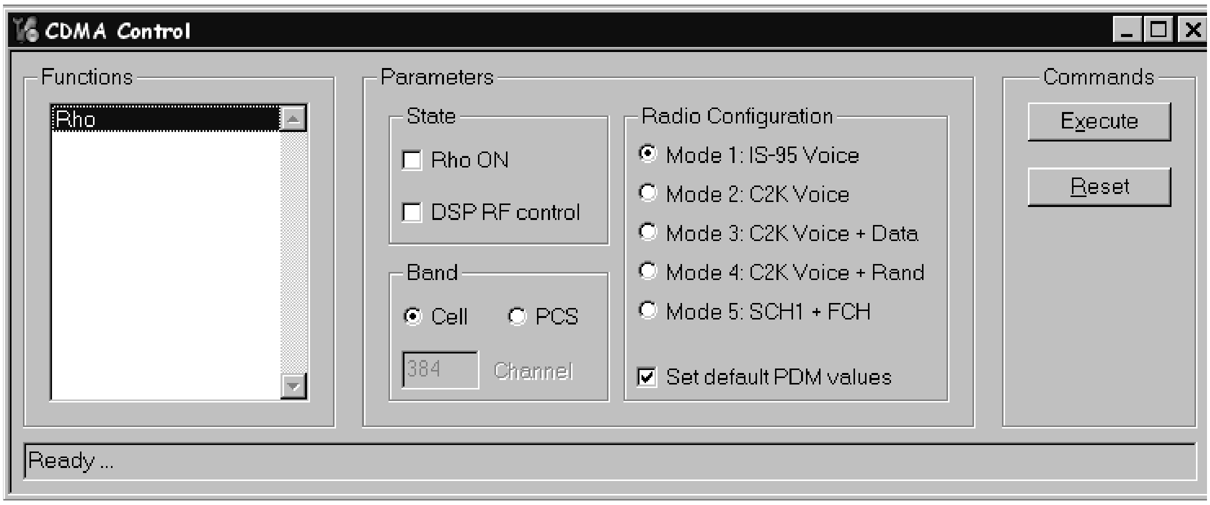
To turn off Cell CDMA Transmitter

Under the RF menu, choose Main Mode, which opens the dialog box shown below.



To turn on the transmitter, first turn on the carrier by highlighting "RX/TX" in the sub-window at the top (which also turns on the receiver), typing the channel in the Channel field, then clicking the **Set** button in the upper right-hand corner.

Next, turn on the modulation by opening the CDMA Control dialog box under the DSP menu. This dialog box is shown next.

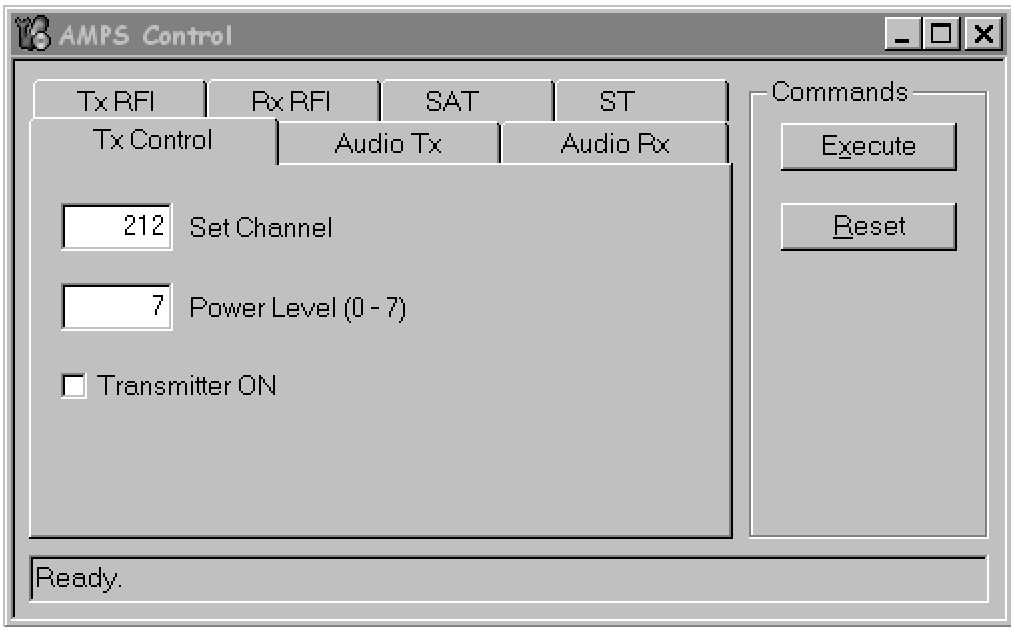


Highlight "Rho" in the Functions field, and click Rho ON in the State field. Choose Cell in the Band field. Under Radio Configurationm choose the desired configuration. C2K is an abbreviation for IS2000. Click **Execute**.

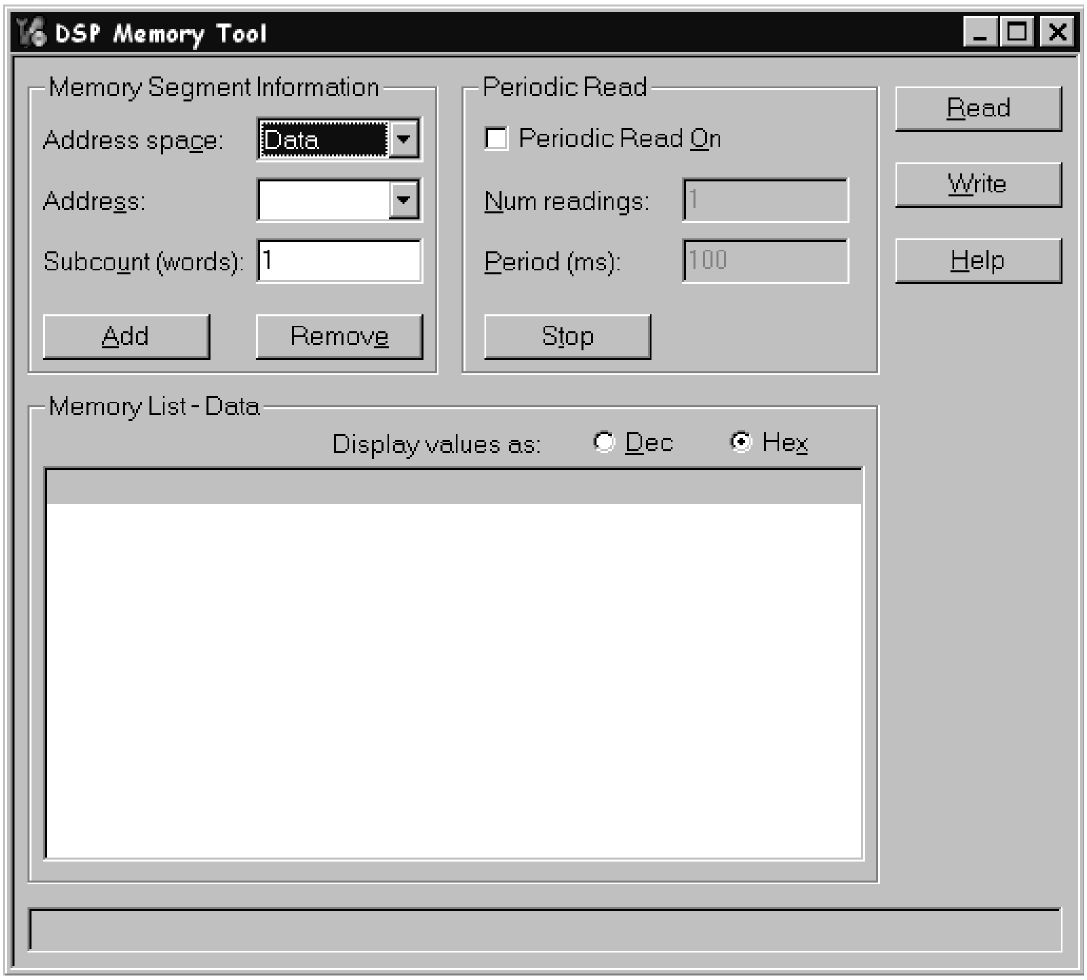
To turn on the AMPS transmitter

Eventually, the method will be to use the RF Main Mode dialog box as shown above, choosing AMPS in the Band field. However, at the moment there is a software problem with this method, with the result that once the AMPS transmitter is turned on in this manner, it does not respond correctly to AGC PDM adjustment.

As a temporary solution, the AMPS Control dialog box, shown below, can be used.



Select the desired channel and power level, click Transmitter ON, then click the **Execute** button. The reason why this is a temporary solution is because in some instances, the AFC and AGC are not disabled, with the results that the signal will not be stable in frequency and will not respond to AGC PDM adjustment. If this is the case, manually disable the AFC and AGC using the DSP Memory dialog box that follows.



Choose the"Data option in the Address Space field, type in the address, leave the Subcount entry at 1, then click the **Add** button. The address will then be displayed in the field in the lower half of the window. Use this method to enter in both the AFC Disable and AGC Disable addresses. These addresses can be obtained from R&D, and they can change with software version. This is the reason this method is temporary.

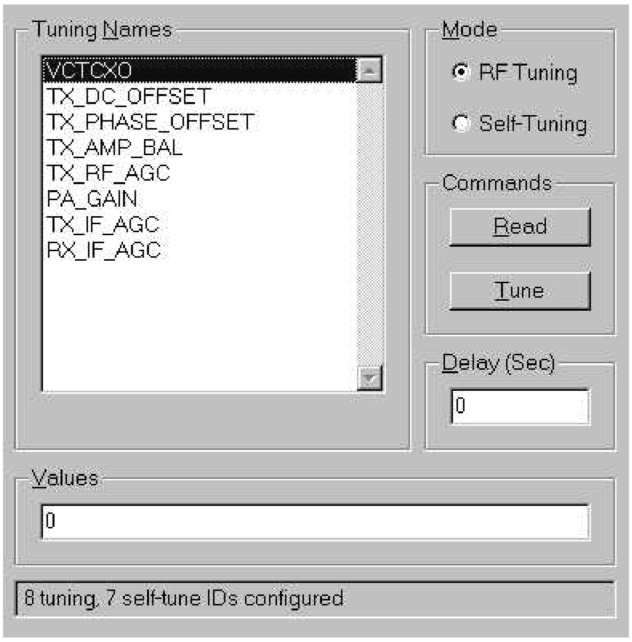
Once both addresses are entered, check "Periodic Read On", then click "Stop". Then click the "Read" button, which will display the values in both addresses. Both should be "1". Change both to "0" by clicking on the "1", which will highlight the data in the address, then you can edit the contents and change the "1" to a "0". Hit the return button on your keyboard to enter the new value. Once the contents of both addresses are changed to "0", click the "Write" button, which writes them into the phone. This data will remain in the phone until the phone is powered down.

To turn on the receiver only, in any mode

To turn on the receiver only, use the Main Mode dialog box as shown previously, highlight RX. In the Band field, choose Cell CDMA.

To verify a single, manual tuning

Open the RF Tuning window, shown below. The tuning descriptions at the beginning of this document describe the tuning and tell you what you need to enter, if anything, and what values will be returned to you from the phone, if any.

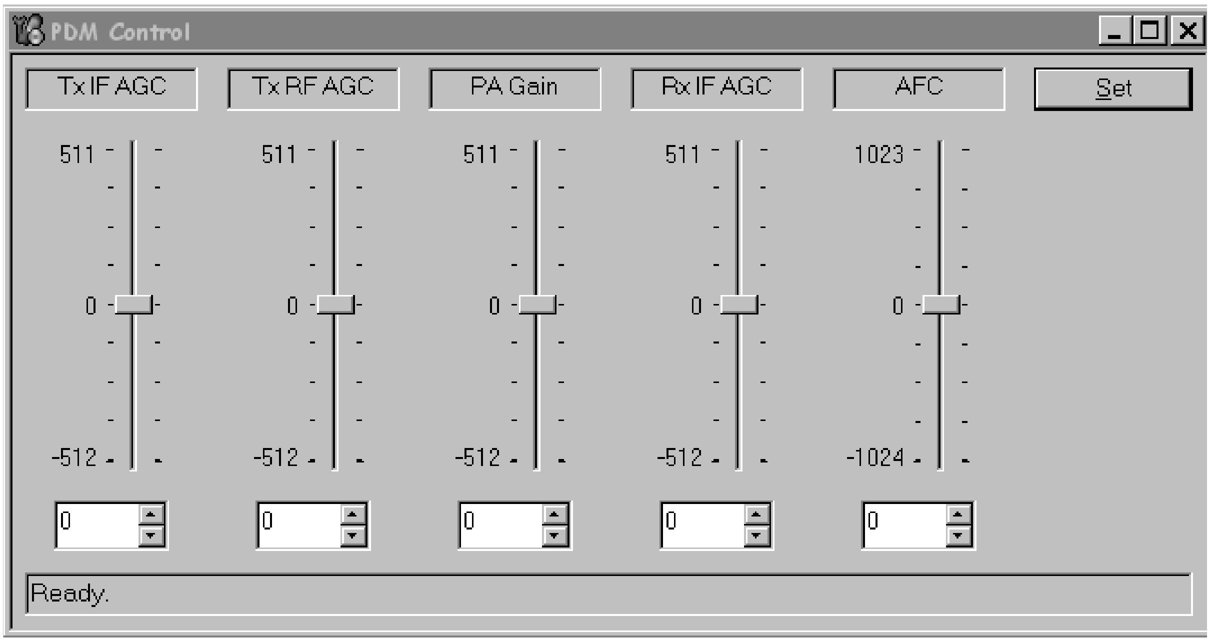


According to these descriptions, choose Self-Tuning for self tunings, and RF Tuning for the others. Choose the appropriate test from the Tuning Names list. Values that you must enter are entered in the Values dialog box. If more than one value is entered, enter a delay time in seconds in the Delay box. This is the delay between applications of the multiple values entered. Three seconds is sufficient for all tests to run; however, in certain cases you may want to increase the delay in order to closely observe the phone's behavior during the tuning.

Any data returned from the phone is displayed on the status line, the box at the bottom which in the following figure says "8 tuning, 7 self-tune Ids configured". If no tuning value is returned, this line will indicate if the tuning was successful or not. To begin a tuning, click the **Tune** button.

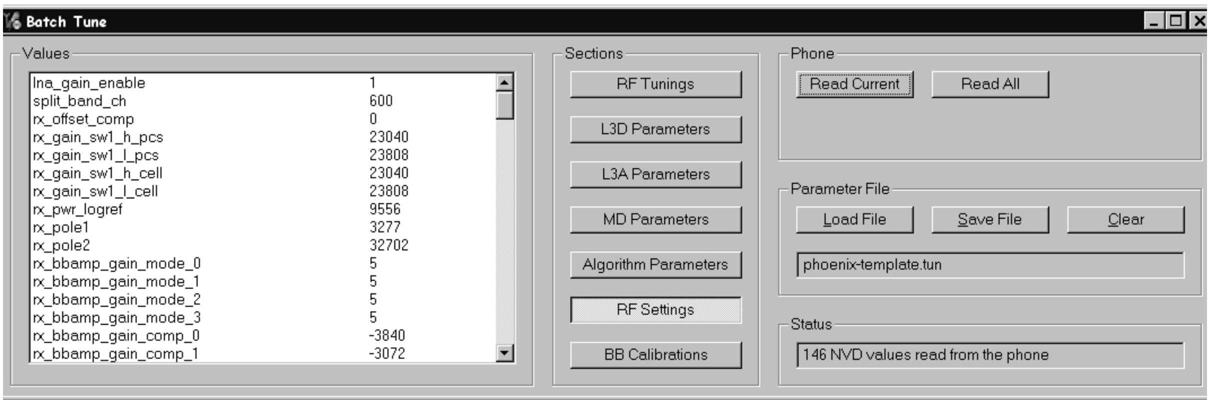
To adjust PDM values of AGCs and AFC

In the PDM dialog box, whic follows, are several sliders, one each for each of the AGCs and the AFC. Drag the slider pointer with your mouse to the value that you want to set. The values are in decimal. Then click **Set**. Alternatively, you can click the up and down arrows next to the value fields below the sliders, which will increase or decrease the value one step at a time. If you do this, you do not have to click **Set**.



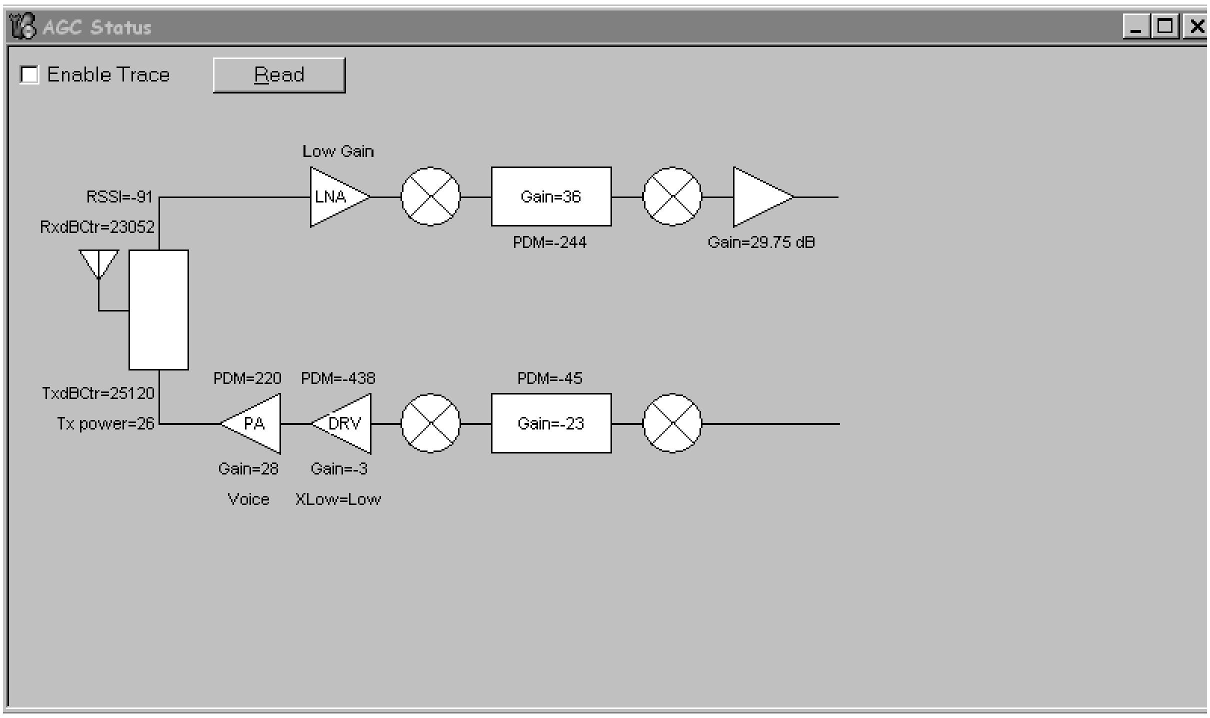
To read tuning values from the phone

Open the Batch Tune dialog box, as shown below. To read the tuning values from the phone, click the **Read All** button under the Phone heading. However, in order for the tuning values to be displayed, you must first load the template file by clicking the **Load File** button under the Parameter File field. Ensure that the template file used is appropriate for the software version in the phone.



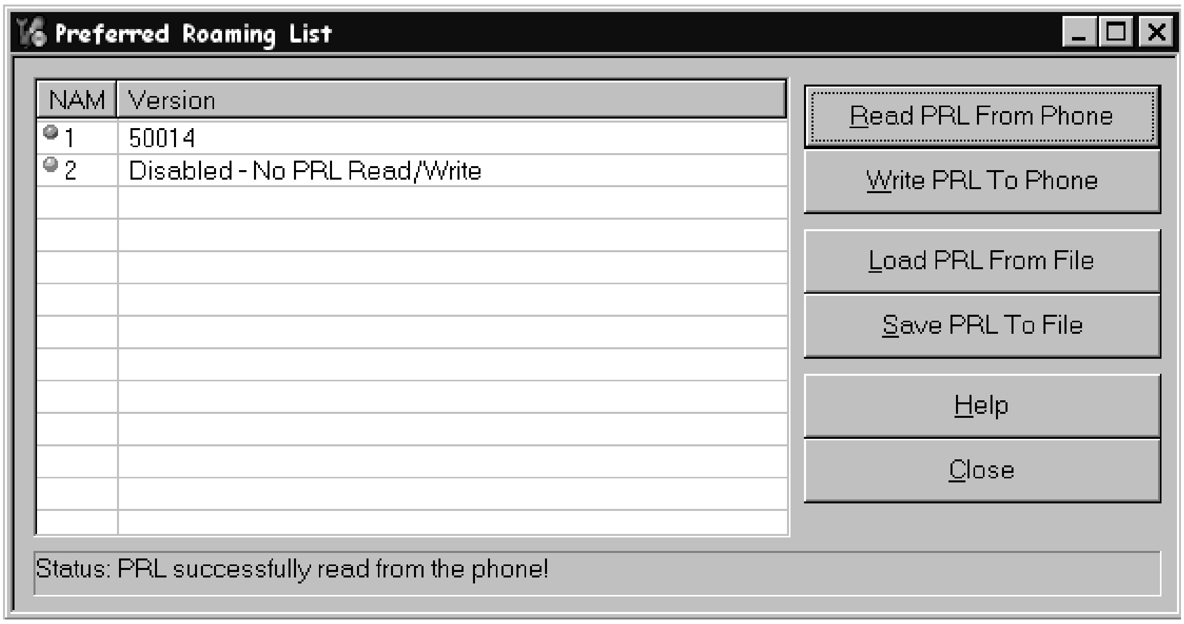
To read RSSI and AGC PDM values from the phone

Open the AGC Status dialog box, which follows. Click Enable Trace. RSSI is the value near the antenna on the receiver side. The AGC PDM values are shown beside their respective variable gain amplifier in the block diagram. The TX AGC PDMs are, as shown in the following diagram from right to left, IF_AGC, RF_AGC, PA_AGC.



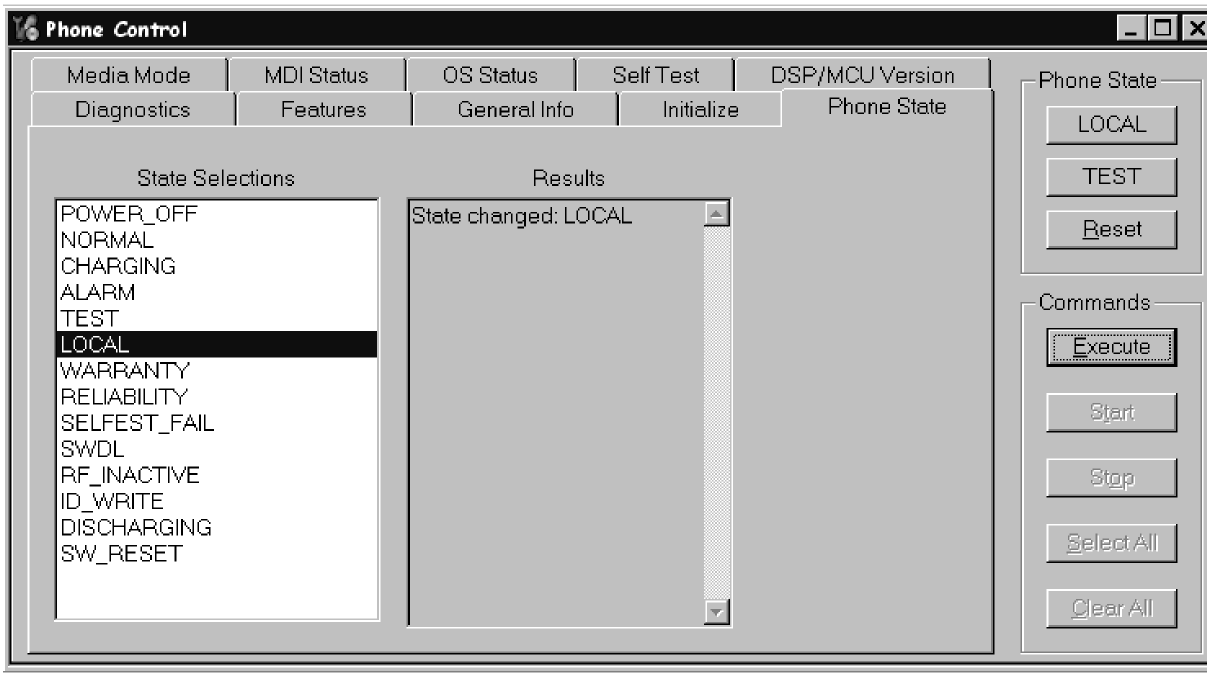
To load a PRL into the phone

Use the PRL dialog box as shown below. Click the **Load PRL From File** button, and choose the desired file, which will then appear in the list on the left side of the window. Highlight the desired file in the list so that it is blue, then click the **Write PRL To Phone** button. At the bottom of the dialog box, a status message will indicate if the file was loaded correctly or not.



To change between Normal and Local modes

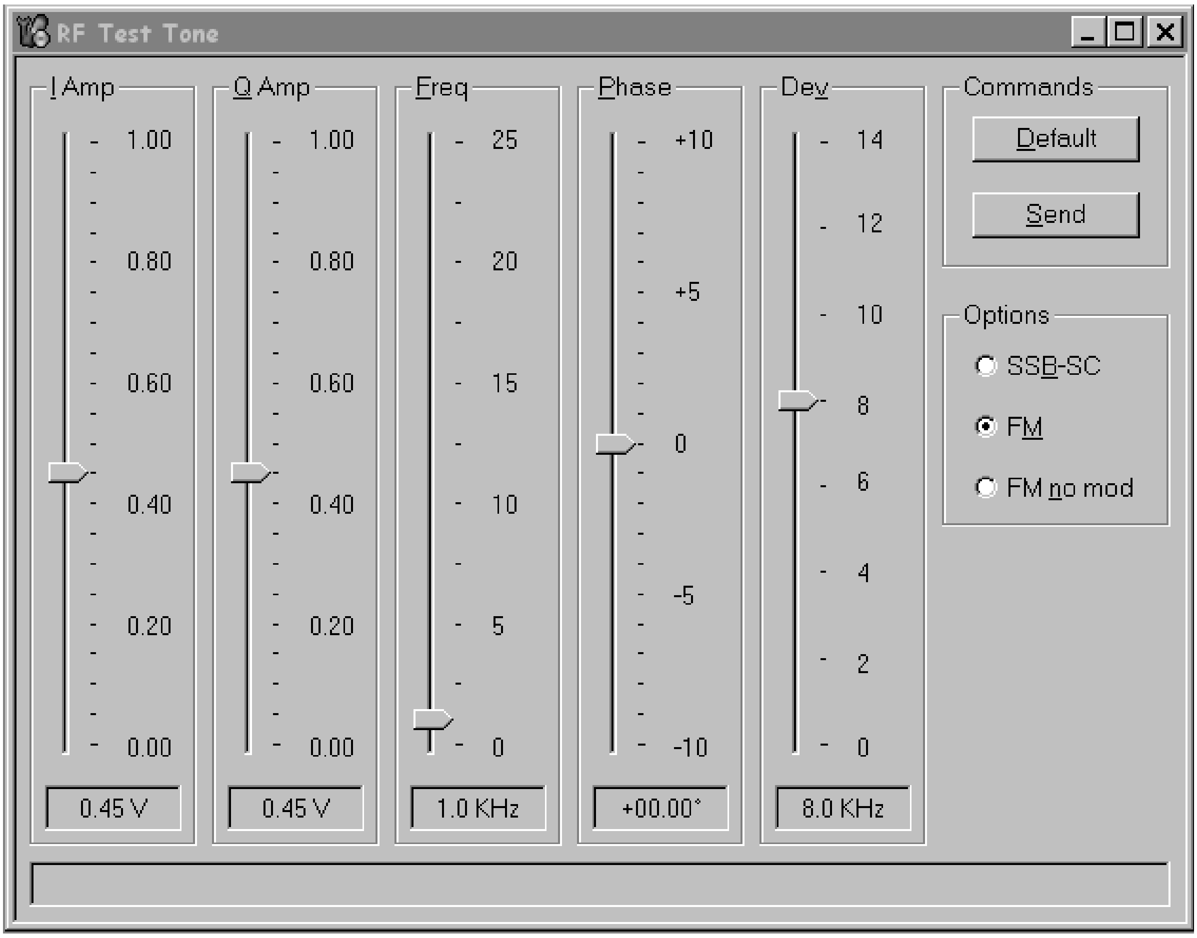
To make a call, the phone should be in normal mode. In normal mode, the phone software is running, and the phone will search for a pilot. To troubleshoot so that you can manually control the phone (not in a call), the phone should be in local mode. In local mode, the phone's software is not running and it will not search for a pilot. To switch between normal and local modes, use the Phone Control dialog box, shown next. This setting will be lost if the phone is powered down.



To add a baseband to the AMPS transmitter

To add a baseband test tone to the AMPS transmitter, open the Test Tone dialog box as shown next and set the parameters as desired.

The DC offset voltages on the I and Q inputs to the modulator are adjusted for minimal carrier feedthrough (maximum carrier suppression). Initially the DC offsets are set to a nominal value, and the power of a tone offset in frequency 20 kHz from the carrier is measured in dBm and recorded as a reference (in this tuning). Then in the next tuning, the carrier suppression (delta between center tone and tone that is offset 20 kHz) is measured. If it passes, it is reported in that tuning. If not, the DC offsets are adjusted until it passes, and the passing value is reported.



APPENDIX B: Definitions

ACPR: Adjacent Channel Power Ratio. A ratio of power at an offset frequency as compared to the power at the center frequency.

ADC: Analog to Digital Converter

AGC: Automatic Gain Control

AFC: Automatic Frequency Control

CW: Continuous Wave. This is a pure sine wave with no modulation such as CDMA or FM.

DAC: Digital to Analog Converter

dB: A power ratio. Formula is 10log(power1/power2). It is used to denote differences, such as gain or loss. Power1 and power2 are in linear units such as W or mW.

dBm: A unit for an absolute power level. Formula is 10log(power in mW/1 mW).

LNA: Low Noise Amplifier

LO: Local Oscillator. This is a CW signal used to mix signals up or down to a different frequency.

PA: Power Amplifier

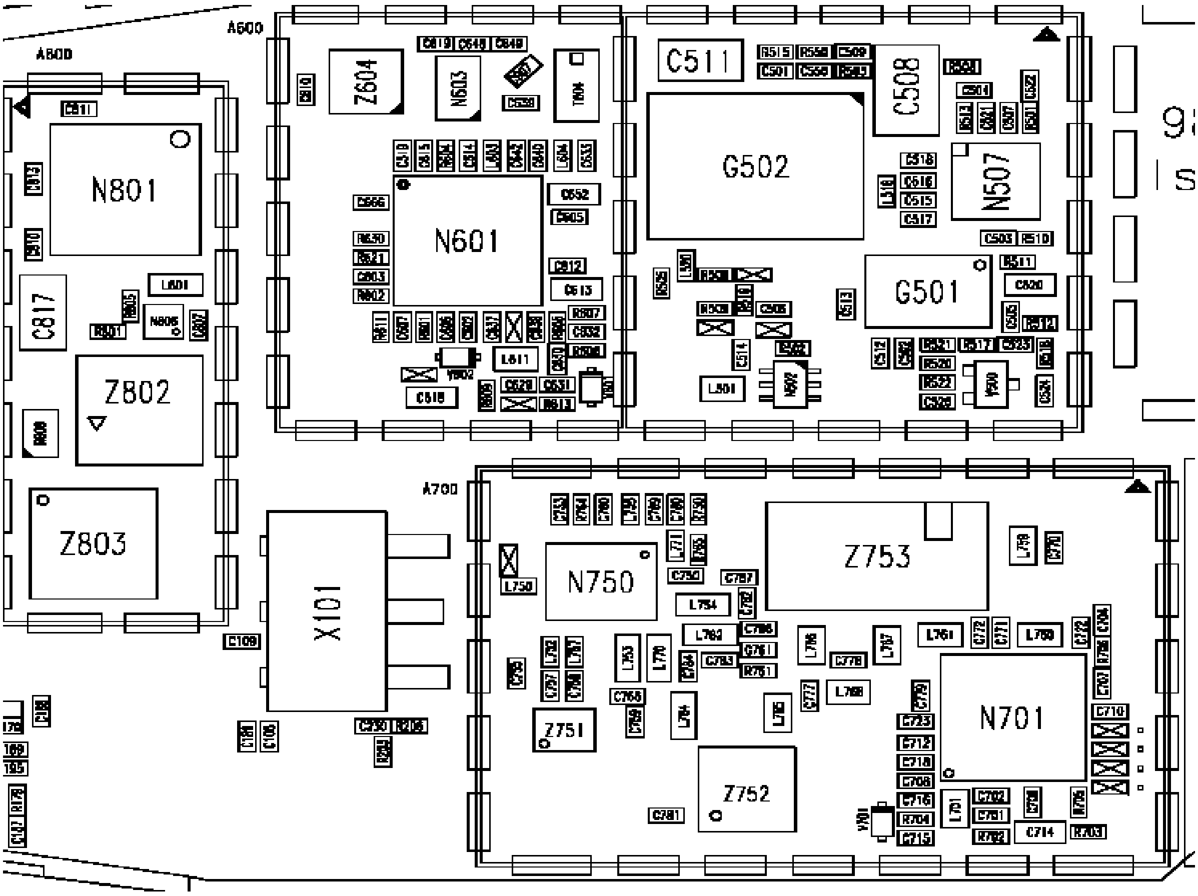
PDM: Pulse Density Modulation. This is used for control signals. The density of a stream of digital voltage pulses is varied proportionally to the desired control level, then it is converted to an analog voltage used as the control signal.

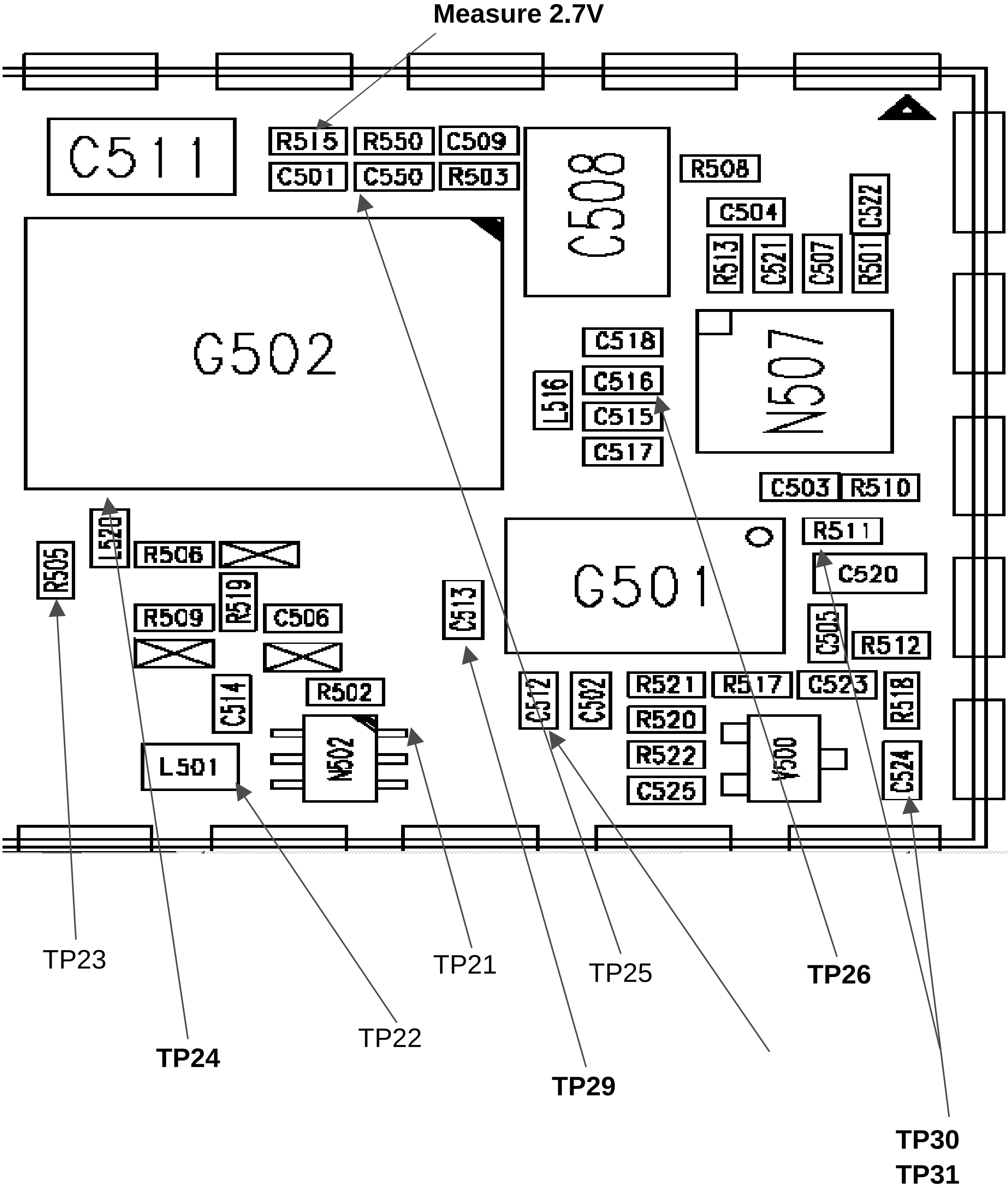
PLL: Phase Locked Loop. Used in Synthesizer circuits to generate an LO.

PPM: part per million

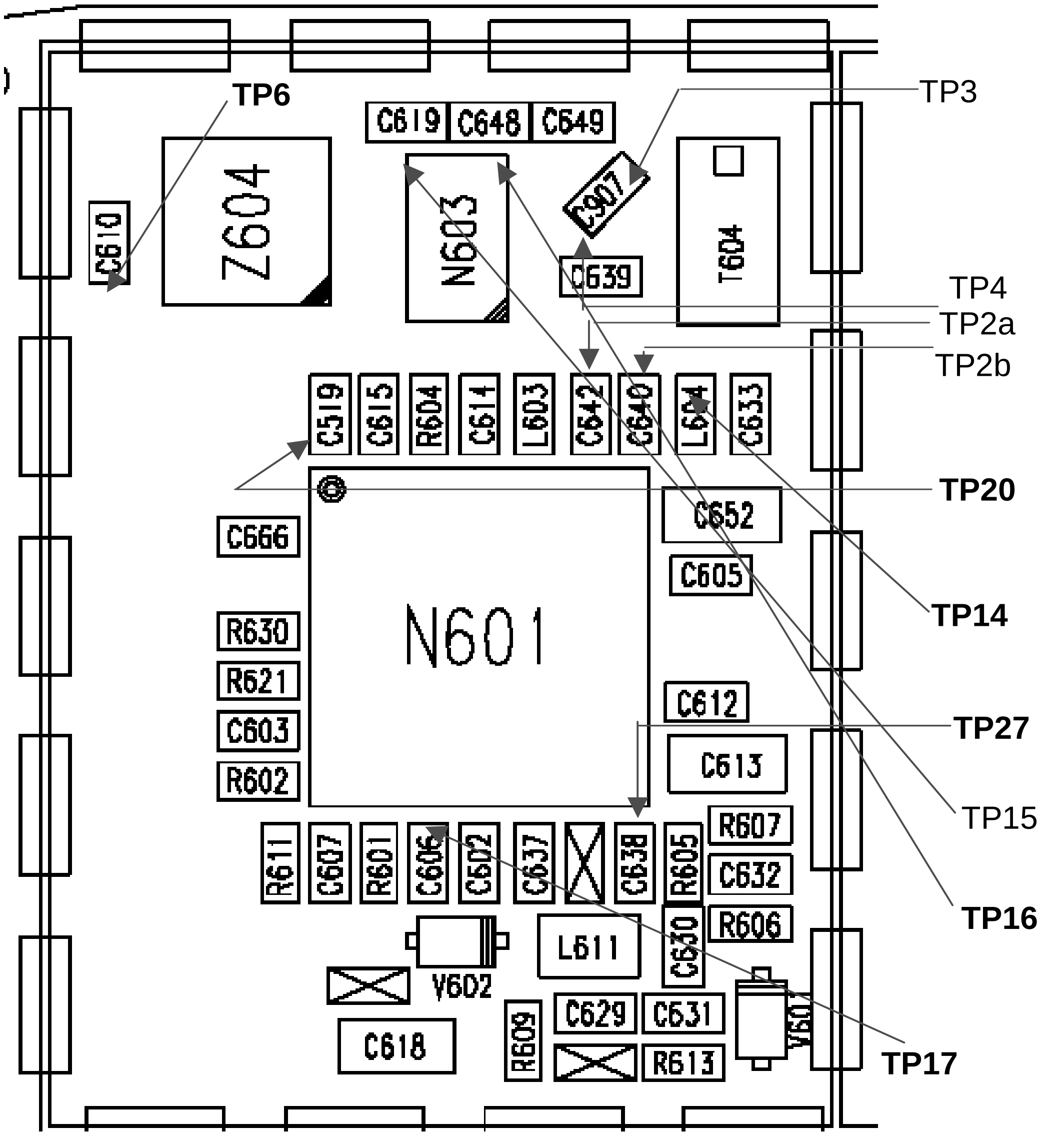
RSSI: Received Signal Strength Indicator.

Radio Portion of Phone Front Panel

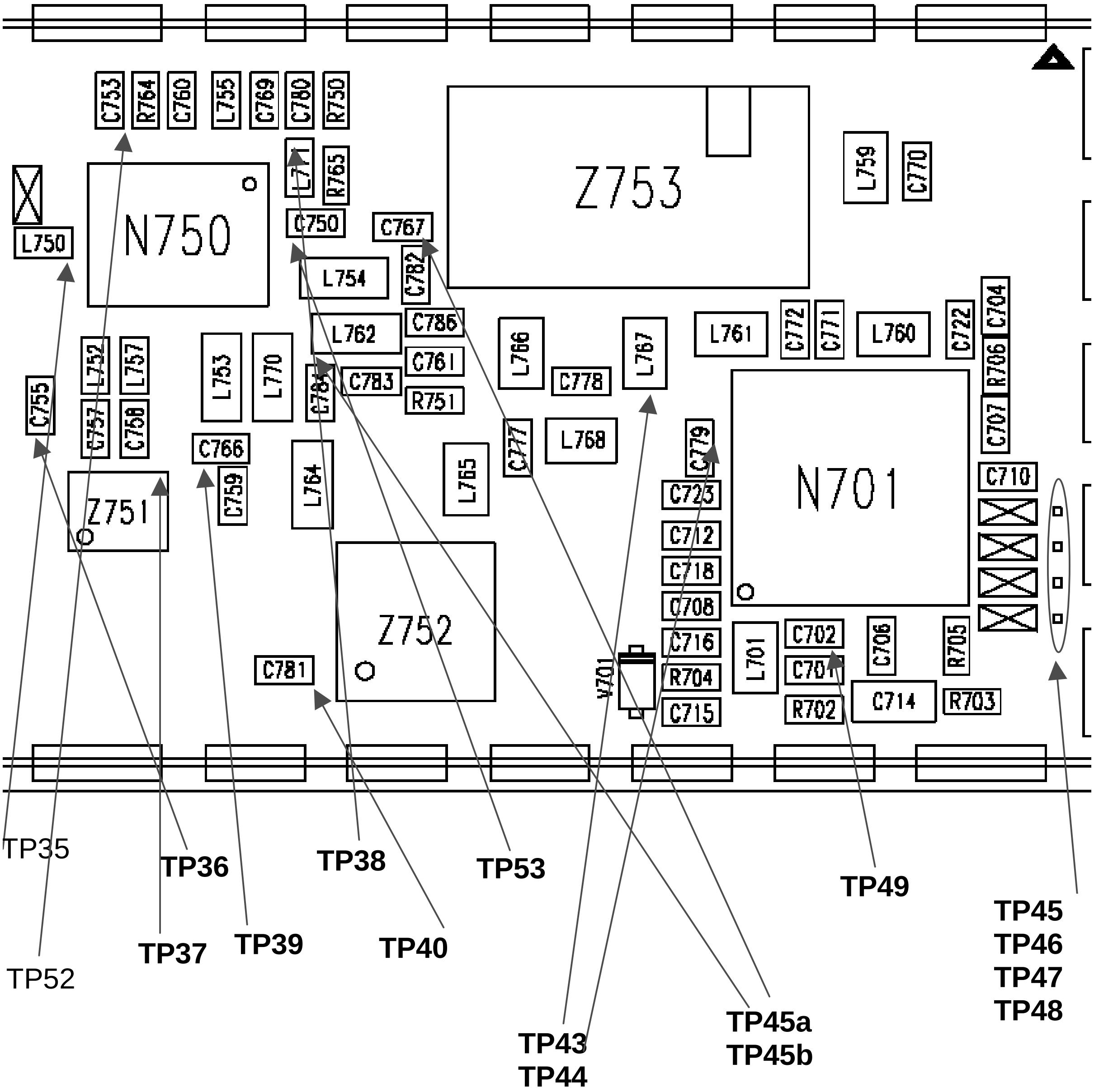


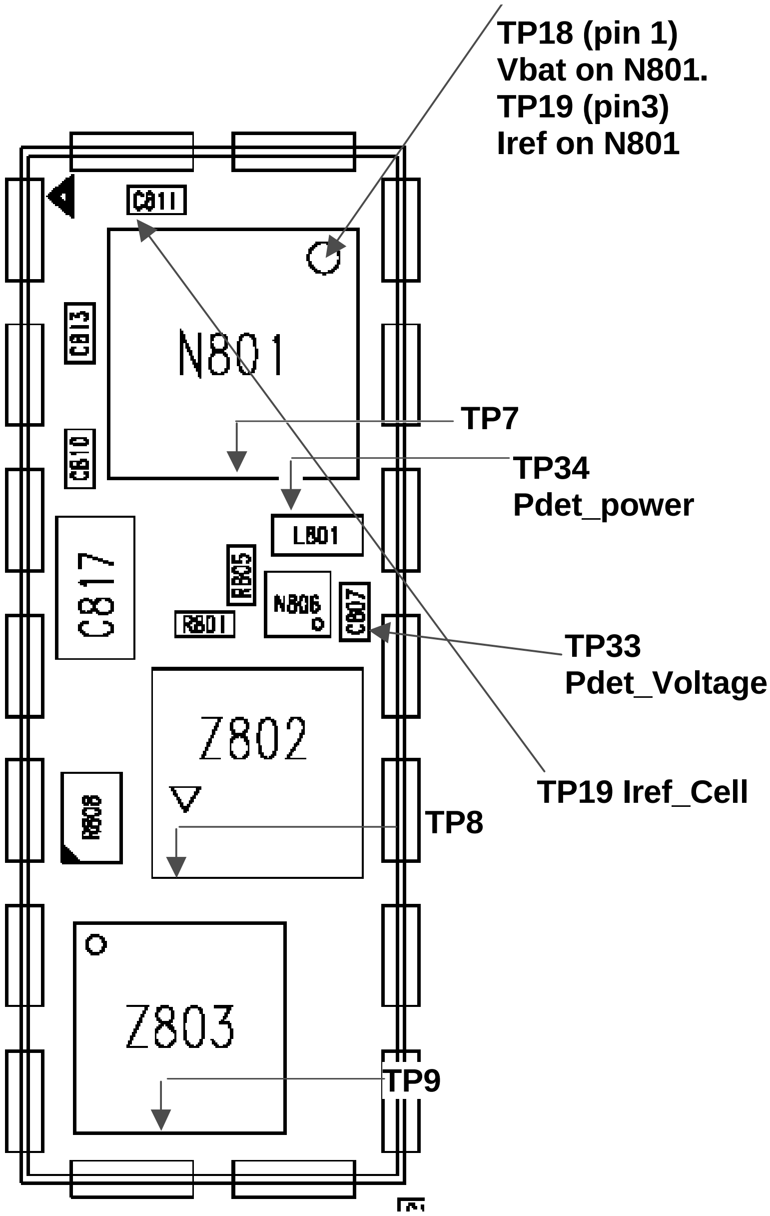

Measure 2.7V
C511
R515
R550
C509
C501
C550
R503
C508
R508
C504
C522
R513
C521
C507
R501
G502
C518
L516
C516
C515
C517
N507
C503
R510
G501
R511
C520
L520
R506
R505
R519
R509
C506
C513
C505
R512
C514
R502
C512
C502
R521
R517
C523
R518
L501
N502
R520
R522
C525
V500
C524
TP23
TP21
TP25
TP26
TP24
TP22
TP29
TP30
TP31

Robin View

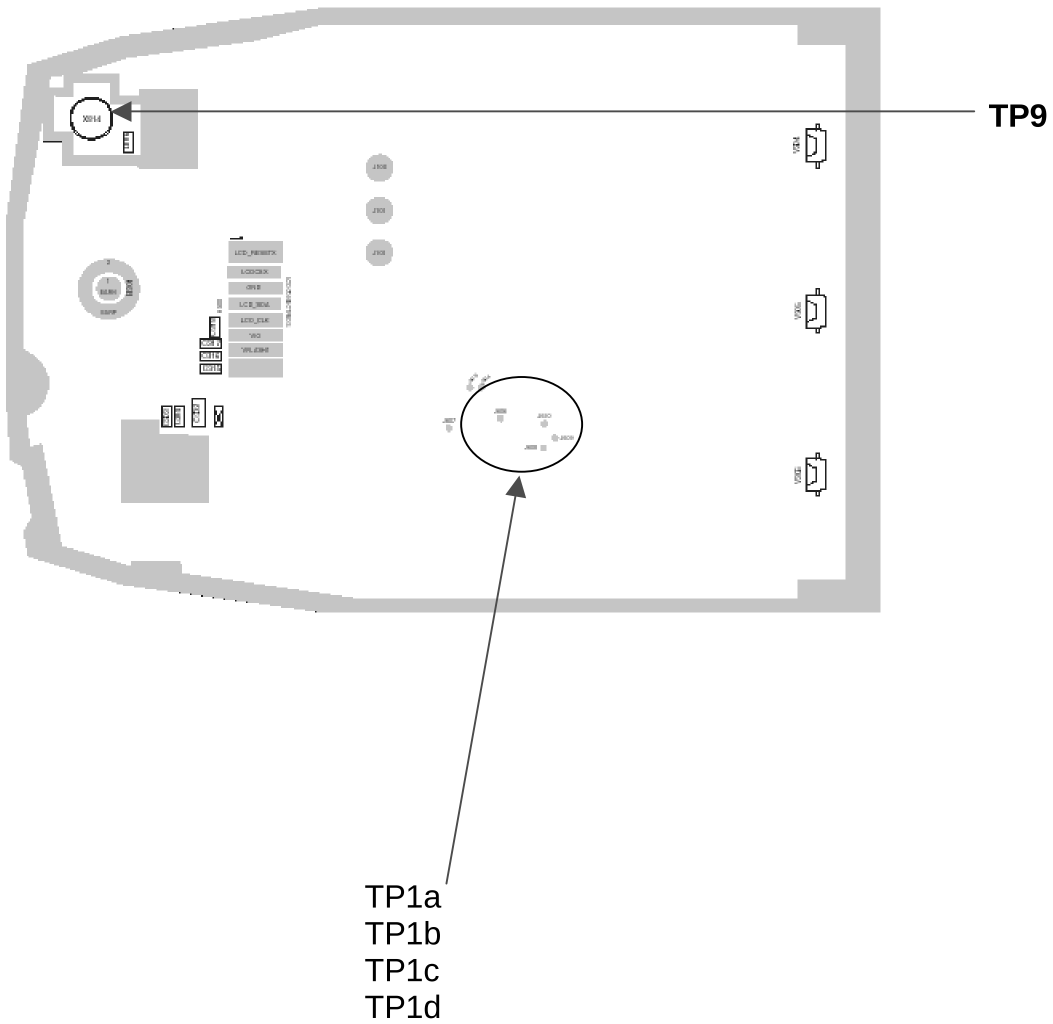

TP6
TP3
C619
C648
C649
Z604
N603
C907
T604
C610
C639
TP4
TP2a
TP2b
C519
C615
R604
C614
L603
C642
C640
L604
C633
TP20
C652
C666
C605
N601
TP14
R630
R621
C603
R602
C612
TP27
C613
R607
TP15
R611
C607
R601
C606
C602
C637
C638
R605
C632
TP16
R606
L611
C630
V602
C629
C631
C618
R609
R613
TP17

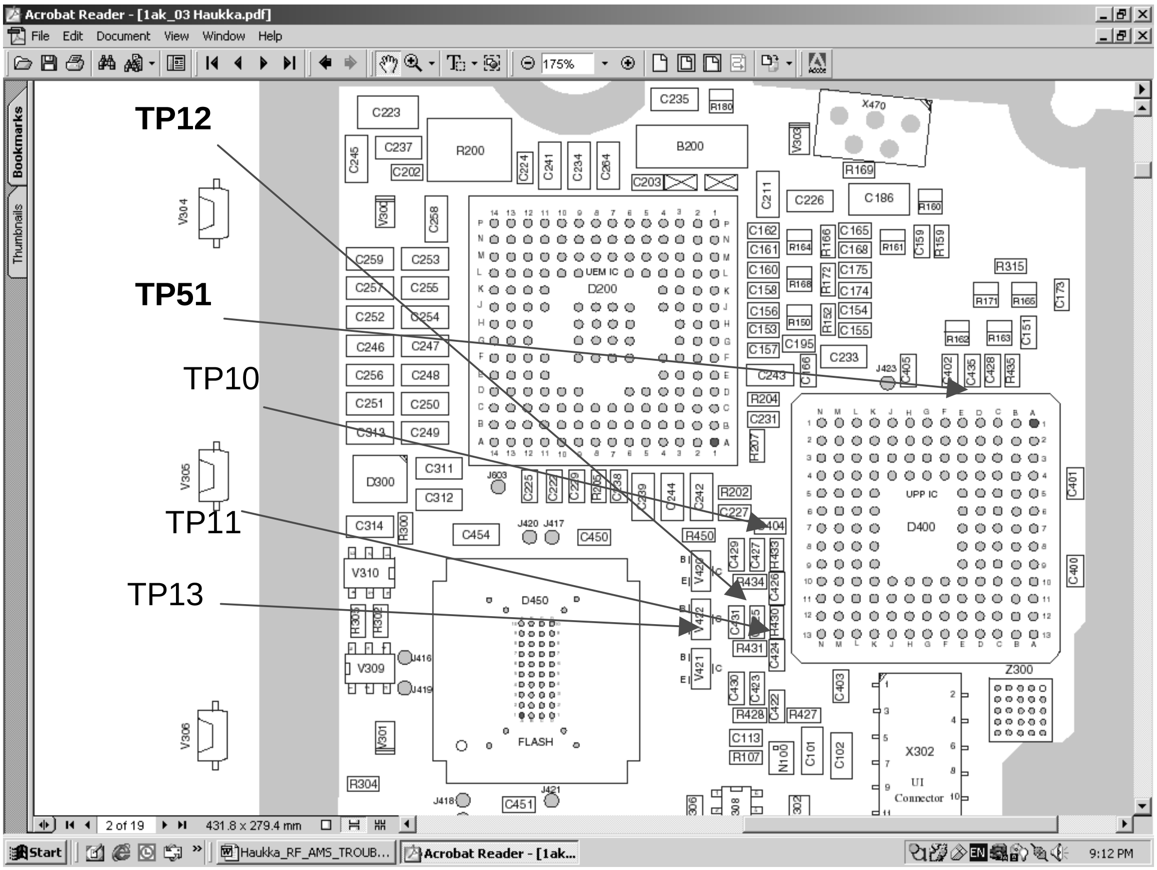
Alfred View


C753
R764
C760
L755
C769
C780
R750
L771
R765
Z753
L759
C770
N750
L750
C750
C767
L754
C782
C786
L762
C761
C783
R751
C784
L752
L757
C755
C757
C758
L753
L770
L766
C778
L767
L761
C772
C771
L760
C722
C704
R706
C707
C710
N701
C766
C759
L764
L765
C777
L768
C779
C723
C712
C718
C708
C716
R704
C715
Z751
Z752
C781
V701
L701
C702
C701
R702
C706
C714
R705
R703
TP35
TP36
TP38
TP53
TP49
TP45
TP46
TP47
TP48
TP37
TP39
TP40
TP52
TP45a
TP45b
TP43
TP44


TP18 (pin 1)
Vbat on N801.
TP19 (pin3)
Iref on N801
C811
N801
C813
C810
TP7
TP34
Pdet_power
L801
C817
R805
N806
C807
R801
TP33
Pdet_Voltage
Z802
TP19 Iref_Cell
R808
TP8
Z803
TP9

Back Panel test points




TP12
TP51
TP10
TP11
TP13