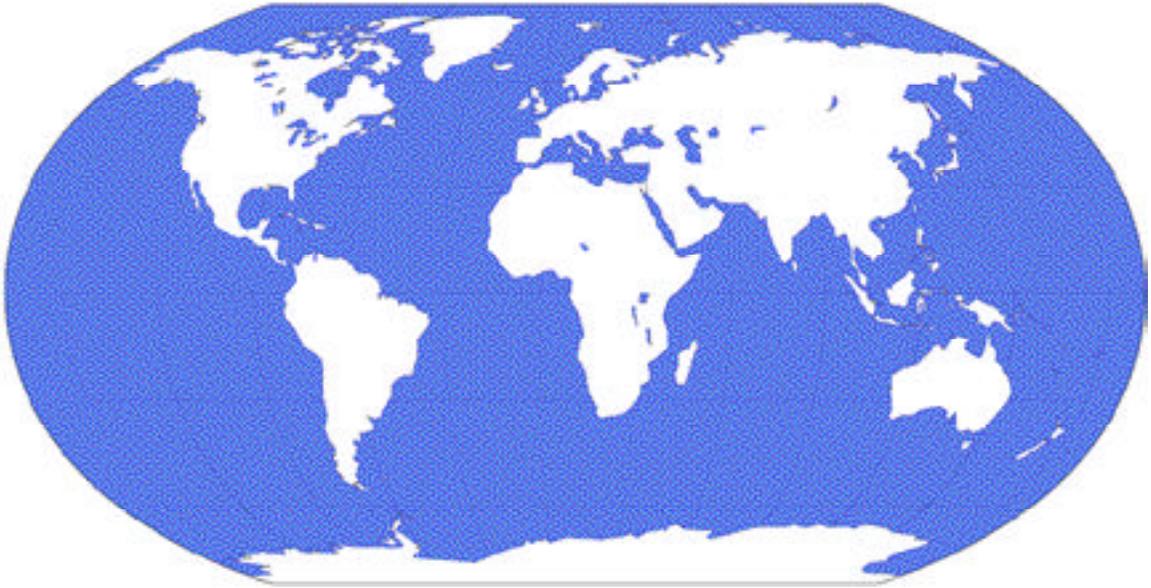




CDMA SC725



The World's Leading Cellular Manufacturer



**Service Manual
Level III**

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Overall System

<i>Function</i>	<i>Specification</i>
Receiver Sensitivity	-116 dBm (AMPS, SINAD, C-MSG weighted) -104 dBm (CDMA, 0.5% Static FER)
Alternate Channel Desense Protection	-60 db @ ± 60 kHz (AMPS)

Environmental

<i>Function</i>	<i>Specification</i>
Temperature Range	Operational -30°C to +60°C (-22°F to +140°F) Storage -55°C to +85°C (-67°F to +185°F) Thermal Shock -40°C to +85°C (-40°F to +185°F) meets Mil. Std. 810C
Shock	Exceeds EIA Standards RS152B (Section 15) and IS-19
Drop	Exceeds EIA Standards RS316B and IS-19
Humidity	95% Relative Humidity; meets EIA Standard IS-19
Vibration	Exceeds EIA Standards RS316B and IS-19
Salt Fog	Salt Solution fog at 35°C (95°F), tested for 48 hours
Dust	140 mesh blown silica flour test, tested for 5 hours
<p>NOTES:</p> <ul style="list-style-type: none"> (1) EIA (Electronic Industries Association) Standard RS152B states the minimum standards for Land Mobile Communications, FM or PM transmitters 25-470 MHz. (2) EIA IS-19 states the recommended standards for 800 MHz cellular subscriber units. (3) EIA Standard RS316B states the standards for portable land mobile communications. (4) U.S. Military Standard 810D establishes uniform environmental test methods for determining the resistance of equipment to the effects of natural and induced environments peculiar to military operations. (5) TIA/EIA/IS-98 Recommended Minimum Performance Standards for Dual-Mode Wide band Spread spectrum Cellular Mobile Stations. 	

Specifications subject to change without notice.

Foreword

Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. It is intended primarily to support basic servicing, which consists primarily of mechanical repairs and circuit board replacement.

Authorized distributors may opt to receive additional training to become authorized to perform limited component repairs. Contact your regional Customer Support Manager for details.

Model and Kit Identification

Motorola products are specifically identified by an overall model number on the FCC label. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them.

Service

Motorola's regional Cellular Subscriber Service Centers offer some of the finest repair capabilities available to Motorola Subscriber equipment users. The Cellular Subscriber Service Centers are able to perform computerized adjustments and repair most defective transceivers and boards. Contact your regional Customer Service Manager for more information about Motorola's repair capabilities and policy for in-warranty and out-of-warranty repairs in your region.

General Safety Information

Portable Operation

DO NOT hold the radio so that the antenna is very close to, or touching, exposed parts of the body, especially the face or eyes, while transmitting. The radio will perform best if it is held in the same manner as you would hold a telephone handset, with the antenna angled up and over your shoulder. Speak directly into the mouthpiece.

DO NOT operate the telephone in an airplane.

DO NOT allow children to play with any radio equipment containing a transmitter.

Mobile Operation (Vehicle Adaptor)

As with other mobile radio transmitting equipment, users are advised that for satisfactory operation of the equipment and for the safety of personnel, it is recommended that no part of the human body shall be allowed to come within 20 centimeters of the antenna during operation of the equipment.

DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere. Mobile telephones are under certain conditions capable of interfering with blasting operations. When in the vicinity of construction work, look for and observe signs cautioning against mobile radio transmission. If transmission is prohibited, the cellular telephone **must be turned off** to prevent any transmission. *In standby mode, the mobile telephone will automatically transmit to acknowledge a call if it is not turned off.*

All equipment must be properly grounded according to installation instructions for safe operation.

Portable/Mobile Telephone Use and Driving

Safety is every driver's business. The portable telephone should only be used in situations in which the driver considers it safe to do so. Use of a cellular portable while driving may be *illegal* in some areas.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

Preface	iii
Specifications.....	iii
Overall System	iii
Environmental	iv
Forward	v
Scope of Manual	v
Model and Kit Identification	v
Replacement Parts Ordering	v
Service	v
General Safety Information	vi
Description	1
Cellular System Overview	1
Overall Concept.....	1
Operation	2
Service Area.....	2
Theory of Operation	3
Receiver Circuitry	3
Block Diagrams	3
Transmit Power Control Circuitry	5
Receive Audio - AMPS Mode	5
Receive Audio - CDMA Mode	5
Transmit Audio - AMPS Mode	5
Transmit Audio - CDMA Mode	5
Block Diagram	5
Test Mode/Test Menu	7
Introduction	7
Status Display Level.....	7
Servicing Level.....	7
CDMA Specific Features.....	8
Test Menu	8
Handset Commands.....	9
Test Commands	10
NAM Programming	21
Introduction	21
Test Mode Programming	21
Test Mode NAM Programming Sequence	22
Disassembly	29
Introduction	29
Recommended Tools	29
Disassembly Procedure	30
Test Procedures	32
Introduction	32
MCEL 2000 Modifications	33
Connections for Test Procedures	34
Test Cable Pin Out	35
Analog Manual Tests.....	36
CDMA Call Processing	39
CDMA RF Parametric Measurements	41
Troubleshooting.....	47

Introduction	47
Troubleshooting and Repair	47

Electrical Parts 51

Section A

Service Diagrams..... A1

Antenna Circuit	A2
RX Mixer	A3
LNA Circuit	A4
Analog-CDMA Switch Circuit.....	A5
ZIF/SYN	A6
VCO	A7
Offset Oscillator	A8
Attenuator/Exciter Circuit	A9
PA Circuit	A2
GCAP	A2
Charger & Supplies	A2
Ref Osc/NEG Regulator	A2
CIA (U1900)	A2
CSP (U1800)	A2
DSP (U1600)	A2
RIB (U1700)	A2
Micro Processor (U1100)	A13
Memory	A2
Connectors	A2
Layout Side 1	A2
Layout Side 2	A2

Mechanical Explosion B1

Parts List	B2
Parts List	B3



Operation

In Figure 1: "Hypothetical Cell System", the area bounded by bold lines represents the total coverage area of a cellular system.

This area is divided into several cells, each containing a cell site base station which interfaces radiotelephone subscribers to the switching system.

Since there are no channels in CDMA, a user has a better chance of completing a call. Also, now there is no hard handoff between cell sites since all sites operate on the same frequency. This is called soft handoffs. In this system, subscribers in cell A & D simultaneously operate in the same frequency.

As a user moves from cell site to cell site, the base station monitors the signal strength of the user. Based on this signal strength, the base station decides which cell shall carry the call.

When a radiotelephone is in use well within a cell, the signal strength received at the cell site base station will be high. As the phone is moved towards the edge of the cell, its received signal strength decreases.

Signal strength information therefore provides an indication of the subscriber's distance from a cell's base station. This change is handled automatically, and is completely transparent to the user.

For example, assume that a cellular telephone initiates a call in cell A and then moves across the system area through cells B and C to cell D. As the phone moves into cell B, it is instructed to change to a different frequency that operates through the B cell on that frequency.

A similar change is performed when the phone moves from cell B to cell C and again when the phone moves from cell C to cell D.

In this example, the radiotelephone has operated in four cell sites, through four cell sites, and on the same spread spectrum without interruptions in voice communica-

tions. As the radiotelephone leaves a cell, the frequency on which the phone and base station were operating is made available to another subscriber in that cell.

Since this radiotelephone is dual mode, the radiotelephone can operate in either a CDMA system or Analog system.

Service Area

The area within which calls can be placed and received is defined by the system operator. (Because this is a radio system, there is no exact boundary that can be drawn on a map.)

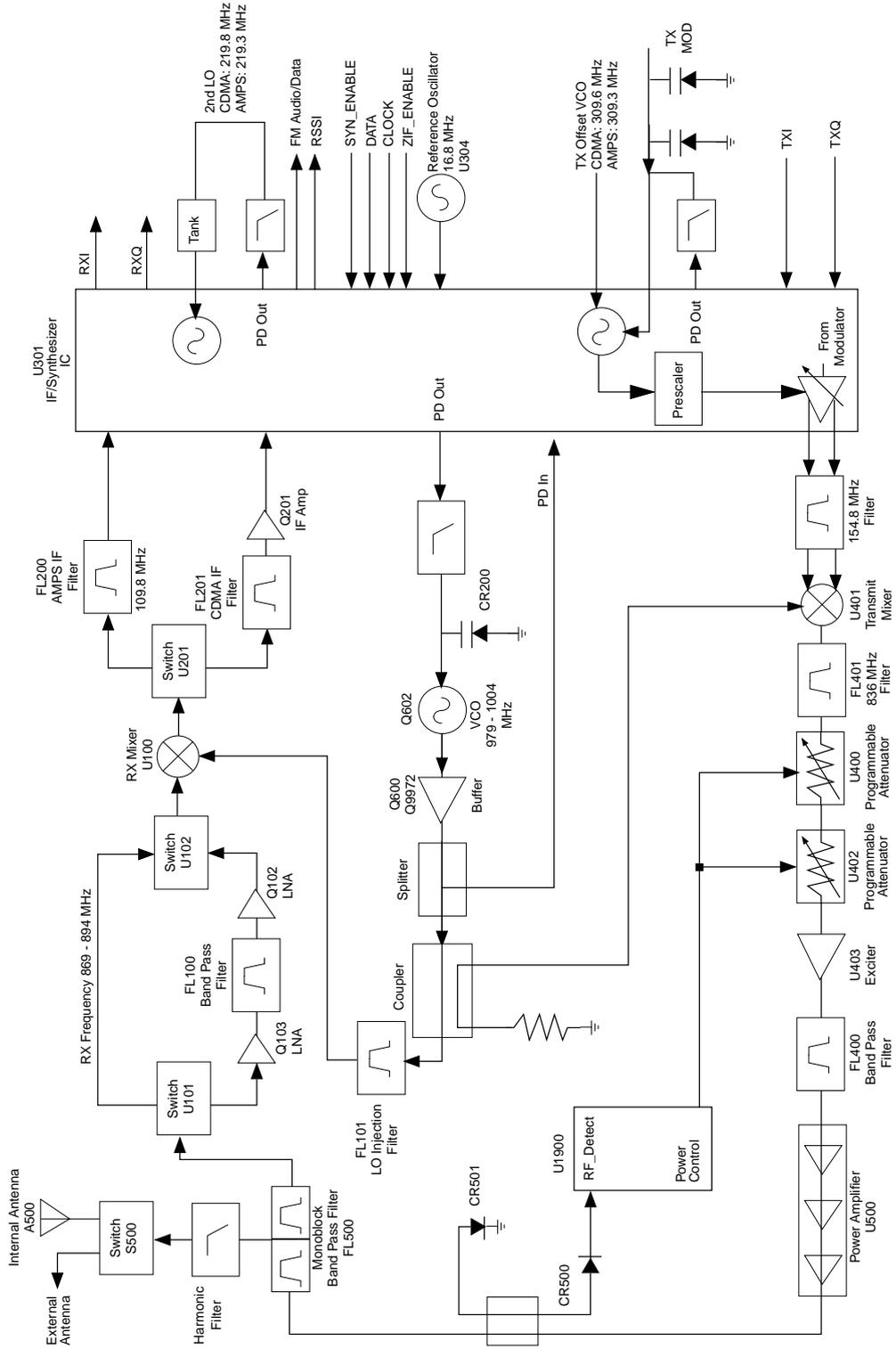
If the portable is outside the radio service area, a **No Svc** (no service) message will appear on the phone's display, and calls cannot be placed or received. If this happens during a conversation, the call is lost.

Places where the ability to place or receive calls would be lost are in totally enclosed areas, such as underground parking garages, in buildings without windows, and in elevators.

This situation would be indicated either by the **No Svc** message illuminating, or by the sound of either a fast busy signal or a high-low siren signal when call placement is attempted.

General usage in buildings having reasonable glass area is usually quite good. However, it may be necessary to move closer to a window to ensure reliable operation.

Figure 2: RF Functional Block Diagram



Transmit Power Control Circuitry

The power control signal controls voltage controlled attenuators U400 and U402 which are after the TX mixer. U1900 compares a detected sample of the TX output signal with a variable reference voltage. A closed loop adjusts the Power Control signal such that the sampled RF signal level matches the reference level. In AMPS mode, the RF power range is +8 dBm to +28 dBm.

In CDMA mode the RF power range is -50 dBm to +24 dBm. In CDMA mode, the power control can operate in either open-loop or closed-loop modes. In open-loop mode, the power level is proportional to the received signal level. In closed loop mode, the power level is controlled by the CDMA cell, based on received signal strength at the cell site.

Receive Audio - AMPS Mode

AMPS discriminator audio is routed to U1900 to be digitized. All receive audio filtering and gain control is performed in the digital domain by DSP U1600. The processed RX audio is converted back to analog by U1900 and amplified by the GCAP IC U2000. The received audio is then routed to either the internal earpiece speaker.

Receive Audio - CDMA Mode

Received CDMA OQPSK data (RX I, RX Q) is gain controlled and converted to digital by U1900. The 1.2288 Mb/sec. RX data stream is then decoded by the U1800 Modem IC to produce a signal containing only the desired data. The digital speech data is routed through the microprocessor U1100, decoded by the U1600 CELP Vocoder, and sent to U1900 to be converted into analog audio. The audio signal is then amplified by U2000 and sent to the earpiece speaker.

Transmit Audio - AMPS Mode

Audio from the internal microphone is amplified and converted to data by U1900. In AMPS mode, the digitized microphone audio is then sent to DSP U1600 which performs all compression, pre-emphasis, limiting, and bandpass filtering functions in the digital domain. All AMPS signalling (SAT, ST, DTMF) is also generated in the digital domain by DSP 1200. The digitized AMPS TX audio signal is converted back to analog by the U1900 and sent to the 154.65 MHz TX Offset VCO to modulate the transmitter.

Transmit Audio - CDMA Mode

In CDMA mode, the digitized TX audio is processed by a CELP variable rate vocoder, U1600. The digital signal is then routed through microprocessor U1100 and processed by the CDMA Modem IC, U1800, which produces the 1.2288 Mb/sec. CDMA data stream. This stream is then converted to analog OQPSK signals (TX I, TX Q) by D/A U1900. The TX I and TX Q signals are sent to the IF/Synthesizer IC U301 which modulates the 154.8 MHz TX offset VCO.

Block Diagram

The block diagram on the following page shows the major audio and signalling sections.

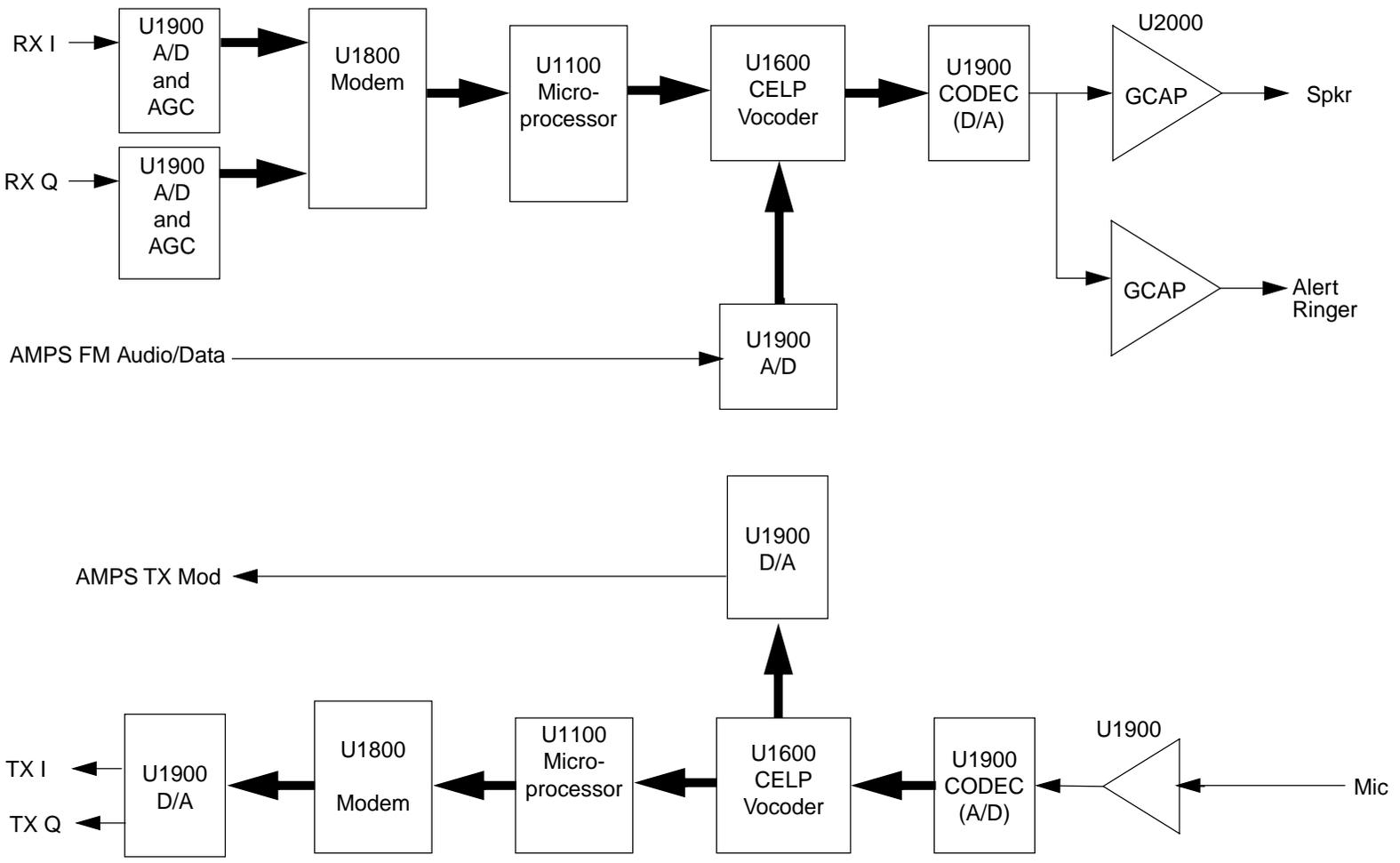


Figure 3: Audio and Signalling Diagram

CDMA Specific Features

Test Menu

A Test Menu allows a user to initiate Markov calls, place Service Option 2 calls and set Software Configuration Options. The Test Menu is intended to provide a simple mechanism to perform various test and S/W debugging functions. Items will be added to and deleted from the menu periodically.

When Test Menu is enabled, it is entered by pressing the FCN key twice. Refer to Step "09" on page 23 for information on how to enable/disable the Test Menu during NAM programming.

Almost every Test Menu command accepts a parameter or data in the scratchpad. The procedure for transferring the scratchpad data and executing the Test Menu command is as follows:

- Step 1. Decide which Test Menu command is going to be executed.
- Step 2. Enter the necessary user input into the scratchpad.
- Step 3. Press the FCN key twice to activate the Test Menu.
- Step 4. Press the volume keys until the desired Test Menu command is indicated on the display.
- Step 5. Press the SND key to activate the command.

While the Test Menu is displayed, any keypress that is not volume or SND will also cause the menu to be exited without executing the current option. The Test Menu will also be exited whenever an incoming call is detected.

Markov Calls

During a Markov call, the "(G)ood" rate will be on the top line, and the "(T)otal" on the bottom line of the display. The display will

cycle through all rates: (F)ull, (1/2) Half, (1/4) Quarter, and (1/8) Eight.

- Mobile originated Markov calls are performed by entering a telephone number and selecting a Test Menu option. Refer to the "Test Menu" section for further information.
- Mobile terminated Markov calls (Land to Mobile) are currently NOT supported.

Pressing the SND key initiates a Markov call with the number in the scratchpad. If scratchpad is empty, "1234567" is used. This feature has no value in AMPS mode.

Service Option 2

For Service Option 2 calls, the In Use indicator will come on, but the display will remain blank.

- Mobile originated Service Option 2 calls are performed by entering a telephone number and selecting a Test Menu option. Refer to the "Test Menu" section for further information.
- Mobile terminated Service Option 2 calls will be automatically answered.

Pressing the SND key initiates a Service Option 2 call with the number in the scratchpad. This feature has no value in AMPS mode.

SW (Software) DIP

Pressing the SND key initiates a one or more SW DIP functions based on the number in the scratchpad. Possible SW DIP functions are:

- 1: Disables closed loop power control.
- 4: Forces vocoder to provide full rate voice (may be enabled at any time during a call).
- 128: Sets the conversation audio path to "audio out" and "audio in" on the external connector.

For example, to disable closed loop power control, the user enters the following key sequence:

1 + FCN + FCN + ^ + SND

Undo all SW DIP settings (default at power on) by pressing:

0 + FCN + FCN + ^ + SND

These may be combined to do more than one at a time. For example, 4 and 1 may be combined by entering 5 before entering menu and selecting SW DIP.

Test Mode

Also included in the software is a Manual Test Mode, which allows viewing the ESN, software version number, and programming the phone number (NAM).

To enter Manual Test Mode:

- (FCN) 0 0 * * 83786633 (STO)

(83786633 spells "TESTMODE" on the keypad).

This will cause the phone to enter the Test Command Mode. The display will show US.

Handset Commands

Table 1: Handset Command Key Entry

<i>Key</i>	<i>Function</i>
*	Toggles the display to the next location (enters data displayed to buffer). When hit at last program step, the command is terminated (if required, information may also be programmed into the EEPROM). If the command relates to a test function with multiple data displays, the * key is used to pause scanning data or to step through sequential test functions. Entering the * key during a pause time resumes scanning.
CLR/END	Resets the location to presently programmed information (if the command allows user input).
#	Terminates command without changing any of the programmed information. Each command consists of at least two digits entered from the telephone keypad with the entry terminated using the # key. For commands that initiate an action that requires a response or that accumulates error counts, the # key terminates the test.
DIGIT	Enter digit value. If the value to be modified is filled or exceeded, the CLR must be pressed before more digit selections are allowed. This is valid only if the command allows user input.
For the GAIN and POWER phasing handset test commands only:	
SND	Send into HEX mode. Keys 0-5 enter immediately after the send key are translated into HEX A-F respectively.
VOLUME UP/DOWN	Increments/decrements the current data value. If the maximum value for this data location is exceeded then it is set to zero.
STO	Shortcut to save values and quit test command.

Test Commands

Table 2: Test Commands For Manual Test Mode

<i>Keypad Entry</i>	<i>Command Description</i>	<i>Status Display</i>	<i>Result</i>
#	SUSPEND		Terminate normal mode and enter Test Command Mode. This command is valid only when in normal mode. The # key must be held for 2 seconds to suspend with handset. Performs initialization as in the INIT test command.
01#	RESTART		Equivalent to turning power off, then on again.
02#	RADIO STATUS REQUEST	AAAZBB BCDEFG HI	<p>Display the current radio status:</p> <p>Handset Display Format:</p> <p>AAA = Current channel (1000-1023 represented as A00-A23)</p> <p>Z = Blank - AMPS</p> <p>Analog Mode:</p> <p>BBB = RSSI reading (averaged) for this channel.</p> <p>C = Digital Color Code (data channel) 0-3 DCC, 4 invalid = SAT Frequency (voice channel) 0=5970 Hz; 1=6000 Hz; 2=6030 Hz; 3=No SAT Lock</p> <p>D = Carrier (0=OFF, 1=ON)</p> <p>E = Word sync status (data channel) and Signalling tone (voice channel) (0=OFF, 1=sync acquired/ON)</p> <p>F = RF Power Level (Steps 0-7)</p> <p>G = Reception Mode (0=voice channel, 1=data channel)</p> <p>H = Receive Audio (0=enabled, 1=muted)</p> <p>I = Transmit Audio (0=enabled, 1=muted)</p> <p>CDMA Mode: (Not currently supported)</p> <p>Bit fields undefined</p>
03#	(NOT USED)		

Table 2: Test Commands For Manual Test Mode

<i>Keypad Entry</i>	<i>Command Description</i>	<i>Status Display</i>	<i>Result</i>
04#	INITIALIZE TRANS- CEIVER		Initialize the current radio as follows: 1. Carrier = OFF 2. RF power attenuation set to level 2 3. Signaling Tone = OFF 4. SAT transponding = OFF 5. Audio Path = TO INTERNAL SPEAKER 6. DTMF & Audio Tones = OFF 7. Receive Audio & Transmit Audio = MUTED 8. AMPS Mode If the radio is a CDMA only model (not dual mode), it will default to CDMA mode instead.
05#	CARRIER- ON		Turn on the carrier. 05# turns the carrier on with a nominal value for the DAC for an output power level.
06#	CARRIER- OFF		Turn off the carrier. 06# turns the carrier off.
NOTES: Use the PATH command (35A#) to select the audio path to test before using commands 07# through 10# . (Default path is to internal speaker and microphone).			
07#	RXMUTE		Mute receive audio.
08#	RXUNMUTE		Unmute receive audio.
09#	TXMUTE		Mute transmit audio.
10#	TXUNMUTE		Unmute transmit audio.
11X#	LOAD- SYNTH		Load the specified channel into the radio synthesizer. X-Enter up to 4-digits for the channel number. Channel numbers must be in the range of 1 to 1024. Narrow mode channel numbers not currently supported.
12X#	SET-ATTN		<u>In AMPS mode:</u> Set the AMPS RF power attenuation to the value specified (0-7). <u>In CDMA mode:</u> Set the TX gain adjust DAC to the value specified (0-255)
13#	(NOT USED)		
14#	STON		Enables continuous signalling tone.
15#	STOFF		Disables signalling tone.
16#-18#	(NOT USED)		

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result												
19#	VERSION		<p>Displays version corresponding to the two digit option x. The following table show the valid options for x:</p> <p>Decimal</p> <table> <tr> <td>00</td> <td>Call processor</td> </tr> <tr> <td>01</td> <td>CDMA test command document number</td> </tr> <tr> <td>02</td> <td>Date</td> </tr> <tr> <td>03</td> <td>Time</td> </tr> <tr> <td>22</td> <td>DSP mask version</td> </tr> <tr> <td>23</td> <td>DSP patch version</td> </tr> </table> <ul style="list-style-type: none"> • The call processor (factory version) number in the format: 00 XXXX • The CDMA test command document number: 01 XXXX • The date the build was created in the format: 01JAN96 • The time the build was created in the format: xxyyzz where xx is the hour, yy is the minute, and zz is the second. • The version of the DSP mask xxxxyyyyyyzzzz where xxxx is the version, yyyyyy is the date, and zzzz is the device. • The version of the DSP patch xxxxyyyyyyzzzz where xxxx is the version, yyyyyy is the date, and zzzz is the device. <p>All data fields can be viewed by hitting the * key repeatedly. To exit hit the # key.</p>	00	Call processor	01	CDMA test command document number	02	Date	03	Time	22	DSP mask version	23	DSP patch version
00	Call processor														
01	CDMA test command document number														
02	Date														
03	Time														
22	DSP mask version														
23	DSP patch version														

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result												
19X#	MULTI-VERSION		<p>Displays version corresponding to the two digit option x. The following table show the valid options for x:</p> <p>Decimal</p> <table> <tr> <td>00</td> <td>Call processor</td> </tr> <tr> <td>01</td> <td>CDMA test command document number</td> </tr> <tr> <td>02</td> <td>Date</td> </tr> <tr> <td>03</td> <td>Time</td> </tr> <tr> <td>22</td> <td>DSP mask version</td> </tr> <tr> <td>23</td> <td>DSP patch version</td> </tr> </table> <ul style="list-style-type: none"> • The call processor (factory version) number in the format: 00 XXXX • The CDMA test command document number: 01 XXXX • The date the build was created in the format: 01JAN96 • The time the build was created in the format: xxyyzz where xx is the hour, yy is the minute, and zz is the second. • The version of the DSP mask xxxxyyyyyyzzzz where xxxx is the version, yyyyyy is the date, and zzzz is the device. • The version of the DSP patch xxxxyyyyyyzzzz where xxxx is the version, yyyyyy is the date, and zzzz is the device. 	00	Call processor	01	CDMA test command document number	02	Date	03	Time	22	DSP mask version	23	DSP patch version
00	Call processor														
01	CDMA test command document number														
02	Date														
03	Time														
22	DSP mask version														
23	DSP patch version														
20#-24#	(NOT USED)														
25X#	SAT/DSAT ON		<p>Enable SAT/DSAT transponding.</p> <p>For AMPS mode, the byte following the opcode is the color code of the SAT frequency that the radio may expect to receive. The command only uses the narrow phase lock loop mode and locks only to the frequency selected (+/- 15 Hz).</p> <p>Valid color codes for X:</p> <table> <tr> <td>0</td> <td>= 5970 Hz</td> </tr> <tr> <td>1</td> <td>= 6000 Hz</td> </tr> <tr> <td>2</td> <td>= 6030 Hz</td> </tr> </table>	0	= 5970 Hz	1	= 6000 Hz	2	= 6030 Hz						
0	= 5970 Hz														
1	= 6000 Hz														
2	= 6030 Hz														
26#	SAT/DSAT OFF		Disable the transponding of SAT/DSAT.												

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result														
27X#	CDATA		<p>AMPS: Continuous Transmit Data on the reverse Analog Control Channel.</p> <p>CDMA: Random Transmit Data (RTD) on the reverse CDMA channel.</p> <table> <thead> <tr> <th><u>Input</u></th> <th><u>Action</u></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Start (AMPS) / Variable Rate (CDMA)</td> </tr> <tr> <td>1</td> <td>Full Rate (CDMA)</td> </tr> <tr> <td>2</td> <td>Half Rate (CDMA)</td> </tr> <tr> <td>4</td> <td>Quarter Rate (CDMA)</td> </tr> <tr> <td>8</td> <td>Eighth Rate (CDMA)</td> </tr> <tr> <td>9</td> <td>Stop RTD (AMPS, CDMA)</td> </tr> </tbody> </table>	<u>Input</u>	<u>Action</u>	0	Start (AMPS) / Variable Rate (CDMA)	1	Full Rate (CDMA)	2	Half Rate (CDMA)	4	Quarter Rate (CDMA)	8	Eighth Rate (CDMA)	9	Stop RTD (AMPS, CDMA)
<u>Input</u>	<u>Action</u>																
0	Start (AMPS) / Variable Rate (CDMA)																
1	Full Rate (CDMA)																
2	Half Rate (CDMA)																
4	Quarter Rate (CDMA)																
8	Eighth Rate (CDMA)																
9	Stop RTD (AMPS, CDMA)																
28#	HITNON		Turn on high tone (Frequency 1150 Hz ± 55 Hz).														
29#	HITNOFF		Turn off high tone.														
30#	LOTNON		Turn on low tone (Frequency 770 Hz ± 40 Hz).														
31#	LOTNOFF		Turn off low tone.														
32#	INVM		<p>Initialize non-volatile memory to all zeros. This command should be reserved for special situations where reprogramming will be required (such as memory chip or circuit board replacement or when a radiotelephone is to be reissued to a new subscriber).</p> <p>This command may take a minute or more to complete; during which time the number 32 will be displayed. DO NOT turn off the radiotelephone until the normal servicing level display resumes.</p>														
33X#	DTMFON		<p>Generates a continuous DTMF tone as specified by input X.</p> <p>Input X may be 0-9 for keypad DTMF, 10-18 for single low or high tone, and 20-25 for tripled low or high tone.</p>														
34#	DTMFOFF		Turn off DTMF tones.														

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result
35X#	PATH		<p>Change the audio path to A, where A =:</p> <ul style="list-style-type: none"> 0 = Hands free (selects input signal AUDIO IN @ J3-pin 8 and outputs audio signal AUDIO OUT/ON-OFF @ J3-pin 7; internal speaker and microphone are muted.) 1 = Speaker (normal audio path; selects internal mic and outputs audio @ AUDIO OUT/ON-OFF @ J3-pin 7; internal speaker is muted.) 2 = Alert (activates the alert transducer for as long as the # key is pressed. To prevent overstressing the alert transducer., DO NOT hold the # key down for extended periods.) 3 = Handset (selects the internal mic and speaker.) 4 = Mute (all audio paths and supplies are off, DSP put to sleep.) This command must be followed by a different AUDIO-PATH command (not MUTE) in order to guarantee proper DSP functionality. Failure to do so may result in a radio failure. 5 = Internal MIC Test (routes the internal mic audio directly to AUDIO OUT/ON-OFF @ J3-pin 7, and routes audio input at AUDIO IN @ J3-pin 8 directly to the earpiece speaker.) 6 = External Handset (selects input audio at AUDIO IN @ J3-pin 8, and outputs audio at AUDIO OUT/ON-OFF @ J3-pin 7; internal speaker and mic are muted, and sidetone is turned on.) 7 = Reserved (not supported) 8 = Reserved (not supported) 9 = Boom MIC (selects input audio at AUDIO IN and outputs audio at AUDIO OUT/ON-OFF to headset connector; internal speaker and mic are muted, and sidetone is turned on.) <p>This command enables all internal and external hardware controls necessary to route audio to/from the correct outputs/inputs.</p>
36#	(NOT USED)		
37#	(NOT USED)		
38#	SND-SN	AABB	<p>Returns serial number contents.</p> <p>If all bytes = 00, no serial number is programmed.</p> <p>Display four byte serial number in hexadecimal one byte at a time, along with a byte count. The * key causes the next byte/count to be displayed.</p>
39#-44#	(NOT USED)		
45#	READRSSI		Returns the RSSI reading taken on the current channel. The number is displayed as a three digit decimal number.
46#	(NOT USED)		

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result
47X#	SET-AUD		Sets the audio level to the value specified by X. Audio level X is represented as 0 = lowest, 15 = loudest. Range of 8-15 has DTMF Feedback boost bit enabled.
48#	SIDETN		Enable sidetone. (Command 05# must also be executed).
49#	SIDETF		Disable sidetone. (Command 06# must also be executed).
50# - 54#	(NOT USED)		
55#	PROG-NAM	NAM	Programs the NAM through the handset. This version uses supports only currently required NAM fields and it supports programming of data logger bytes. At the last step, the user enters a 1 to begin programming the data logger bytes. Handset key entry is defined in Table 1: "Handset Command Key Entry" on page 9. Refer to "NAM Programming" on page 21 of this manual for programming details.
56#	AUTO-CYCLE		Puts the radio in autocycle mode (CDMA only). Exit this command with the # key. This command causes the radio to infinitely loop between 2 cycles. One cycle is the display/transmit and the other is standby. The display/transmit cycle has a duration of 90 seconds and the radio has the following setup: <ul style="list-style-type: none"> • Display has all 8's showing. • Turn on variable rate random transmit data. • Carrier is enabled. The standby cycle has a duration of 4.5 minutes and the radio has the following setup: <ul style="list-style-type: none"> • Display is blank. • Turn off variable rate random transmit data • Carrier is disabled. This test command forces the radio into CDMA mode.

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result
57X#	CP-MODE		<p>Select radio call processing mode. This command will set up the radio to operate in the mode selected and will also perform initialization as specified by the INIT command. The synthesizer will be reprogrammed to setup parameters for the mode selected.</p> <p>0 AMPS signalling (stop call processing test commands and PCM Loopback)</p> <p>1 Not supported - NAMPS signalling</p> <p>2 Not supported - Reserved for NAMPS expansion</p> <p>3 Not supported - Reserved for NAMPS expansion</p> <p>4 Not supported - Reserved for NAMPS expansion</p> <p>5 CDMA signalling (stop call processing test commands and PCM Loopback)</p> <p>6xy SIMVC test command From the handset, x is the maximum rate and y is the minimum rate.</p> <p>Valid rates for x and y are:</p> <p>4 - Full rate</p> <p>3 - Half rate</p> <p>2 - Quarter rate</p> <p>1 - Eighth rate</p> <p>From the Computer, no parameters are accepted and Full rate is forced. (This is not supported yet)</p> <p>7 Start PCM Loopback</p> <p>8 CDMA T-Tester mode (channel must be set by LOAD-SYTH. Handset only).</p> <p>9 Not supported - CDMA force random data transmission</p> <p>12 Stop CPU - There is no way out of this except cycling power.</p>
58#	COMPON		Turns on the Compandor.
59#	COMPON-OFF		Turns off the Compandor.
60# - 67#	(NOT USED)		
68#	READ-MODEL		<p>Read radio model type.</p> <p>Displays three radio model bytes: hardware (model), flex (type), and factory.</p>
69# - 71#	(NOT USED)		

Table 2: Test Commands For Manual Test Mode

Keypad Entry	Command Description	Status Display	Result																														
72X#	GAIN-PHASE		<p>Program AMPS (only) gain phasing values through the handset.</p> <p>Gain phasing depends on the call processing mode. It is the responsibility of the user to select the proper call processing mode before using this test command.</p> <p>This command reprograms the EEPROM phasing values for MOD, MIC, AUX, etc.</p> <p>The value in X selects which step to start on. If no value for X is entered, it will start at step 0.</p> <p>The command keys are defined in Table 1: "Handset Command Key Entry" on page 9.</p> <p>NOTE: If you power down the radio after changes are made, the power up sequence re-programs the hardware with the correct phasing values.</p> <p>Refer to the "Tests and Adjustments" on page 31 for instructions on entering parameters from the keypad.</p> <table border="0" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">AMPS GAIN PHASING</th> <th style="text-align: center;">RANGE</th> </tr> <tr> <th style="text-align: left;"><u>STEP #</u></th> <th style="text-align: left;"><u>PARAMETER</u></th> <th style="text-align: left;"><u>(HEX)</u></th> </tr> </thead> <tbody> <tr> <td>00-04</td> <td>MOD 0- MOD 4</td> <td>0-7</td> </tr> <tr> <td>05</td> <td>Aux. audio path deviation</td> <td>0-1</td> </tr> <tr> <td>06</td> <td>MIC audio deviation</td> <td>0-F</td> </tr> <tr> <td>07</td> <td>DTMF deviation</td> <td>0-3</td> </tr> <tr> <td>08</td> <td>Data deviation</td> <td>0-3</td> </tr> <tr> <td>09</td> <td>SAT deviation</td> <td>0-3</td> </tr> <tr> <td>0A</td> <td>Discriminator audio gain</td> <td>0-7</td> </tr> <tr> <td>0B</td> <td>AFC WARP Analog</td> <td>0-FF</td> </tr> </tbody> </table>		AMPS GAIN PHASING	RANGE	<u>STEP #</u>	<u>PARAMETER</u>	<u>(HEX)</u>	00-04	MOD 0- MOD 4	0-7	05	Aux. audio path deviation	0-1	06	MIC audio deviation	0-F	07	DTMF deviation	0-3	08	Data deviation	0-3	09	SAT deviation	0-3	0A	Discriminator audio gain	0-7	0B	AFC WARP Analog	0-FF
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Keypad Entry	Command Description	Status Display	Result																																																																					
73#	PWR-PHASE		<p>Programs power phasing values through the handset.</p> <p>Power phasing depends on the call processing mode. It is the responsibility of the user to select the proper call processing mode before using this test command.</p> <p>This command reprograms the EEPROM phasing values for Max. Power Level, Attenuator Slope Adjust, etc.</p> <p>The value in X selects which step to start on. If no value for X is entered, it will start at step 0.</p> <p>The command keys are defined in Table 1: "Handset Command Key Entry" on page 9.</p> <p>NOTE: If you power down the radio after changes are made, the power up sequence re-programs the hardware with the correct phasing values.</p> <p>Refer to "Tests and Adjustments" on page 31 for instructions on entering parameters from the keypad.</p> <p>Analog Power Level Parameters:</p> <table border="0"> <thead> <tr> <th></th> <th></th> <th style="text-align: right;">RANGE</th> </tr> </thead> <tbody> <tr> <td>STEP #</td> <td>POWER LEVEL</td> <td style="text-align: right;">(HEX)</td> </tr> <tr> <td>00</td> <td>Power Step 0</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>01</td> <td>Power Step 1</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>02</td> <td>Power Step 2</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>03</td> <td>Power Step 3</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>04</td> <td>Power Step 4</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>05</td> <td>Power Step 5</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>06</td> <td>Power Step 6</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>07</td> <td>Power Step 7</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>08-0B</td> <td>Do Not Adjust</td> <td></td> </tr> </tbody> </table> <p>CDMA Power Level Parameters:</p> <table border="0"> <thead> <tr> <th></th> <th></th> <th style="text-align: right;">RANGE</th> </tr> </thead> <tbody> <tr> <td>STEP #</td> <td>POWER LEVEL</td> <td style="text-align: right;">(HEX)</td> </tr> <tr> <td>00</td> <td>Attenuator Slope Adjust</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>01</td> <td>Attenuator Offset Adjust</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>02</td> <td>Clamp Adjust</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>03</td> <td>VCA Slope Adjust</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>04</td> <td>VCA Offset Adjust</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>05</td> <td>PMax 1 (Chan. 991-1023, 1-100)</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>06</td> <td>PMax 2 (Chan. 101-322)</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>07</td> <td>PMax 3 (Chan. 323-544)</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>08</td> <td>PMax 4 (Chan. 545-766)</td> <td style="text-align: right;">00-FF</td> </tr> <tr> <td>09</td> <td>PMax 5 (Chan. 767-990)</td> <td style="text-align: right;">00-FF</td> </tr> </tbody> </table>			RANGE	STEP #	POWER LEVEL	(HEX)	00	Power Step 0	00-FF	01	Power Step 1	00-FF	02	Power Step 2	00-FF	03	Power Step 3	00-FF	04	Power Step 4	00-FF	05	Power Step 5	00-FF	06	Power Step 6	00-FF	07	Power Step 7	00-FF	08-0B	Do Not Adjust				RANGE	STEP #	POWER LEVEL	(HEX)	00	Attenuator Slope Adjust	00-FF	01	Attenuator Offset Adjust	00-FF	02	Clamp Adjust	00-FF	03	VCA Slope Adjust	00-FF	04	VCA Offset Adjust	00-FF	05	PMax 1 (Chan. 991-1023, 1-100)	00-FF	06	PMax 2 (Chan. 101-322)	00-FF	07	PMax 3 (Chan. 323-544)	00-FF	08	PMax 4 (Chan. 545-766)	00-FF	09	PMax 5 (Chan. 767-990)	00-FF
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NOTE

Changed NAM values are not stored until pressing * after Step 25 (Step 12 if a second phone number was entered.)

Test Mode NAM Programming Sequence

- *** Advances to the next programming step; also programs the NAM after the last programming step is entered. A valid value must be entered. Otherwise the phone will not advance to the next NAM step.
- CLR** Clears the entered information and displays previously entered data for the current programming step.
- #** Exits the programming mode without programming the NAM.

Table 4: Test Mode NAM Programming Sequence

Step	Factory Default	Description
01	00000	Home System ID (SID) Number. Number assigned by system operator for system identification.
02	00000100	A OPTION BYTE. The display for step 02 represents the status of eight options, A7 through A0. Bit A7 (msb) is programmed first, followed by A6-A0. Bits enter display on the right and scroll left.
	0	Local Use (Bit A7). If set to 1 phone will respond to local control orders in the home area or when the group ID is matched. Assigned by system operator.
	0	Preferred System (Bit A6). Applies to units capable of operating on two service systems (A or B). 0 = system B; 1 = system A.
	0	End-to-End Signaling (Bit A5). When enabled, the phone is equipped for DTMF signaling during a call. 1 = enabled, 0 = disabled.
	0	Markov test override MSB (Bit A4). Enter 0.
	0	Markov test override (Bit A3). Enter 0.
	1	Bit not used (Bit A2). Enter 1.
	0	Markov test override LSB. Enter 0.
	0	MIN Mark (Bit A0). Supplied by system operator. When enabled the user's area code will be sent with each call initiated or answered. 1 = enabled, 0 = disabled.

Table 4: Test Mode NAM Programming Sequence

Step	Factory Default	Description
03	1111110111	User 10 digit radiotelephone phone number (MIN). 10_digits including area code; changing this value sets default for AOC. Number is assigned by system operator.
04	010 042 074 106	Station class mark (SCM). A 2 digit number assigned by the system operator. Indicates maximum power step, VOX capability, and number of channels used. CDMA only & Non-Slotted mode configuration CDMA only & Slotted mode configuration Dual Mode & Non-Slotted mode configuration Dual Mode & Slotted mode configuration
05	Last digit of Access Overload Class	Access overload class. Specifies the level of priority assigned to the phone when accessing the system. Assigned by system operator.
06	000000	Security code. A 6-digit number supplied by the user. This number is used by the user to access or change "security" features such as the 3-digit unlock code or the service level.
07	123	Unlock code. A 3-digit number supplied by the user. If the lock feature is enabled by the user, the phone can be operated only by individuals who know the unlock code.
08	4	Service level. This 1-digit number supplied by the user allows various call placement restrictions if desired.
09	01100000 Test Menu enabled 00100000 Test Menu disabled	B OPTION BYTE The display for step 10 represents the status of eight options, B7 through B0. B7 (msb) is programmed first followed by B6-B0. Bits enter display on the right and scroll left.

Table 4: Test Mode NAM Programming Sequence

Step	Factory Default	Description
09 (con't)	0	<p>Display Pilot Set Status/AMPS Status Mode (Bit B7).</p> <p>CDMA: These statistics are useful for testing handoff parameters. When enabled, this feature displays the strongest pilot offset in the "Active Set" (only member during Idle) on the top line of the display, and the strongest pilot in the "Neighbor Set" on the bottom line. Each line has the same format. The left most 3-digit number is the pilot offset, and the right number is a relative signal strength.</p> <p>IDLE HANDOFF (handoffs on a paging channel) occurs when a Neighbor pilot is judged to be better. That neighbor pilot will be promoted to the active set, and thus move to the top line of the display.</p> <p>SOFT HANDOFF (handoff on a traffic channel) occurs when a Neighbor pilot fulfills requirements set by the network, and the network directs the mobile to add the new pilot to the Active Set.</p> <p>Pilot Set status is enabled by setting Step #9, bit #7 to 1. Channel Statistics is disabled by setting Step #9, bit #7 to 0.</p> <p>WARNING: Turning on this option makes it difficult to see the Markov error rate statistics in a call.</p> <p>AMPS: In AMPS mode, setting this bit to 1 causes status information similar to current Motorola AMPS products to be displayed. The contents of the display depends on the channel being monitored.</p>
	0	<p>Test Menu (Bit B6). This bit allows the user to enable or disable the FCN key Test Menu. Refer to "Test Menu" on page 8 for further information on Test Menu. 1 = enabled, 0 = disabled.</p>
	1	<p>Paging Channel Message Filtering (Bit B5). This bit limits the amount of paging channel messaging seen by the data logger debugging tool. A user not using this tool should see no noticeable difference in performance. 1 = enabled, 0 = disabled.</p>
	0	<p>Portable Data Logging (Bit B4). Enter 0.</p>
	0	<p>Single Serving System Scan (Bit B3). This bit allows the user to enable or disable the serving system scanning on serving systems other than the phone's home serving system. If the phone has an odd Home System Identifier (Step 1), it's home serving system is A, otherwise it is B. If Single Serving System Scanning is enabled, only the home serving system will be scanned, otherwise both serving systems will be scanned. 1 = enabled, 0 = disabled.</p>
	1	<p>Auto Recall (Bit B2). When set to one, the user may access repertory by a one or two digit send sequence (speed dialing).</p>
	0	<p>Disable Service Levels (Bit B1). If set to 1, the service level (call restrictions) cannot be changed by the user.</p>

Table 4: Test Mode NAM Programming Sequence

<i>Step</i>	<i>Factory Default</i>	<i>Description</i>
09 (con't)	0	Lock Disable (Bit B0). When set to 1, the user cannot lock and unlock the phone unit via the 3 digit lock code.
10	00000000	C OPTION BYTE The display for step 11 represents the status of eight options, C7 through C0. C7 (msb) is programmed first followed by C6-C0. Bits enter display on the right and scroll left.
	0	User Mode NAM Programming Disable (Bit C7). When set to 1, User Mode NAM programming cannot be accessed.
	0	Dual NAM System Registration Enable (Bit C6). Enter 1 if dual NAM operation is desired (for models capable of dual system operation). Enter 0 for single NAM operation.
	0	Test Mobile Enable/Auto Answer (Bit C5). Enter 0.
	0	Auto Redial Disable (Bit C4). When set to 1, the user cannot access the 6-minute auto redial feature.
	0	Three Wire Bus Speaker Disable (Bit C3). This bit is used to disable internal handset speaker when adding V.S.P. option. 1 = handset speaker disabled, 0 = handset speaker enabled.
	0	Bit not used (Bit C2). Enter 0.
	0	Selectable System Scan Disable (Bit C1). When set to 1, the user cannot select the primary system.
	0	Diversity Antenna (Bit C0). (Extended systems only) 0 = Non-diversity, 1 = Diversity.
11	0334	AMPS Initial paging channel. There are 4 significant bits for the initial paging channel. For system A enter 0333 and system B enter 0334.
12	0333	AMPS Initial A system channel. To initialize system A enter 0333.
13	0334	AMPS Initial B system channel. To initialize system B enter 0334.
14	021	AMPS Dedicated Paging Channels. Number of dedicated paging channels is 21. Enter 021.

Table 4: Test Mode NAM Programming Sequence

Step	Factory Default	Description
15	00001000	D OPTION BYTE. The display for step 16 represents the status of eight options, D7 through D0. D7 (msb) is programmed first, followed by D6-D0. Bits enter display on the right and scroll to left.
	0	Enhanced Scan (Bit D7). Enter 1.
	0	Cellular Connection 1 (Bit E6). Normally set to 0.
	0	Long Tone DTMF Enable (Bit E5). Normally set to 1.
	0	Transportable Transducer Disable (Bit E4). Enter 0.
	1	Bit not used (Bit E3). Normally set to 0.
	0	Handset Test Mode Disable (Bit E2). Enter 0.
	0	Failed Page Indication Disable (Bit E1).
	0	Word Sync Scan Disable (Bit E0). Set to 1.
16	00100111	E OPTION BYTE. The display for step 16 represents the status of eight options, E7 through E0. E7 (msb) is programmed first, followed by E6-E0. Bits enter display on the right and scroll to left.
	0	Bit not used (Bit E7). Enter 0.
	0*	Preferred mode (Bit E6). Normally set to 0. Bit 6 - 1 and Bit 5 - 1 = Analog preferred Bit 6 - 1 and Bit 5 - 0 = Analog only
	1*	Preferred mode (Bit E5). Normally set to 1. Bit 5 - 1 and Bit 6 - 1 = CDMA preferred Bit 5 - 1 and Bit 6 - 0 = CDMA only
	0	Extended Address Method (Bit E4). Enter 0.
	0	Preferred Analog Serving System (Bit E3). Normally set to 0.
	1†	Config. for mob term using home SID, NID pair (Bit E2). Enter 1. 1 = Allow mobile terminated call while using a home (SID, NID) pair. 0 = Disallow mobile terminated call while using a home (SID, NID) pair.
	1†	Config. for mob term while SID roamer (Bit E1) Enter 1. 1 = Allow mobile terminated call while a SID roamer. 0 = Disallow mobile terminated call while a SID roamer.
	1†	Config. for mob term while NID roamer (Bit E0). Enter 1. 1 = Allow mobile terminated call while a NID roamer. 0 = Disallow mobile terminated call while a NID roamer.
17	0	CDMA: Slot Cycle Index. TBD
18	Entry Required	CDMA: SID (SID_NIDp). Up to 5-digits.

Table 4: Test Mode NAM Programming Sequence

<i>Step</i>	<i>Factory Default</i>	<i>Description</i>
19	00000	CDMA: Network ID Number (NID of SID_NIDp). Up to 5-digits.
20	11111	Mobile Country Code (first 3-digits), IMSI 11 (1-digit), IMSI 12 (1-digit).
21	Entry Required	CDMA: Primary Channel. System A up to 4 decimal digits.
22	Entry Required	CDMA: Primary Channel. System B up to 4 decimal digits.
23	Entry Required	CDMA: Secondary Channel. System A up to 4 decimal digits.
24	Entry Required	CDMA: Secondary Channel. System B up to 4 decimal digits.
25	0	Data Logger Switch. Enter 0. 1 = enabled, 0 = disabled.

* These bits will determine which modes of operation the radio will attempt when seeking communication with a Base Station. Care should be taken when either the CDMA only or the Analog only modes of operation are selected, because this configuration will cause a dual mode phone to operate as a single mode phone. Another issue to be aware of is that whenever Bit 5 is set to 0, no handoffs between Analog and CDMA mode can take place. No examination of the RF environment is performed when setting these fields.

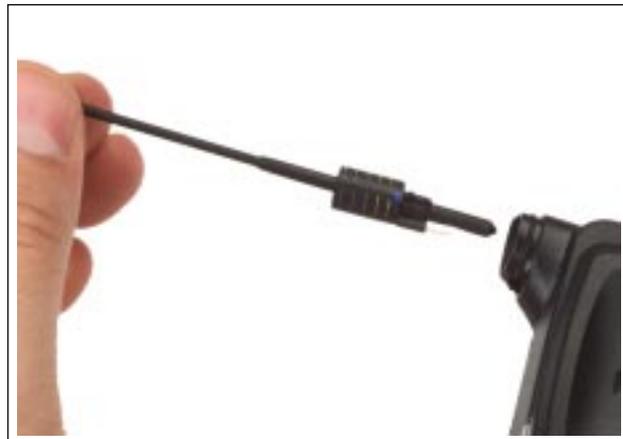
† Setting these bits also effects the registrations that are transmitted by the Mobile Station. If bits are set such that the Mobile cannot receive any incoming calls (in CDMA mode), it is not necessary to send out any Registration messages. It should be noted that if all Mobile Terminated Call Preference bits are set to zero, that there would (in a spec compliant system) be no way for the Mobile Station to receive incoming calls.



Antenna Removal

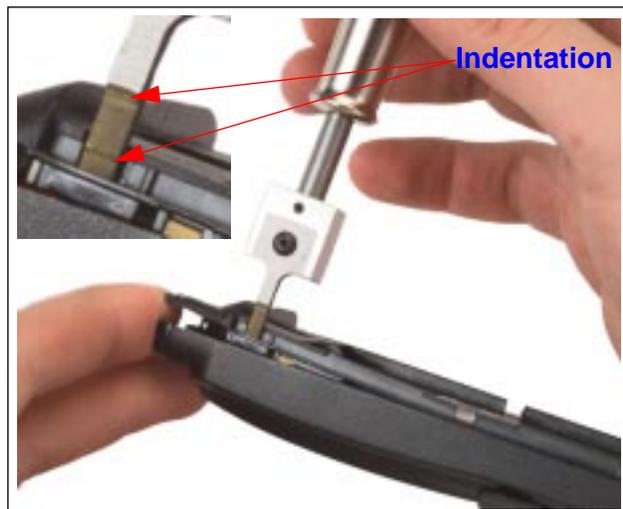
- Step 1.** Turn off the telephone.
- Step 2.** Press down on the battery's tab, slide down, and remove the battery from the housing.
- Step 3.** Using the antenna removal tool, pry off the antenna cap.
- Step 4.** Remove the antenna assembly by simply pulling it out of the housing.

If it proves difficult to remove, remove it after separating the front and back housings.



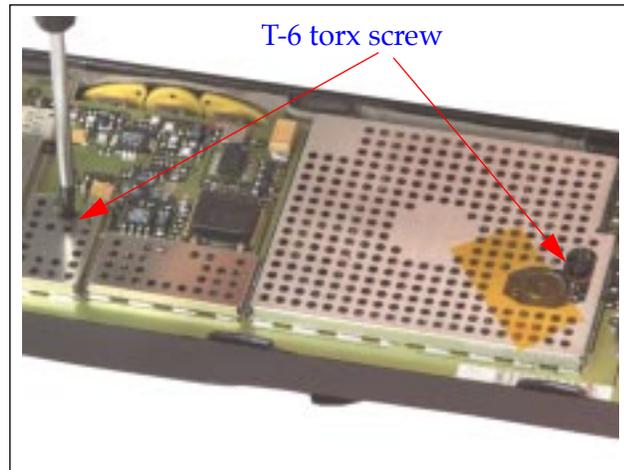
Opening housing

- Step 1.** Place phone on a flat surface.
- Step 2.** Insert rear housing removal tool (indented side out) as per illustration, and push straight in until tab holding back housing disengages.
- Step 3.** Repeat Step 2 to disengage the remaining tabs.
- Step 4.** When all tabs are disengaged, gently pull the rear housing off of the front housing, beginning with the side closest to the antenna.



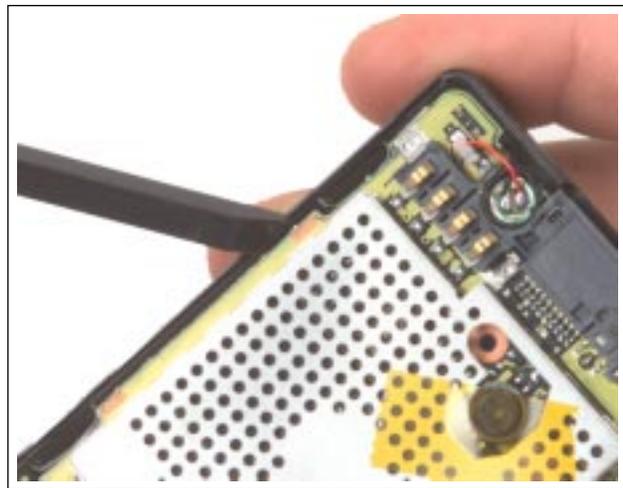
Board Removal

Step 1. Remove the two T-6 torx screws.



Step 2. Use the plastic tool to push away the retaining tabs from RF/Logic board.

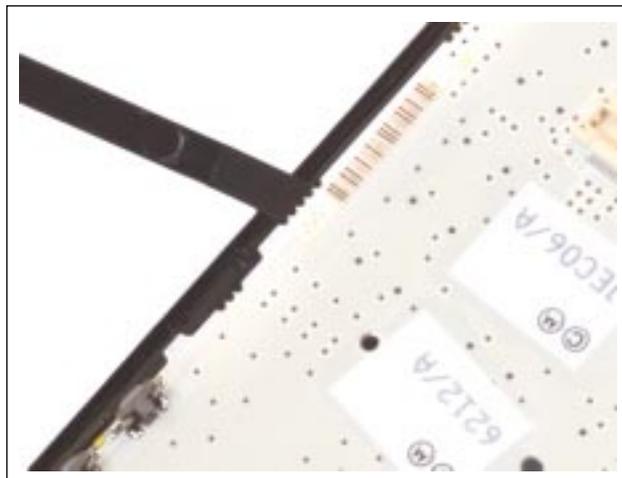
Step 3. Starting at one corner, use your fingers to carefully ease the RF/Logic board away from the Keypad/Display board, while slightly pulling the housing away.



Step 4. Use the plastic tool to push away the retaining tabs from Keypad/Display board.

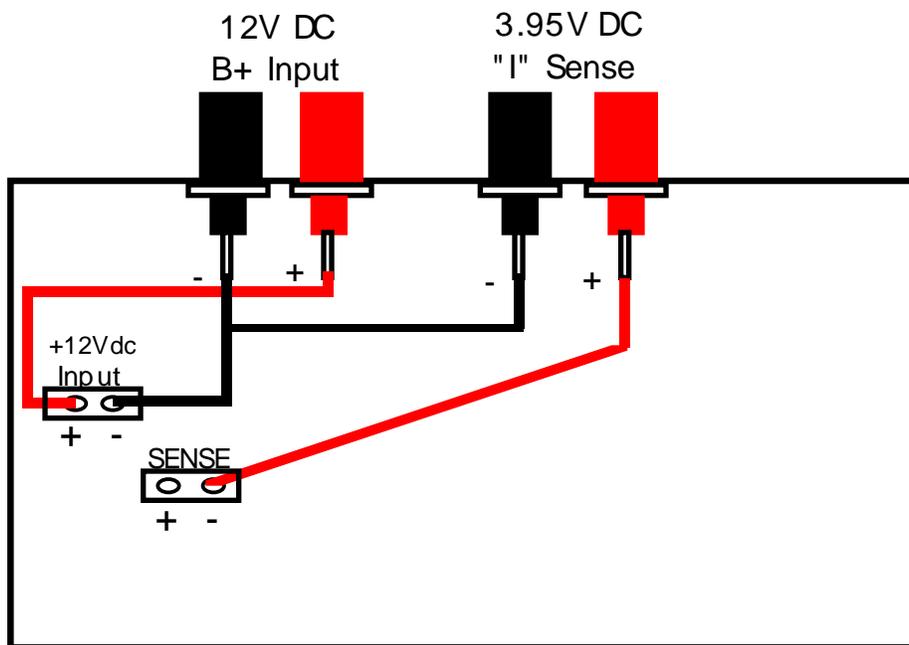
Step 5. Using your fingers, lift up the Keypad/Display board from one corner, while slightly pulling the housing away.

After getting that corner started, the rest of the board lifts out from under the tabs easily.



MCEL 2000 Modifications

The diagram below shows the modification that the MCEL 2000 needs in order to properly supply the correct operating voltage to the cellular phone.



Connection for Tests and Adjustments

The diagram below shows the recommended connections for testing and keypad calibration of the transceivers.

The MCEL2000 test interface and an RF adapter with a low loss RF cable is used to interface with the communications analyzer.

A variety of communications analyzers may be used. Refer to the analyzer manufacturer's user manual for proper setup before starting tests.

Connections for Testing and Adjustments

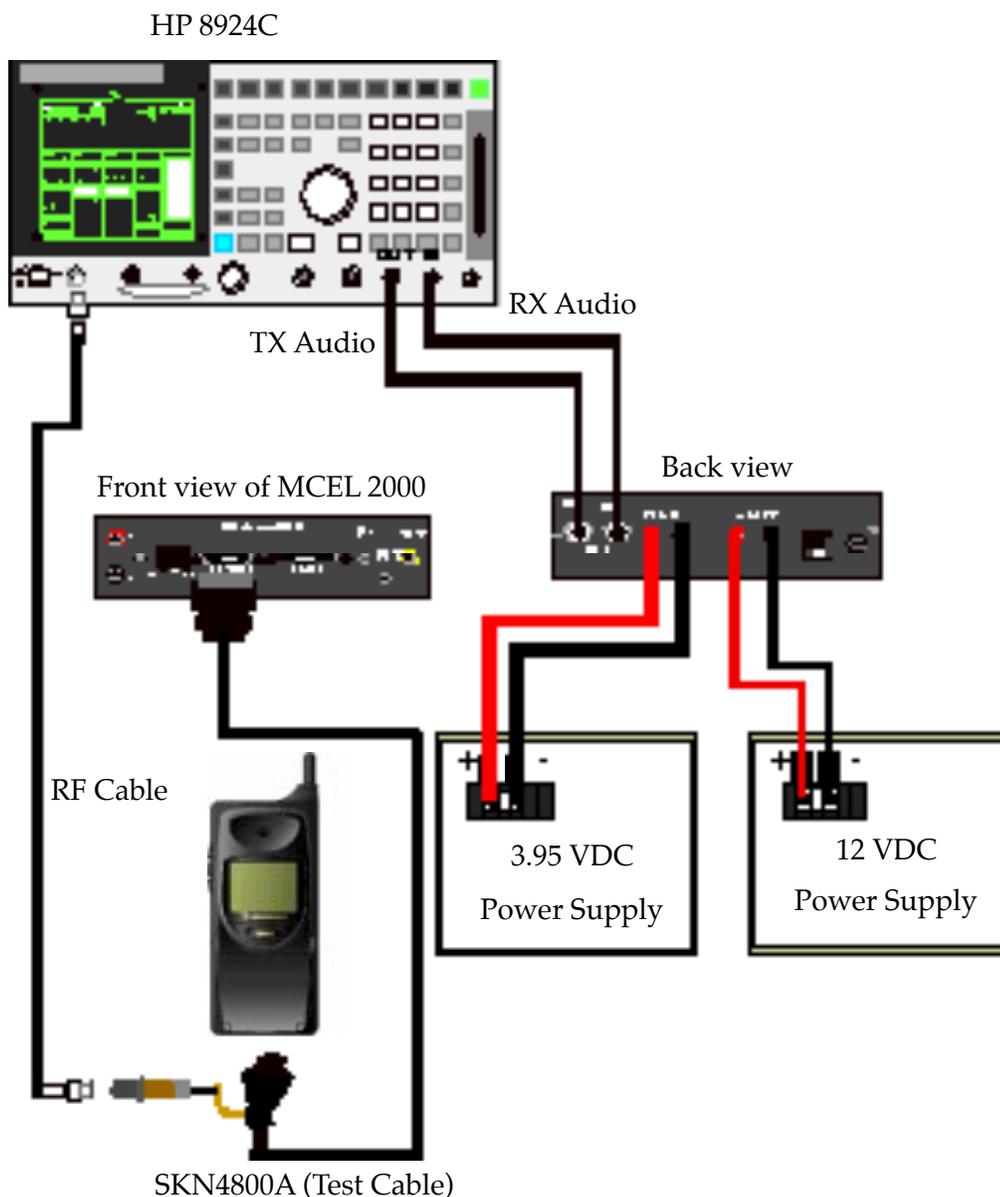


Table 5: Test Cable Pin Out

<i>10 Pin Connector To Phone</i>		<i>15 Connector To Test Interface</i>	
<i>Pin</i>	<i>Function</i>	<i>Pin</i>	<i>Function</i>
1	Analog Ground	1	N/C
2	Ext. B+	2	TX Audio On/Off
3	TRU	3	Manual Test
4	CMP	4	N/C
5	RTN	5	N/C
6	Logic Ground	6	Ground
7	RX Audio Out / On-Off	7	N/C
8	TX Audio In	8	Reg. B+
9	Manual Test	9	RX Audio On/Off
10	Batt Feedback	10	N/C
		11	TRU
		12	RTN
		13	N/C
		14	CMP
		15	Ground

Analog Manual Tests

The following test procedures may be used to test various operating parameters.

NOTE

In some cases a channel other than 333 must be used in order to avoid interference. In other cases it is useful to test the radio performance on the band edges such as channel 991 (lowest frequency) and 799 (highest frequency).

RX Sensitivity Test (SINAD)

Communications Analyzer Setup:

RF Generator frequency: 879.99 MHz (ch. 333)

RF Level: -116 dBm

FM Deviation: 8 kHz

Modulation frequency: 1 kHz

Filtering: C-message

Select: SINAD meter

Test Mode Commands:

11333# Load synthesizer to channel 333
 08# Unmute receive audio path
 58# Turn on compandor
 474# Set volume control to level 4
 356# Set RX audio path to Ext. Audio-Path

SINAD measured on the communications analyzer must be ≥ 12 dB. Duplex SINAD can be measured with the same setup by entering 122# and the 05# test command, which turns on the transmitter at power step 2.

RX Audio Distortion Test

Communications Analyzer Setup:

RF Generator frequency: 879.99 MHz (ch. 333)

RF Level: -50 dBm

FM Deviation: ± 8 kHz peak

Modulation frequency: 1 kHz

Filtering: C-message

Select: Distortion Meter

Test Mode Commands:

11333# Load synthesizer to channel 333
 08# Unmute receive audio path
 58# Turn on compandor
 474# Set volume control to level 4
 356# Select external RX audio path

Distortion measured on the communications analyzer must be less than 5%.

TX Power Out Test

Communications Analyzer Setup:

Monitor Frequency: 834.99 MHz (ch. 333)

Test Mode Commands:

11333# Load synthesizer to channel 333
 122# Set power level to step 2
 05# Turn on transmit carrier
 12X# Set power level to step X, where X is a power level from 2 to 7.

The TX Power Out specification for each portable power level is as follows:

Power Step 2	28 dBm +2/-4 dB
Power Step 3	24 dBm +2/-4 dB
Power Step 4	20 dBm +2/-4 dB
Power Step 5	16 dBm +2/-4 dB
Power Step 6	12 dBm +2/-4 dB
Power Step 7	8 dBm +2/-4 dB

Typically, the power for each step will be in

the range of +1/-2 dB from nominal.

NOTE

When taking measurements, remember to compensate for cable loss.

TX Frequency Error Test

Communications Analyzer Setup:

Monitor Frequency 834.99 MHz
(ch. 333)

Test Mode Commands:

11333# Load synthesizer to channel 333
122# Set power level to power step 2
05# Turn on transmit carrier

The frequency error measured on the communications analyzer must be less than ± 2.5 ppm (± 2.09 kHz).

TX Audio Distortion Test

Communications Analyzer Setup:

Monitor Frequency: 834.99 MHz
(ch. 333)

Audio Generator: 1 kHz tone input
~800 mV rms or equivalent to achieve
8kHz deviation

Filtering: C-message, 750 μ s
de-emphasis, 50Hz highpass, 15kHz
lowpass

Select: Distortion meter

Test Mode Commands:

11333# Load synthesizer to channel 333
122# Set power level to power step 2
05# Turn on transmit carrier
10# Unmute transmit audio path
59# Turn off compandor
356# Select External TX Audio path

Adjust the audio generator amplitude to obtain ± 8 kHz peak deviation. The transmit distortion should read less than 5%.

TX Maximum Deviation Test

Communications Analyzer Setup:

Monitor Frequency: 834.99 MHz
(ch. 333)

Filtering: 750 μ s de-emphasis
50 Hz highpass, 15 kHz lowpass

Audio Generator: 1 kHz tone, 6V rms

Select: Peak deviation meter

Test Mode Commands:

11333# Load synthesizer to channel 333
122# Set power level to power step 2
05# Turn on transmit carrier
356# Select External TX Audio path
10# Unmute TX Audio path
58# Turn on compandor

The peak deviation should be very close to, but must not exceed ± 12 kHz.

TX SAT Deviation Test

Communications Analyzer Setup:

Generate Frequency: 879.99MHz
(ch. 333) with 6000 Hz tone and 2kHz
deviation

RF Level: -50dBm

Monitor Frequency: 834.99 MHz
(ch. 333)

Filtering: 750us de-emphasis
50 Hz highpass, 15 kHz lowpass

Select: Peak deviation meter

Test Mode Commands

11333# Load synthesizer to channel 333
122# Set power level to power step 2
05# Turn on transmit carrier
251# Enable 6000 Hz SAT tone

The transponded peak SAT deviation is measured on the communications analyzer and should be $2 \text{ kHz} \pm 200 \text{ Hz}$. The demodulated signal on the communications analyzer should have an audio frequency of 6000 Hz.

TX ST Deviation Test

Communications Analyzer Setup:

Monitor Frequency: 834.99 MHz
(ch. 333)

Filtering: 750us de-emphasis
50 Hz highpass, 15 kHz lowpass

Select: Peak deviation meter

Test Mode Commands:

11333# Load synthesizer to channel 333

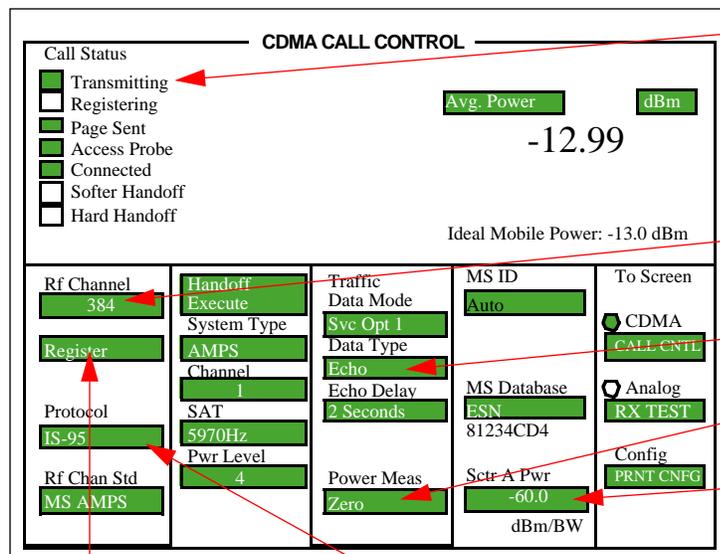
122# Set power level to power step 2

05# Turn on transmit carrier

14# Enable signaling tone

The peak ST deviation measured on the communications analyzer should be $8 \text{ kHz} \pm 800 \text{ Hz}$ deviation. The demodulated signal on the communications analyzer should have an audio frequency of 10 kHz.

Set up for CDMA call



Pseudo LED's show call Status

The "Transmitting" light means that the HP 8924C is configured and transmitting the required CDMA signals to make a call.

Enter the expected RF channel number

Select Echo Mode

Zero the Power Meter

Set CDMA Generator Power to -60 dBm/1.23MHz

Select Protocol

Once the Phone Acquires Service, Register it by Using the Knob

1. Enter the channel number that the CDMA phone expects to find a CDMA system on. The IS-95A standard defines a primary and secondary channel number for both the A and B service providers. These channels are: 283 and 691 for the A side, and 384 and 777 for the B side. A CDMA phone will only look for a CDMA system on power-up at its programmed primary or secondary channels. The HP 8924C defaults to channel 384. The phone you are using is set to B side service with a primary channel of 384.
2. Select the necessary protocol (IS-95, ID-95A, J-STD-008). For this demo we select IS-95.
3. Select the Traffic Data Mode to Service Option 001 (duplexed voice mode).
4. Set the Data Type to echo. This will allow you to speak into the phone under test and hear the voice quality echoed in the phone via the CDMA link from the HP 8924C.
5. Zero the average power detector. This is a good time to perform this step since no power is being transmitted by the phone.
6. Finally, set the Sector A power to -60 Dbm/1.23 MHz. You are now ready to make a CDMA phone call.
7. Make sure that the phone has acquired service (some type of display indicator on the phone).
8. Register the phone. This step is not required for mobile initiated calls. When registration is successful, the Registration Indicator will go out. The MS database should now show an ESN value.

Making a CDMA Phone Call

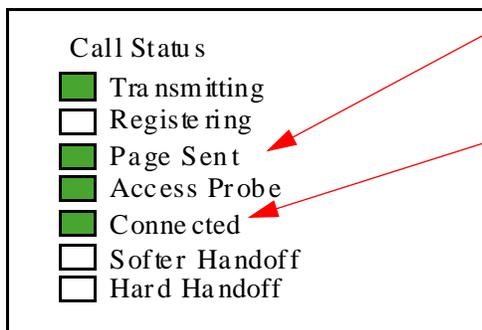


Press the front panel "CALL" key to initiate a CDMA call.



Answer the call on the CDMA Phone. Then speak into the phone and wait to hear your voice echoed back to you by the HP8924C.

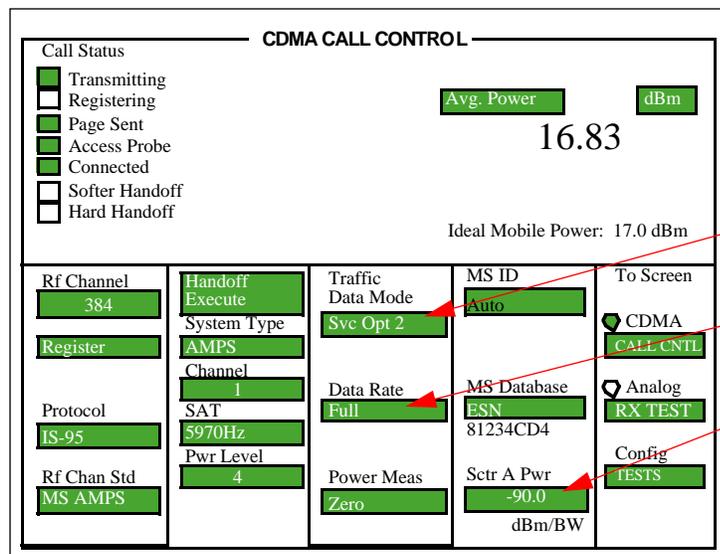
Each light activates as the call processing proceeds.



The "Connected" light indicates that the call was successfully completed.

1. Press the HP 8924C's CALL button.
2. Notice the call status indicators are activated at each step in the call process. First the PAGE indicator activates when the HP 8924C sends out a page message on its paging channel. When the mobile answers with an access probe, the access probe indicator is activated.
3. The phone will now ring, or indicate on its' display there is an incoming call.
4. To complete the call, press the send key on the phone. The connected indicator should now be on. When the HP 8924C receives an acknowledgment from the phone that the traffic channel connection process is completed, the connected indicator is activated.

Set up for CDMA RF Parametric Measurements



Setup a CDMA Call with the following parameters:

- Traffic Data Mode: **Service Option 2**
- Data Rate: **Full**
- Set Sector A's power: **-90 dBm/1.23 MHz**
- Press the front panel "CALL" key



While service option 001 calls are useful for the verification of CDMA mobile functionality, parametric tests cannot be accurately made in this mode. The TIA IS-98A minimum performance standard recommends that testing be made using service option 002. In service option 002, the mobile under test demodulates the received signal and then re-transmits this data to the HP 8924C. This mode allow accurate receiver performance measurements.

To make a service option 002 call:

1. Press the **END CALL** front panel key to terminate the service option 001 call.
2. Return to the CDMA Call Control screen.
3. Change the Traffic Data Mode to Service Option 002.
4. Make sure that the Data Rate is set to Full.

5. Set Sector A's power to -90 dBm/1.23 MHz (this value may need some adjustment for varying cable losses - some phones with their associate fixtures may require higher levels due to path losses to make a phone call).
6. Press the HP 8924C's front panel CALL button.

The HP 8924C's call status indicators should now indicate that a call is connected. Depending on the phone being used, either SO2 or Loop-back will be shown on the phone's display. Also available is service option 03 (voice EVRC), along with service option 09 and service option 32768 for 14.4 vocoder type phones.

Making a Receiver Sensitivity Measurement

CDMA CELLULAR MOBILE RECEIVER TEST				
Test Status <input checked="" type="checkbox"/> Connected <input checked="" type="checkbox"/> Service Opt 2/9 <input checked="" type="checkbox"/> Testing <input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Max Frames				
		FER		0.00 %
		Errors Counted		0
		Frames Counted		367
Meas Cntl	Max Frames	Traffic	Setr A Pwr	To Screen
Single / Cont	10000	Data Mode	-100.0	CDMA
	Confidence	Svc Opt 2	dBm / BW	CALL CNTL
	95.00	Data Rate	Traffic	Analog
	%	Full	-15.6	RX TEST
	FER Spec	Eb / Nt	dB	Config
	0.50		AWGN	PRNT CNFG
	%		Off	
Display Interim Results				
Yes / No				

To make an FER Measurement:

- Enter the Maximum number of frames to Test: 10,000
- Enter the Confidence: 95%
- Enter the Target FER Specification: 0.5%
- Enable the display of interim results: Yes

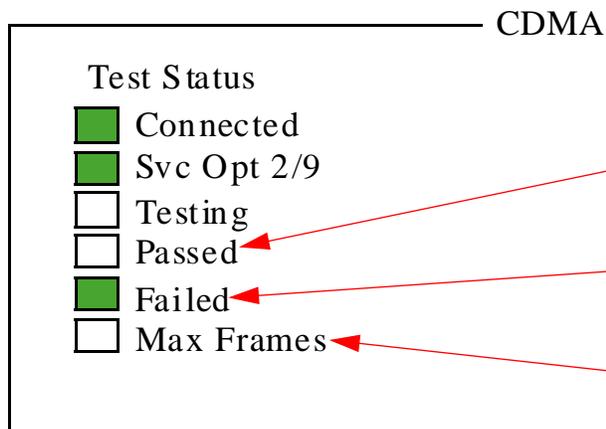
Arm the Measurement

- Place the cursor at the "Cont" field under Meas Cntl
- Push the Knob

Now that you have a service option 002 call connected, you are ready to make parametric receiver and transmitter measurements. To perform receiver measurements:

1. Go to the **RX Test screen**
2. Notice that the RX Test screen also has call status indicators that show if the call is still connected and if the call is a service option 002 call.
3. The parameter used to evaluate CDMA receiver quality is frame-error-rate. To setup a FER measurement with the HP 8924C, you need to enter three parameters: Max Frames, Confidence, and FER Spec.
4. Enter 10,000 into the Max frames field. This sets an upper bound to the time limit of the test.
5. Enter 95% into the Confidence field. This field sets the desired confidence limit for the test. If confidence limit testing is not desired, you can turn this field off. In that case, the FET test will run until the number of frames tested reaches the value entered into the Max Frames field.
6. Enter 0.5% into the FER spec field. This field sets the desired FER specification to test to.
7. Make sure that the Display Interim Results field is set to yes.
8. Use the knob to place the cursor in front of the Arm field. Press the knob to start the measurement.

Receiver Test Termination



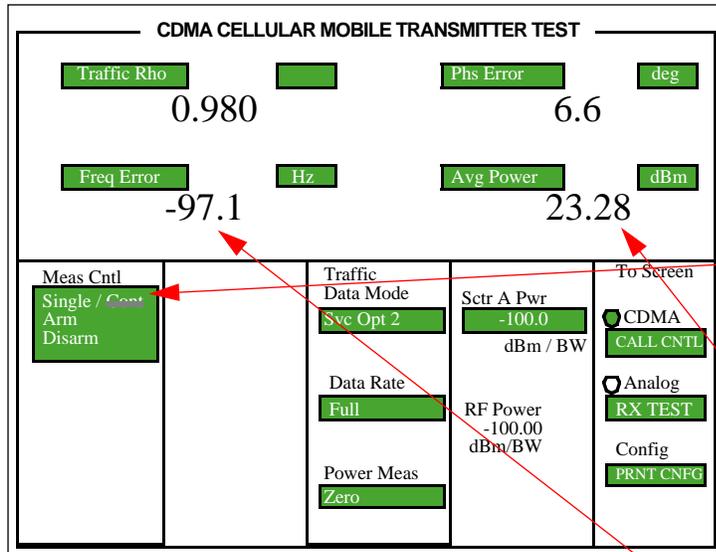
There are 3 possible outcomes to an FER Test:

- **Passed:** this means that the measured FER meets the target FER specification with the specified confidence.
- **Failed:** this means that the measured FER does not meet the target FER specification with the specified confidence.
- **Max Frames:** this means that the test was indeterminate in that the measured FER could neither pass nor fail the target FER specification with the specified confidence in the number of frames specified.

There are three possible outcomes for a confidence interval receiver frame-error-rate test with the HP 8924C:

1. When the HP 8924C determines that the measured FER will meet the user specified FER specification with the specified confidence level, the test is halted and the Passed indicator is activated.
2. The HP 8924C extends the TIA recommendation to also check for failures with the user specified confidence level. In other words, if the HP 8924C detects that the measured FER will fail the user entered FER specification with the specified confidence level, the test is halted and the Failed indicator is activated. This feature eliminates wasted time testing phones that are clearly failing the test.
3. If neither the pass or fail conditions are met, the FER test will run until the number of frames counted equals the valued entered into the Max Frames field. When this occurs, the Max Frames indicator is activated. If the confidence interval is turned off, the HP 8924C does not perform any confidence level checking and the FER test will run until the number of frames tested equals Max Frames.

CDMA Transmitter Tests



To make Concurrent RX and TX Measurements:

- Restart FER with Confidence Limits Off
- Go to the TX Test Screen
- Switch to Continuous Measurements

Read Average Power

- Check Max Power
- Check Open Loop Power Control

Read Rho Measurements

- Waveform Quality
- Frequency Error
- Amplitude & Phase Error

Simultaneous and transmitter tests is another feature of the HP 8924C. Simultaneous measurements results in much reduced test time. To make simultaneous receiver sensitivity and transmitter measurements:

1. Go to the TX test screen. (Press TX Test under the CDMA screens area.)
2. Make sure that the Meas Cntl is in Continuous mode. The HP 8924C will now make TX measurements.
3. Now select several measurement fields and change the measurement types. Note: TM Rho (Test Mode Rho) only works with phones that have Test Mode functionality.

Now switch back to the RX Test screen. Notice that the FER test continued to run while you were making TX measurements.

CDMA Transmitter Power Range Test

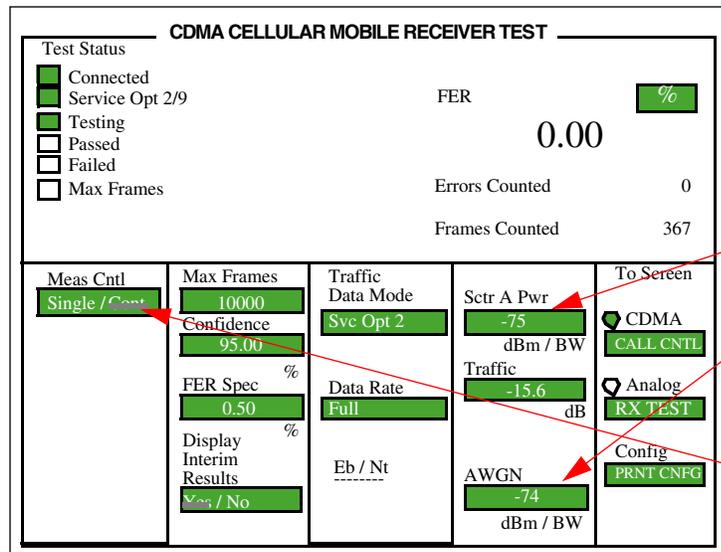
CDMA TRANSMITTER POWER RANGE TEST				
Max Power 25.46 dBm		Avg Power <input type="text" value="1.54"/> dBm		
Min Power -54.42 dBm		Ideal Mobile Power: 1.6 dBm		
Meas Cntl <input type="button" value="Execute"/>	Closed Loop Pwr Cntl <input type="button" value="Closed Loop Change"/> <input type="button" value="Always down"/> <input type="button" value="Steps"/> <input type="text" value="50"/> <input type="button" value="Execute"/> <input type="button" value="Drop Timer"/> <input type="button" value="On / Off"/>	Traffic Data Mode <input type="button" value="Svc Opt 2"/> <input type="button" value="Data Rate"/> <input type="text" value="Full"/> <input type="button" value="Power Meas"/> <input type="text" value="Zero"/>	Sctr A Pwr <input type="text" value="-75.0"/> dBm / BW <input type="button" value="Traffic"/> <input type="text" value="-15.6"/> dB <input type="button" value="Atten Hold"/> <input type="button" value="On / Off"/>	To Screen <input checked="" type="radio"/> CDMA <input type="button" value="CALL CNTL"/> <input type="radio"/> Analog <input type="button" value="RX TEST"/> <input type="button" value="Config"/> <input type="button" value="PRNT CNFG"/>

The ability to do min/max power measurements just by selecting Execute is another advanced feature of the HP 8924C. In this screen you can also control and test each power step while comparing Ideal Mobile Power to actual Avg Power measurements.

Select Execute

1. Go the CDMA Transmitter Power Range Test screen (press the blue Shift key and then the Range key).
2. Now execute the min/max power measurement (use the knob and select execute under the min/max power field).
3. You will also notice in this screen you can select closed-loop power control to manually control power settings of the phone. Note: If "always down" is selected, the phone will step its power down until the call is lost. If power control is changed, be sure to return it to "closed-loop" before proceeding onto the next test.

FER with AWGN Tests



To make a CDMA FER with AWGN measurement:

- ¥ Use the same setup as for the receiver sensitivity test
- ¥ Set Sector A Power to -75 dBm/1.23 MHz
- ¥ Set AWGN Power to -74 dBm/1.23 MHz

Arm the Measurement

- ¥ Place the cursor at the Cont field under Meas Cntl
- ¥ Push the knob

The other key receiver measurement for CDMA phones is the FER with AWGN test. In this test, large amounts of uncorrelated noise is added to simulate the actual conditions encountered by a CDMA phone in actual use. To make this measurement:

1. Set the Sector A Power to -55 dBm/1.23 MHz.
2. Set the AWGN source to -54 dBm/1,23 MHz (this means that the traffic channel is 16.6 dB below the noise level!).
3. Arm the measurement by selecting Continuous in the Meas Cntl field.
4. Under these conditions, a CDMA phone should meet 0.5% FER with 95% confidence.

Standards specify other tests for other rates. These can be performed by changing the Data Rate and Traffic level to the specified settings.

Table 7: Assembly Replacement Level Troubleshooting and Repair Chart

<i>Symptom</i>	<i>Probable Cause</i>	<i>Verification and Remedy</i>
1. Phone will not turn on or stay on.	a) Battery either discharged or defective.	<ol style="list-style-type: none"> 1. Measure battery voltage across a 50 ohm (>1 Watt) load. 2. If the battery voltage is <6 V DC, recharge the battery using the appropriate battery charger. 3. If the battery will not recharge, replace the battery.
	b) Battery connector open or misaligned.	<ol style="list-style-type: none"> 1. Visually inspect the battery connectors on both the battery pack and the transceiver, including the solder connections from the battery connector to the main PC board. 2. Realign the contacts or, if necessary, replace either the battery or battery connector.
	c) Switch inside option connector is open.	<ol style="list-style-type: none"> 1. Measure resistance across the two option connector solder connections on the RF side of the RF/Audio-Logic board. 2. If the switch measures open, replace the option connector.
	d) Keypad membrane defective.	<ol style="list-style-type: none"> 1. Replace the keypad membrane with a known good part. 2. Temporarily connect +6 V DC to the battery contacts. 3. Depress the PWR button; if unit turns on and stays on, disconnect the power source and reassemble the phone with the new keypad membrane.
	e) Keypad board defective.	<ol style="list-style-type: none"> 1. Replace keypad board assembly with a known good assembly. 2. Temporarily connect +6 V DC to the battery contacts. Depress the PWR button. 3. If the units turns on and stays on, disconnect the power source and reassemble the phone with the new keypad board assembly.
	f) RF/Audio-Logic Board defective.	<ol style="list-style-type: none"> 1. Remove the RF/Audio-Logic Board. Substitute a known good board. 2. Temporarily connect +6 V DC to the battery contacts. 3. Depress the PWR button; if unit turns on and stays on, disconnect the power source and reassemble the phone with the new RF/Audio-Logic board and re-test phone.

Symptom	Probable Cause	Verification and Remedy
2. Phone exhibits poor reception and/or erratic operation (such as calls frequently dropping, weak and/or distorted audio, etc.)	a) Defective antenna or damaged antenna connector.	1. Make sure the antenna shaft ferrule is screwed into the antenna socket. 2. Make sure pin on antenna coil is seated in antenna connector socket. 3. Replace the antenna with a known good antenna.
	b) Defective RF/Audio-Logic Board.	Replace the transceiver board (refer to symptom 1c Verification and Remedy.)
3. Display is erratic, or provides partial or no display.	a) Defective display module.	1. Gain access to RF/Audio-Logic board or keypad board as described in the "Disassembly" section of this manual. 2. Check connection. If connection not at fault, proceed to b.
	b) RF/Audio-Logic board defective.	Replace the RF/Audio-Logic Board (refer to symptom 1f Verification and Remedy).
4. Alert ringer volume is distorted or too low.	a) Alert ringer defective.	Replace the defective speaker or alert ringer with a known good speaker or alert ringer.
	b) RF/Audio-Logic board defective.	Replace the RF/Audio-Logic Board (refer to symptom 1f Verification and Remedy).
5. Transmit audio is weak, distorted, or dead.	a) Microphone defective.	Replace defective microphone.
	b) RF/Audio-Logic board defective.	Replace the RF/Audio-Logic Board (refer to symptom 1f Verification and Remedy).
6. Receive audio is weak and/or distorted.	a) Speaker defective.	Replace defective speaker.
	b) RF/Audio-Logic board defective.	Replace the RF/Audio-Logic Board (refer to symptom 1f Verification and Remedy).
7. MicroTAC SC-725 (CDMA) model does not sense when flip is opened and closed.	a) Defective reed switch or magnet on keypad board	Replace keypad board assembly or magnet/flip assembly.



Reference Designator	Part#	Reference Designator	Part#	Reference Designator	Part#
VR1704	0609118R02	R00408	0662057M58	R02551	0662057M98
R00450	0660076N07	R00331	0662057M61	R01999	0662057N01
R02007	0660076N45	R00113	0662057M62	R01704	0662057N03
R02009	0660076N89	R00209	0662057M62	R01913	0662057N03
R01803	0660076S01	R00320	0662057M62	R00329	0662057N05
R00413	0660076S01	R00203	0662057M68	R02015	0662057N07
R01102	0662057M01	R01975	0662057M74	R00355	0662057N07
R01300	0662057M01	R01997	0662057M74	R00414	0662057N09
R01400	0662057M01	R01998	0662057M74	R00332	0662057N11
R01700	0662057M01	R05001	0662057M74	R01904	0662057N13
R01701	0662057M01	R00324	0662057M76	R02005	0662057N13
R01708	0662057M01	R00333	0662057M76	R01104	0662057N15
R01914	0662057M01	R00206	0662057M80	R01105	0662057N15
R01915	0662057M01	R11546	0662057M82	R01106	0662057N15
R01988	0662057M01	R00204	0662057M82	R01911	0662057N15
R02013	0662057M01	R00205	0662057M82	R00326	0662057N15
R02552	0662057M01	R00321	0662057M84	R00327	0662057N15
R02597	0662057M01	R05000	0662057M84	R01912	0662057N20
R00301	0662057M01	R01802	0662057M85	R00325	0662057N20
R00328	0662057M01	R01718	0662057M86	R01114	0662057N23
R00390	0662057M01	R00199	0662057M86	R01951	0662057N23
R00392	0662057M01	R02016	0662057M86	R01992	0662057N23
R00394	0662057M01	R11548	0662057M90	R02050	0662057N23
R00395	0662057M01	R01902	0662057M90	R02501	0662057N23
R00398	0662057M01	R01932	0662057M90	R02000	0662057N25
R00399	0662057M01	R01933	0662057M90	R02001	0662057N25
R00406	0662057M01	R00309	0662057M90	R01907	0662057N27
R00412	0662057M01	R02099	0662057M92	R01910	0662057N27
R00109	0662057M26	R01909	0662057M94	R02002	0662057N27
R00110	0662057M26	R01903	0662057M95	R02003	0662057N27
R01100	0662057M26	R00330	0662057M95	R02004	0662057N27
R01101	0662057M26	R01108	0662057M98	R01706	0662057V07
R00310	0662057M26	R00111	0662057M98	R01930	0662057V07
R00318	0662057M26	R01110	0662057M98	R01931	0662057V07
R00323	0662057M26	R01111	0662057M98	R01705	0662057V11
R00335	0662057M26	R01112	0662057M98	R01709	0662057V15
R00336	0662057M26	R01115	0662057M98	R01710	0662057V15
R00403	0662057M26	R00112	0662057M98	R01905	0662057V15
R01120	0662057M36	R01130	0662057M98	R02014	0662057V15
R02599	0662057M43	R11537	0662057M98	R01711	0662057V19
R00616	0662057M43	R01702	0662057M98	R01712	0662057V19
R00421	0662057M46	R01703	0662057M98	R02006	0680195M64
R01715	0662057M50	R01707	0662057M98	C01913	2109622N06
R01716	0662057M50	R01916	0662057M98	C00362	2109622N06
R01717	0662057M50	R01917	0662057M98	C00345	2113740F11
R00334	0662057M50	R01918	0662057M98	C00370	2113740F11
R00337	0662057M50	R01990	0662057M98	C00349	2113740F22
R00420	0662057M50	R01991	0662057M98	C00348	2113740F27
R00422	0662057M50	R00207	0662057M98	C01910	2113740F41
R00208	0662057M54	R02098	0662057M98	C01917	2113740F41
R00319	0662057M56	R02500	0662057M98	C01908	2113740F59
R00202	0662057M58	R02502	0662057M98	C01909	2113741F07
R00407	0662057M58	R02550	0662057M98	C00323	2113741F13

Reference Designator	Part#	Reference Designator	Part#	Reference Designator	Part#
C01915	2113741F33	C01922	2113743K15	C00335	2113743M24
C02026	2113741F49	C01923	2113743K15	C00344	2113743M24
C01108	2113743A19	C01924	2113743K15	C00346	2113743M24
C02006	2113743E03	C01925	2113743K15	C00352	2113743M24
C02008	2113743E03	C01926	2113743K15	C00407	2113743N03
C02099	2113743E03	C02007	2113743K15	C00202	2113743N10
C01901	2113743E07	C02022	2113743K15	C00203	2113743N12
C01920	2113743E10	C02501	2113743K15	C00121	2113743N14
C01105	2113743E20	C02502	2113743K15	C00122	2113743N14
C01903	2113743E20	C02503	2113743K15	C00219	2113743N14
C01914	2113743E20	C01707	2113743L05	C00317	2113743N14
C01930	2113743E20	C01712	2113743L11	C00343	2113743N14
C00300	2113743E20	C01999	2113743L17	C00217	2113743N16
C00302	2113743E20	C00331	2113743L17	C00206	2113743N18
C00316	2113743E20	C00338	2113743L17	C00218	2113743N18
C00326	2113743E20	C00416	2113743L17	C00340	2113743N20
C00328	2113743E20	C00420	2113743L17	C00201	2113743N22
C00334	2113743E20	C02014	2113743L21	C00341	2113743N22
C00353	2113743E20	C02096	2113743L27	C00355	2113743N22
C00354	2113743E20	C02097	2113743L27	C00411	2113743N22
C02011	2113743F16	C01107	2113743L41	C00422	2113743N22
C01102	2113743G26	C00118	2113743L41	C00425	2113743N22
C01975	2113743G26	C00124	2113743L41	C00120	2113743N24
C02500	2113743G26	C00132	2113743L41	C00321	2113743N24
C05000	2113743G26	C00133	2113743L41	C02021	2113743N26
C02050	2113743G26	C00134	2113743L41	C00424	2113743N26
C02051	2113743G26	C01907	2113743L41	C00421	2113743N28
C02001	2113743G26	C00200	2113743L41	C00426	2113743N28
C02002	2113743G26	C00204	2113743L41	C00119	2113743N30
C02000	2113743H14	C00208	2113743L41	C00216	2113743N30
C02401	2113743H14	C00209	2113743L41	C00347	2113743N38
C01100	2113743K15	C00210	2113743L41	C00123	2113743N40
C01101	2113743K15	C00212	2113743L41	C00125	2113743N40
C01103	2113743K15	C00214	2113743L41	C00126	2113743N40
C01104	2113743K15	C00215	2113743L41	C00127	2113743N40
C01106	2113743K15	C00220	2113743L41	C00128	2113743N40
C01109	2113743K15	C00231	2113743L41	C00129	2113743N40
C01110	2113743K15	C00304	2113743L41	C00130	2113743N40
C01300	2113743K15	C00305	2113743L41	C00131	2113743N40
C01700	2113743K15	C00309	2113743L41	C00135	2113743N40
C01701	2113743K15	C00310	2113743L41	C01704	2113743N40
C01702	2113743K15	C00311	2113743L41	C01705	2113743N40
C01804	2113743K15	C00313	2113743L41	C01706	2113743N40
C01805	2113743K15	C00315	2113743L41	C01750	2113743N40
C01806	2113743K15	C00325	2113743L41	C00230	2113743N40
C01807	2113743K15	C00329	2113743L41	C00318	2113743N40
C01810	2113743K15	C00333	2113743L41	C00319	2113743N40
C01811	2113743K15	C00336	2113743L41	C00322	2113743N40
C01900	2113743K15	C00357	2113743L41	C00327	2113743N40
C01904	2113743K15	C00358	2113743L41	C00330	2113743N40
C01905	2113743K15	C00415	2113743L41	C00332	2113743N40
C01912	2113743K15	C00419	2113743L41	C00339	2113743N40
C01921	2113743K15	C01400	2113743M24	C00400	2113743N40

MAIN BOARD SIDE 1(Iss. P8.2)

CDMA SC725

Reference Designator	Part#	Reference Designator	Part#	Reference Designator	Part#
C00401	2113743N40	L00403	2462587V36	U01300	5109688L09
C00402	2113743N40	J01100	2809305U01	U00202	5109768D04
C00403	2113743N40	SH0011	4209099E02	U01100	5109841C42
C00404	2113743N40	SH0014	4209099E02	U00301	5109879E15
C00405	2113743N40	SH0015	4209099E02	U00401	5109911N01
C00408	2113743N40	SH0016	4209099E02	U01900	5109923D31
C00409	2113743N40	SH0017	4209099E02	U00400	5109940K20
C00413	2113743N40	SH0018	4209099E02	U00402	5109940K20
C00417	2113743N40	SH0019	4209099E02	U00100	5109944C13
C00418	2113743N40	SH0024	4209099E02	U01700	5109962C10
C00423	2113743N40	SH0028	4209099E02	U01800	5109962C12
C00430	2113743N40	SH0006	4209099E02	U01400	5199299A01
C00431	2113743N40	Q00300	4809527E12	FL0200	9109142L01
C00320	2113743N42	Q01100	4809579E02	FL0401	9109383J01
C02598	2113928A01	U02001	4809579E04	FL0102	9109403K01
C02599	2113928A01	Q02500	4809579E12	FL0201	9109405J01
C00307	2113928A01	Q02501	4809579E12	FL0101	9109580M01
C01916	2113928C03	Q02502	4809579E12		
C01919	2113928C03	Q00401	4809579E12		
C00301	2113928G01	CR0303	4809606E03		
C00303	2113928G01	Q00200	4809608E03		
C00306	2113928G01	CR0301	4809612F03		
C00308	2113928G01	CR2000	4809653F02		
C00312	2113928G01	VR0001	4809788E06		
C00337	2311049A56	VR1701	4809788E06		
C00356	2311049A59	VR0002	4809788E06		
C00450	2311049A59	U02002	4809939C04		
C00451	2311049A59	Q01900	4809939C06		
L00230	2404574Z06	Q01700	4809939C09		
L00203	2404574Z07	Q00104	4809940E02		
L00204	2404574Z08	Q00105	4809940E02		
L00201	2404574Z12	Q00202	4809940E02		
L00200	2404574Z14	Q02503	4809940E02		
L00107	2409646M04	Q02504	4809940E02		
L00108	2409646M08	Q02550	4809940E02		
L00420	2409646M70	Q02551	4809940E02		
L00303	2409646M73	Q00400	4809940E02		
L00304	2409646M73	Q00403	4809940E02		
L00307	2409646M85	CR2001	4813825A05		
L00308	2409704K09	CR2003	4813825A05		
L00400	2409704K37	U00403	4813827A32		
L00402	2409704K37	VR1900	4813830A73		
L00106	2409704K54	CR0300	4862824C01		
L00302	2462587P09	CR0302	4862824C01		
L00202	2462587Q38	Q00201	4883477R02		
L00306	2462587Q38	U02500	5105750U06		
L00300	2462587Q44	U00420	5105750U18		
L00301	2462587V27	U01601	5109522E24		
L00406	2462587V27	U01801	5109522E24		
L00401	2462587V33	U00101	5109572E05		
L00404	2462587V33	U00102	5109572E05		
L00405	2462587V33	U00201	5109572E05		
L00407	2462587V33	U02000	5109632D54		

MAIN BOARD SIDE 2(Iss. P8.2)

CDMA SC725

Reference Designator	Part#	Reference Designator	Part#	Reference Designator	Part#
Z00004	0609118R01	R00362	0662057M74	C00100	2113743E20
R03000	0660076N73	R00605	0662057M74	C10088	2113743E20
R03002	0660076N73	R11555	0662057M78	C00101	2113743E20
R03003	0660076N73	R02600	0662057M80	C00104	2113743E20
R11541	0660076S01	R00606	0662057M81	C00105	2113743E20
R01699	0660076S01	R00500	0662057M82	C03000	2113743E20
R11536	0662057M01	R00613	0662057M82	C00514	2113743E20
R11542	0662057M01	R00611	0662057M84	C02019	2113743H14
R01201	0662057M01	R00614	0662057M84	C02020	2113743H14
R01203	0662057M01	R00501	0662057M90	C02024	2113743H14
R01207	0662057M01	R00502	0662057M90	C01200	2113743K15
R01208	0662057M01	R00503	0662057M90	C01201	2113743K15
R01500	0662057M01	R00505	0662057M94	C01500	2113743K15
R01605	0662057M01	R00509	0662057M94	C01600	2113743K15
R01614	0662057M01	R00615	0662057M94	C01601	2113743K15
R01616	0662057M01	R00504	0662057M95	C01602	2113743K15
R01810	0662057M01	R11539	0662057M98	C01603	2113743K15
R01935	0662057M01	R01600	0662057M98	C01604	2113743K15
R01936	0662057M01	R01610	0662057M98	C01605	2113743K15
R00361	0662057M01	R01615	0662057M98	C01606	2113743K15
R11557	0662057M19	R00004	0662057M98	C01607	2113743K15
R11558	0662057M26	R11570	0662057N07	C01608	2113743K15
R00540	0662057M26	R11571	0662057N07	C01609	2113743K15
R00600	0662057M26	R00506	0662057N11	C01610	2113743K15
R00608	0662057M26	R00514	0662057N11	C01611	2113743K15
R00609	0662057M26	R01103	0662057N15	C01612	2113743K15
R00411	0662057M32	R01117	0662057N15	C01613	2113743K15
R00610	0662057M36	R01202	0662057N15	C01615	2113743K15
R00532	0662057M43	R01204	0662057N15	C01617	2113743K15
R00601	0662057M46	R01601	0662057N15	C01618	2113743K15
R01714	0662057M50	R01602	0662057N15	C02300	2113743K15
R00003	0662057M50	R01604	0662057N15	C02301	2113743K15
R00612	0662057M50	R01607	0662057N15	C00103	2113743L11
R00101	0662057M54	R11565	0662057N17	C10079	2113743L17
R00602	0662057M56	R00400	0662057N20	C10081	2113743L17
R00607	0662057M56	R00542	0662057N20	C00526	2113743L17
R00107	0662057M58	R00544	0662057N20	C00615	2113743L27
R00104	0662057M58	R00002	0662057N23	C00616	2113743L27
R00402	0662057M60	R02701	0662057N23	C00617	2113743L27
R00409	0662057M60	R00401	0662057N25	C01614	2113743L41
R00100	0662057M60	R03001	0662057N47	C00365	2113743L41
R02602	0662057M62	R01611	0662057V02	C00366	2113743L41
R00517	0662057M62	J02000	0909705K03	C00601	2113743L41
R00530	0662057M66	J05000	0909888M01	C00612	2113743L41
R11556	0662057M67	J01000	0909958J04	C00359	2113743M24
R00103	0662057M68	C00519	2109622N06	C00510	2113743M24
R00105	0662057M68	C00608	2113740F15	C00599	2113743N03
R00603	0662057M68	C00609	2113740F15	C00501	2113743N05
R00604	0662057M68	C00607	2113740F21	C00605	2113743N10
R00516	0662057M70	C01911	2113740F41	C00114	2113743N12
R00001	0662057M74	C00004	2113741F49	C00115	2113743N14
R01996	0662057M74	C01616	2113743A27	C00116	2113743N14
R02700	0662057M74	C00613	2113743B23	C00610	2113743N17

Reference Designator	Part#	Reference Designator	Part#	Reference Designator	Part#
C00600	2113743N18	L00524	2409704K45	FL0500	9109381J02
C00522	2113743N20	L00600	2409704K47	FL0400	9109383J01
C00113	2113743N20	L00601	2409704K47	FL0100	9109384J01
C00614	2113743N36	L00500	2462587V26		
C10087	2113743N40	L00522	2462587V29		
C00107	2113743N40	L00501	2462587V33		
C00108	2113743N40	T02000	2509021J01		
C00111	2113743N40	SH0DSP	2603971K01		
C00112	2113743N40	SHOVCO	2603972K01		
C00117	2113743N40	SHOLNA	2603973K01		
C01703	2113743N40	A00500	3909014B03		
C00412	2113743N40	CR0502	4809007R01		
C00500	2113743N40	Q00500	4809579E04		
C00504	2113743N40	U02700	4809579E04		
C00506	2113743N40	Q00501	4809605E07		
C00507	2113743N40	CR0500	4809606E05		
C00508	2113743N40	Q00100	4809608E03		
C00512	2113743N40	Q09976	4809608E03		
C00515	2113743N40	CR2002	4809653F02		
C00516	2113743N40	CR2700	4809653F02		
C00517	2113743N40	U00304	4809718L10		
C00602	2113743N40	CR0001	4809788E06		
C00604	2113743N40	VR1700	4809788E06		
C00606	2113743N40	VR1702	4809788E06		
C00611	2113743N40	VR1703	4809788E06		
C10082	2113743N42	Q00503	4809939C03		
C10083	2113743N42	Q00502	4809939C04		
C10089	2113743N50	U03000	4809939C04		
C00518	2113743N50	U03001	4809939C04		
C00361	2113928C03	CR9953	4809948D05		
C00109	2113928G01	Q03000	4813823A07		
C10074	2309121D21	Q03001	4813823A07		
C10076	2311049A07	CR2004	4813825A05		
C02600	2311049A07	Z00003	4813830A25		
C02601	2311049A07	CR0600	4862824C01		
C02603	2311049A07	Q00102	4882022N70		
C00556	2311049A07	Q00103	4882022N70		
C00524	2311049A54	Q00600	4883477R02		
C00603	2311049A56	Q00602	4883477R02		
C00618	2311049A56	Q09972	4884906R02		
C02602	2311049A63	U02300	5109632D09		
C10091	2311049A97	U09965	5109730C07		
L00105	2409646M05	U00501	5109768D04		
L00102	2409646M06	U02600	5109781E15		
L00104	2409646M06	U00502	5109781E33		
L00100	2409646M06	U09963	5109781E33		
L00101	2409646M70	U00110	5109781E91		
L00103	2409646M70	U00111	5109781E91		
L00520	2409704K20	S00500	5109783D03		
L00604	2409704K36	U01200	5199245A01		
L00603	2409704K37	U09964	5199249A01		
L00606	2409704K38	U01600	5199322A01		
L00521	2409704K39	ISO001	5809053U01		





Service Diagrams

The service diagrams were carefully prepared to allow a Motorola certified technician to easily troubleshoot cellular phone failures. Our professional staff provided directional labels, color coded traces, measurement values and other guidelines to help a technician troubleshoot a cellular phone with speed and accuracy.

We worked hard in trying to provide the best service diagrams, therefore, to avoid cluttered diagrams, we excluded some components from the service diagrams. Our professional staff carefully selected to excluded components that are unlikely to fail.

Test Point Measurements

The measurements labeled on the service diagrams are approximate values and may vary slightly. These measurements are dependent on the accuracy of the test equipment. We suggest that the test equipment calibration schedule be followed as stated by the manufacturer.

The types of probes used will also affect measurement values. Test probes and cables should be tested for RF losses and loose connections.

Because of the sensitivity of RF, measure readings will be greatly affected if they're taken in certain locations. To get the most accurate readings, take measurements nearest to the labeled measurement on the service diagram.

Model Specific Electrical Circuits

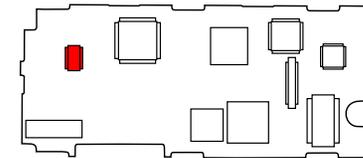
These service diagrams cover CDMA cellular phones. They include the SC725.

Some CDMA models have extra electrical circuits used for expanded features. Models that don't have these expanded features will have these electrical circuits excluded. The main circuit board is designed to operate whether or not these extra electrical circuits are present. So, don't be alarmed if you find some components missing on some models.

CDMA SC725: RX Mixer

FE_4.75V
page A14

4.75V



A3

RX Signal	LO Gain	HI Gain
(A)	2.62V	0V
(B)	0V	2.62V
(C)	2.62V	0V

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FE_4.75V
page A14

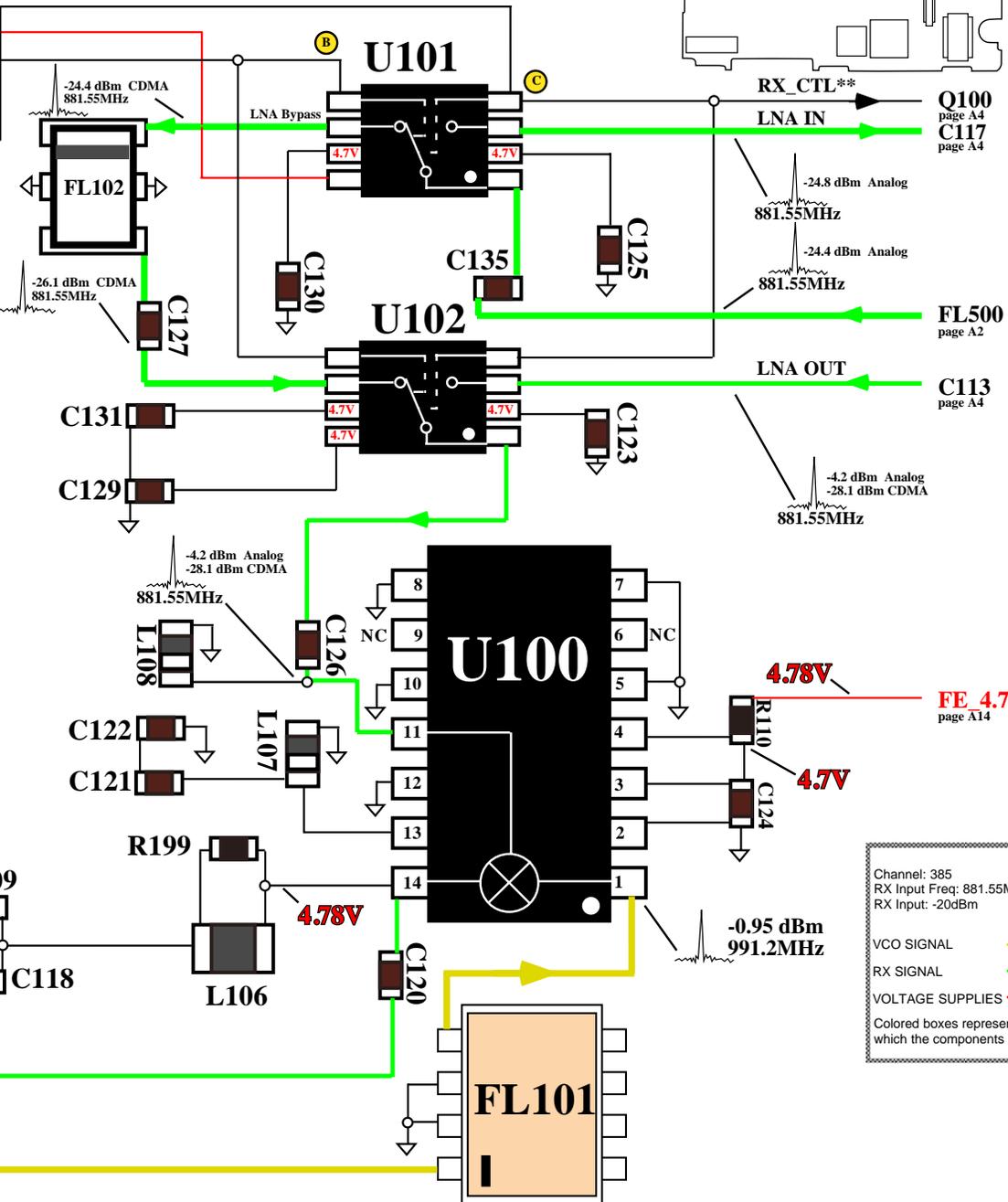
4.75V

U201-1
page A5

R600
page A7

-8.4 dBm Analog @ 109.3 MHz
-28.3 dBm CDMA @ 109.6 MHz

0.85 dBm
991.2MHz



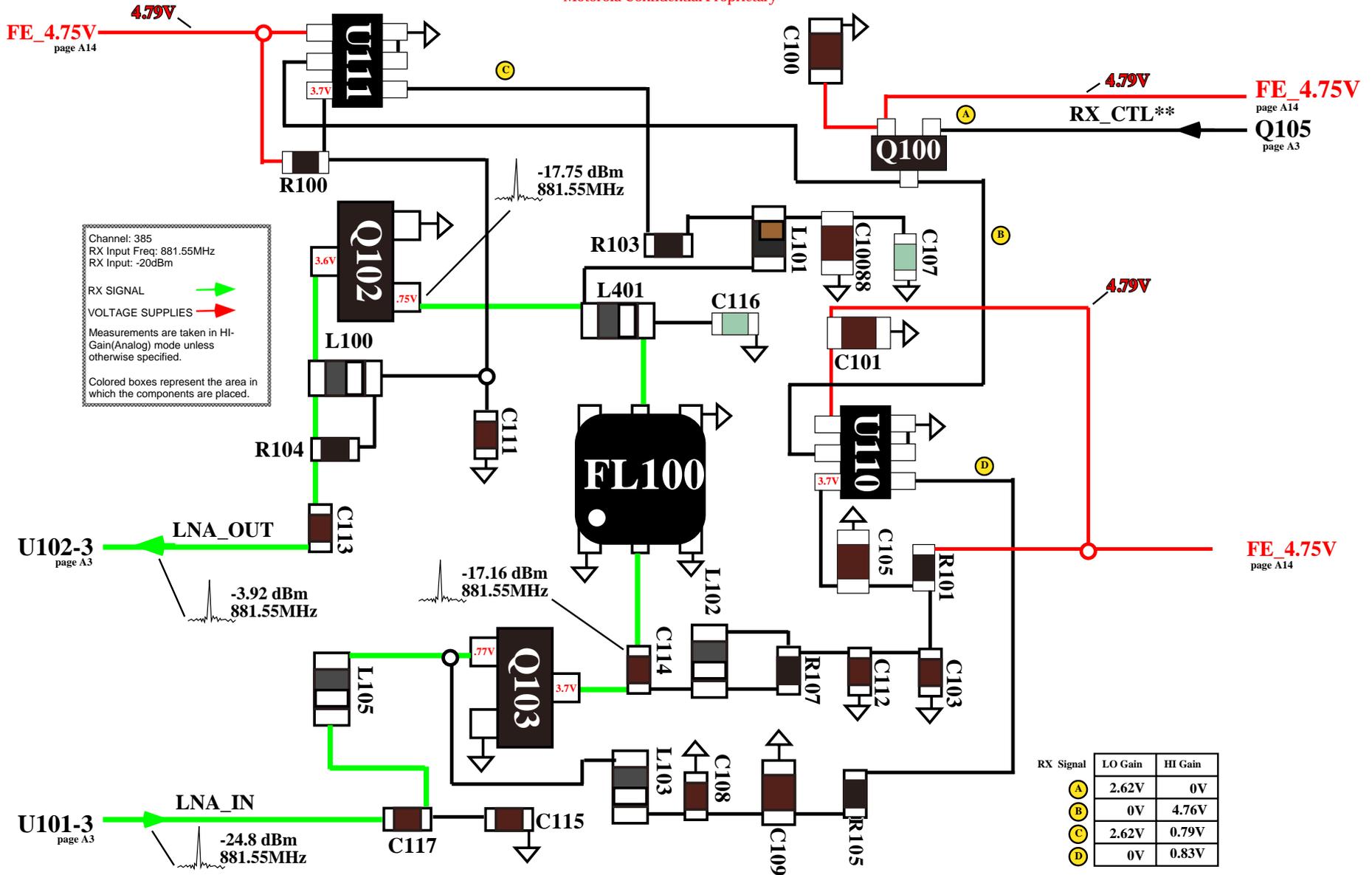
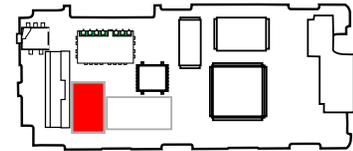
Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm

VCO SIGNAL →
RX SIGNAL →
VOLTAGE SUPPLIES →
Colored boxes represent the area in which the components are placed.

CDMA SC725: LNA Circuit

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Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

RX SIGNAL →
 VOLTAGE SUPPLIES →

Measurements are taken in HI-Gain(Analog) mode unless otherwise specified.

Colored boxes represent the area in which the components are placed.

RX Signal	LO Gain	HI Gain
A	2.62V	0V
B	0V	4.76V
C	2.62V	0.79V
D	0V	0.83V

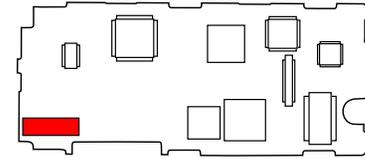
A4

FE_4.75V
page A14

FE_4.75V
page A14
Q105
page A3

FE_4.75V
page A14

CDMA SC725: Analog-CDMA Switch Circuit



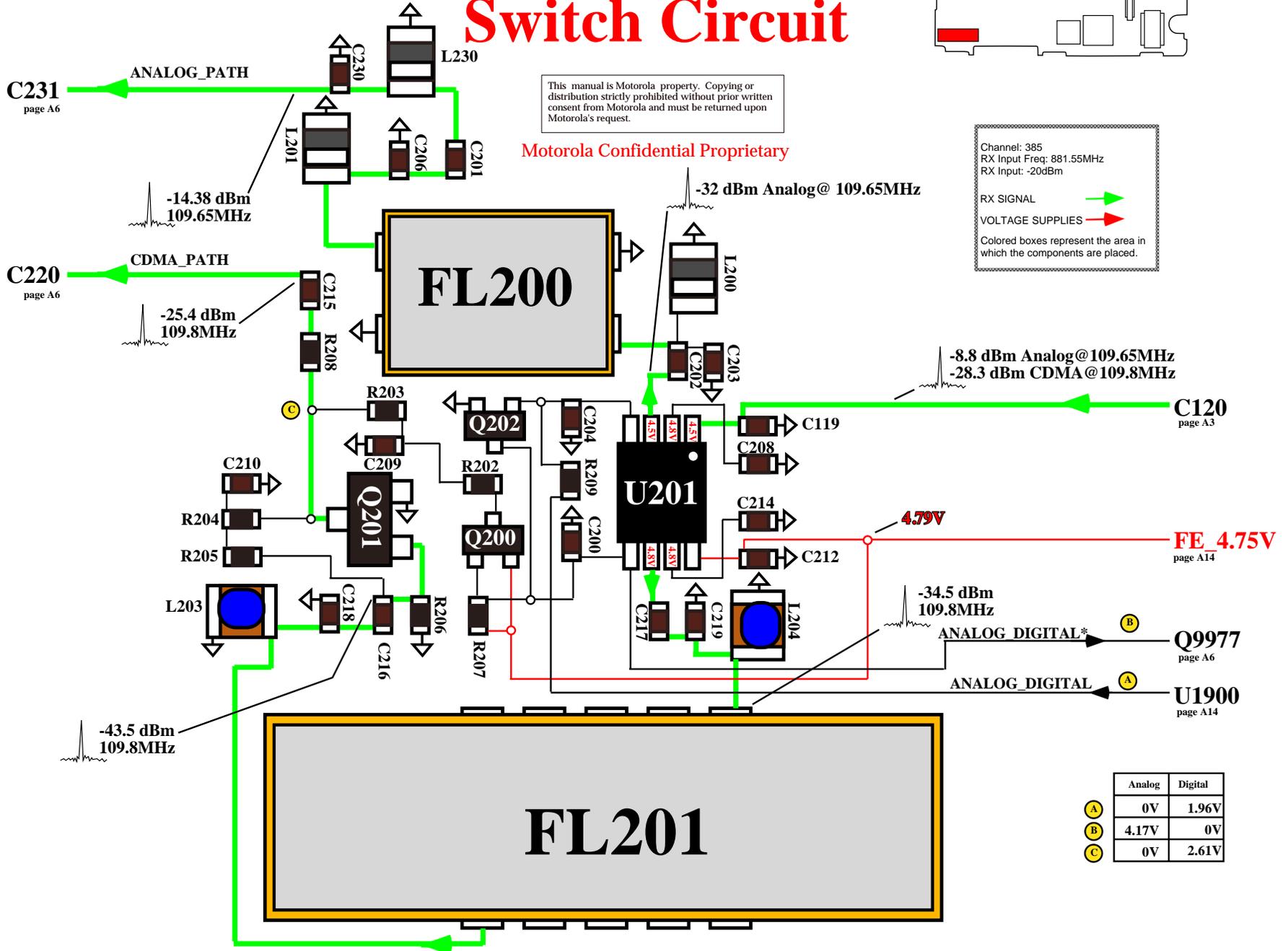
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Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

RX SIGNAL → (Green Arrow)
 VOLTAGE SUPPLIES → (Red Arrow)

Colored boxes represent the area in which the components are placed.



AS

	Analog	Digital
(A)	0V	1.96V
(B)	4.17V	0V
(C)	0V	2.61V

CDMA SC725: VCO

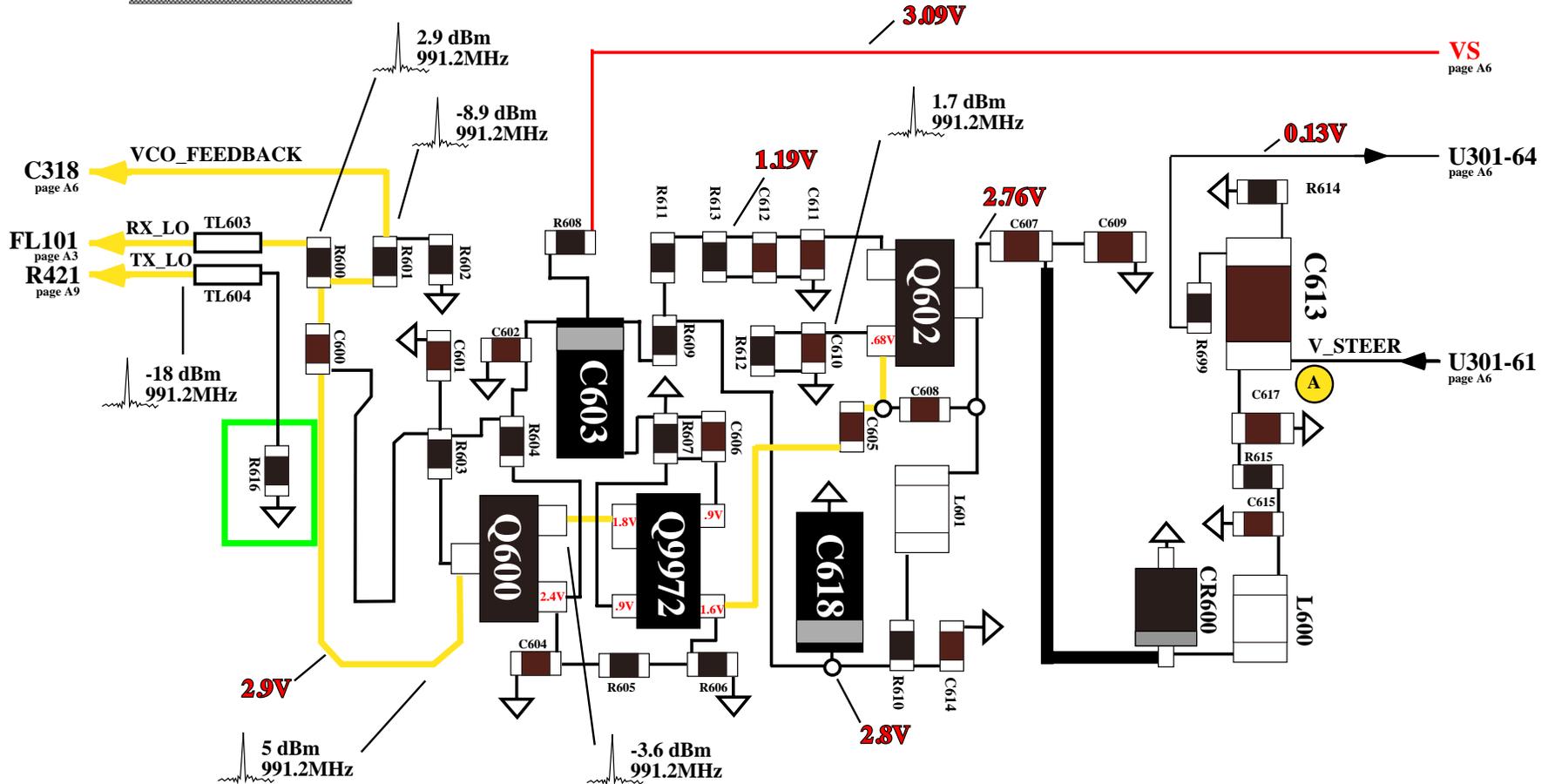
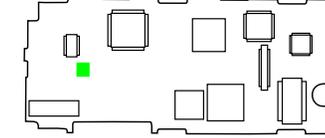
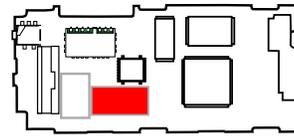
Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm
 TX Power Level 2

VCO Signal 
 Voltage Supplies 

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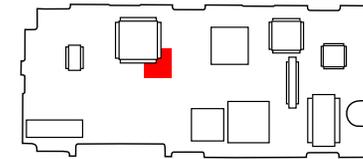


Channel	991	333	799
	1.54V	1.9V	2.39V

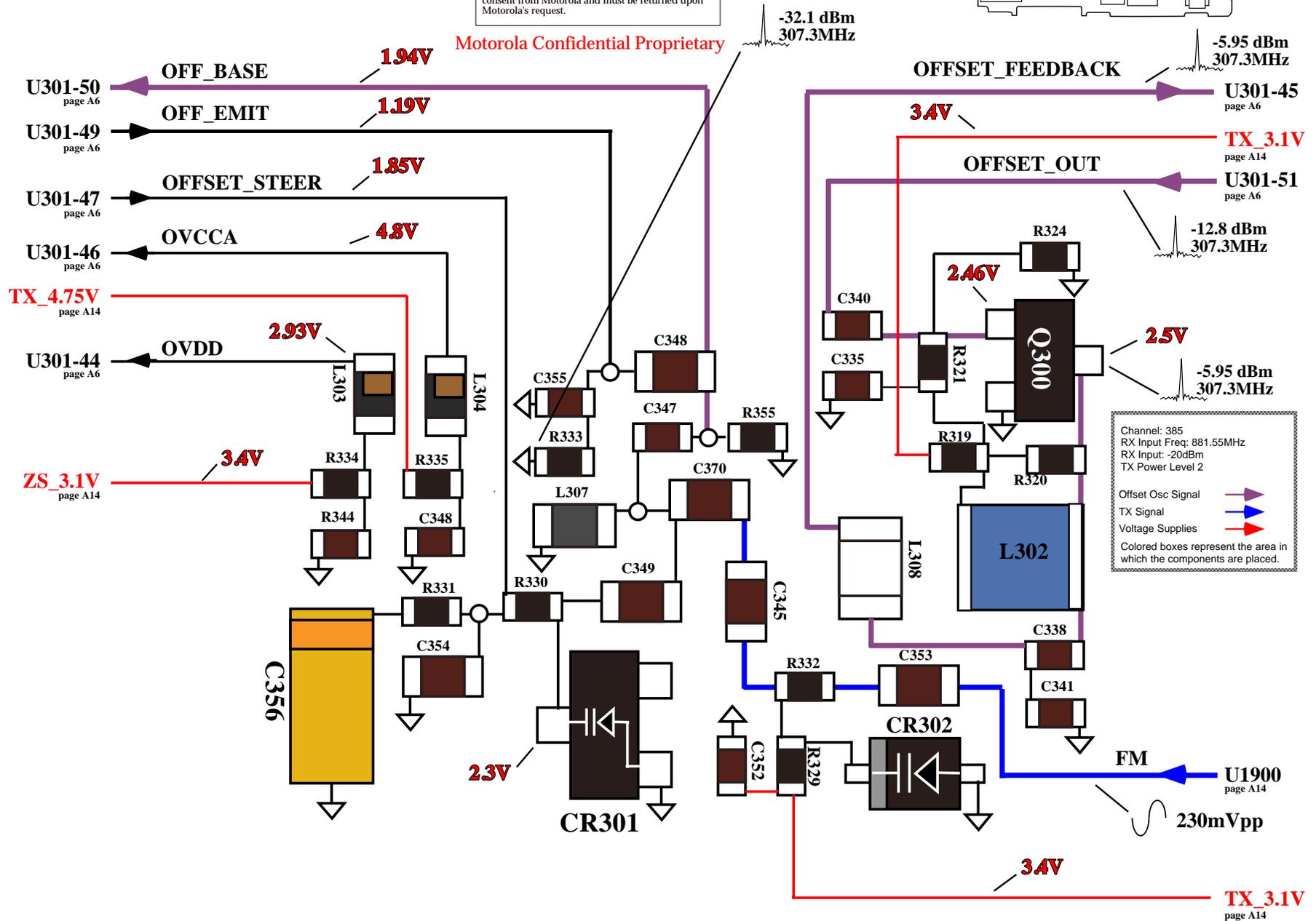
CDMA SC725: Offset Oscillator

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A8

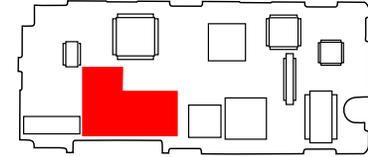


TX_3.1V
page A14

CDMA SC725: Attenuator/Exciter Circuit

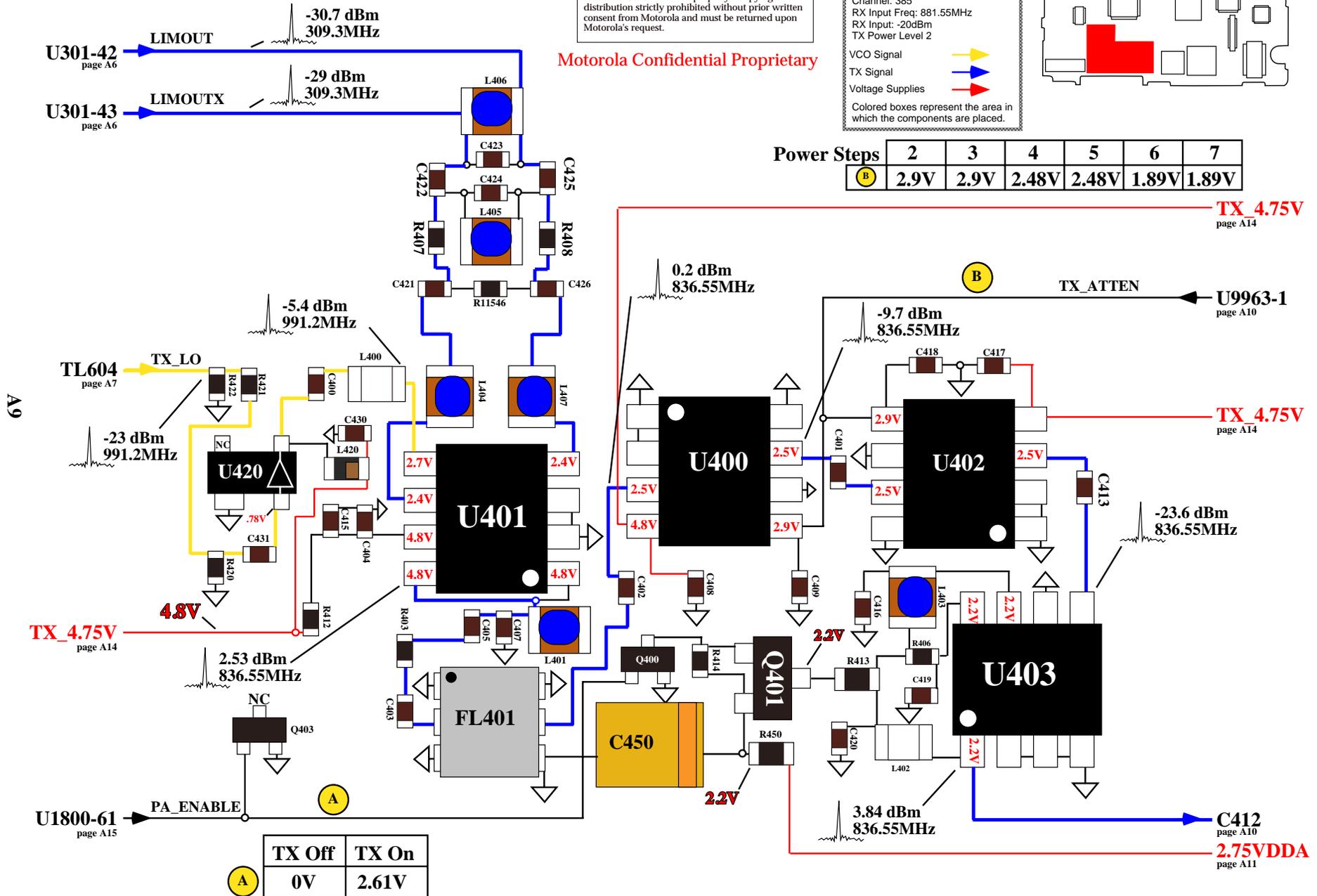
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Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm
 TX Power Level 2
 VCO Signal
 TX Signal
 Voltage Supplies
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Power Steps	2	3	4	5	6	7
(B)	2.9V	2.9V	2.48V	2.48V	1.89V	1.89V



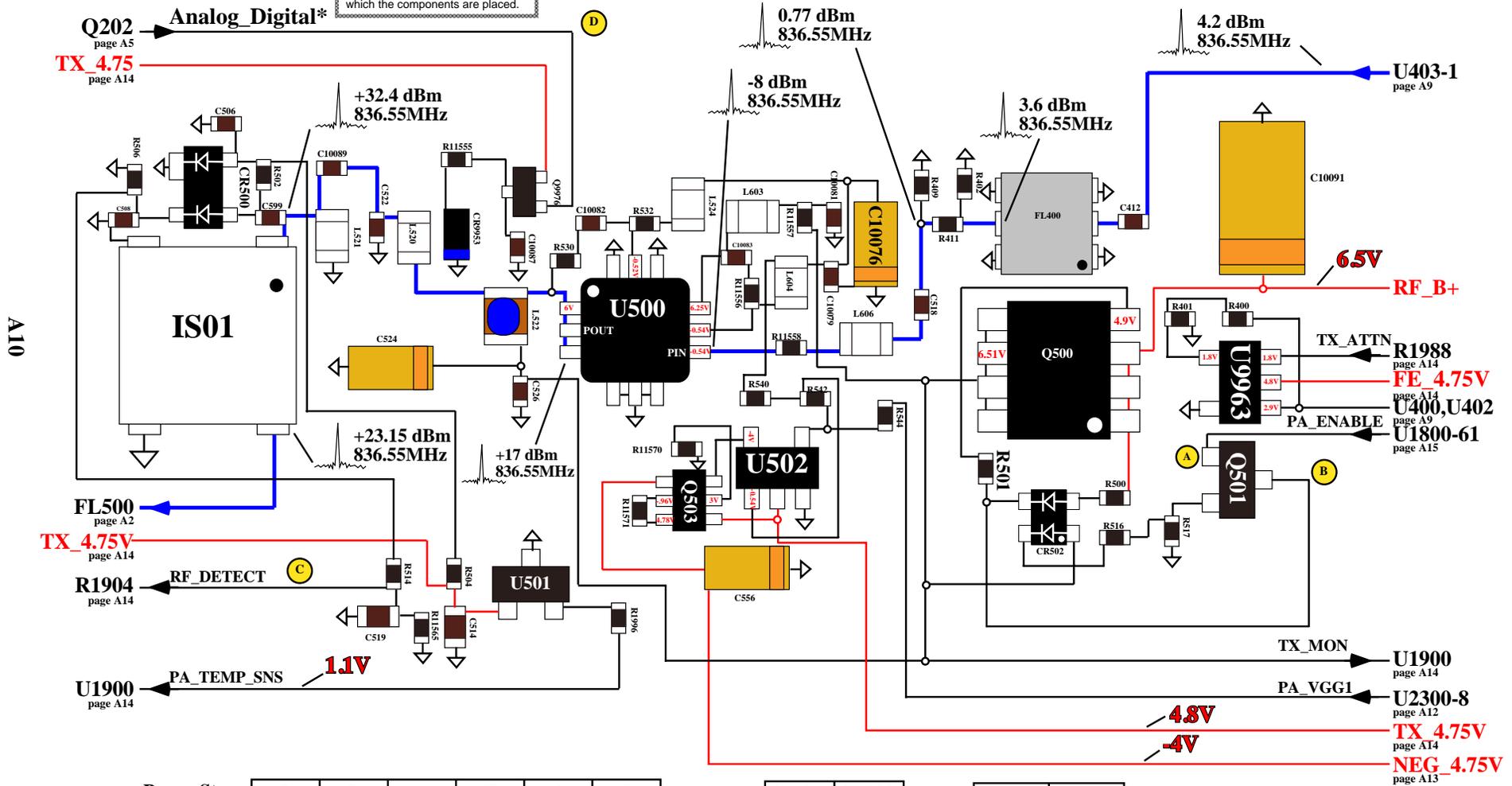
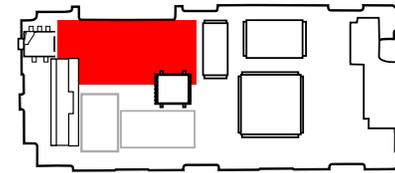
CDMA SC725: PA Circuit

Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm
 TX Power Level 2

TX Signal 
 Voltage Supplies 
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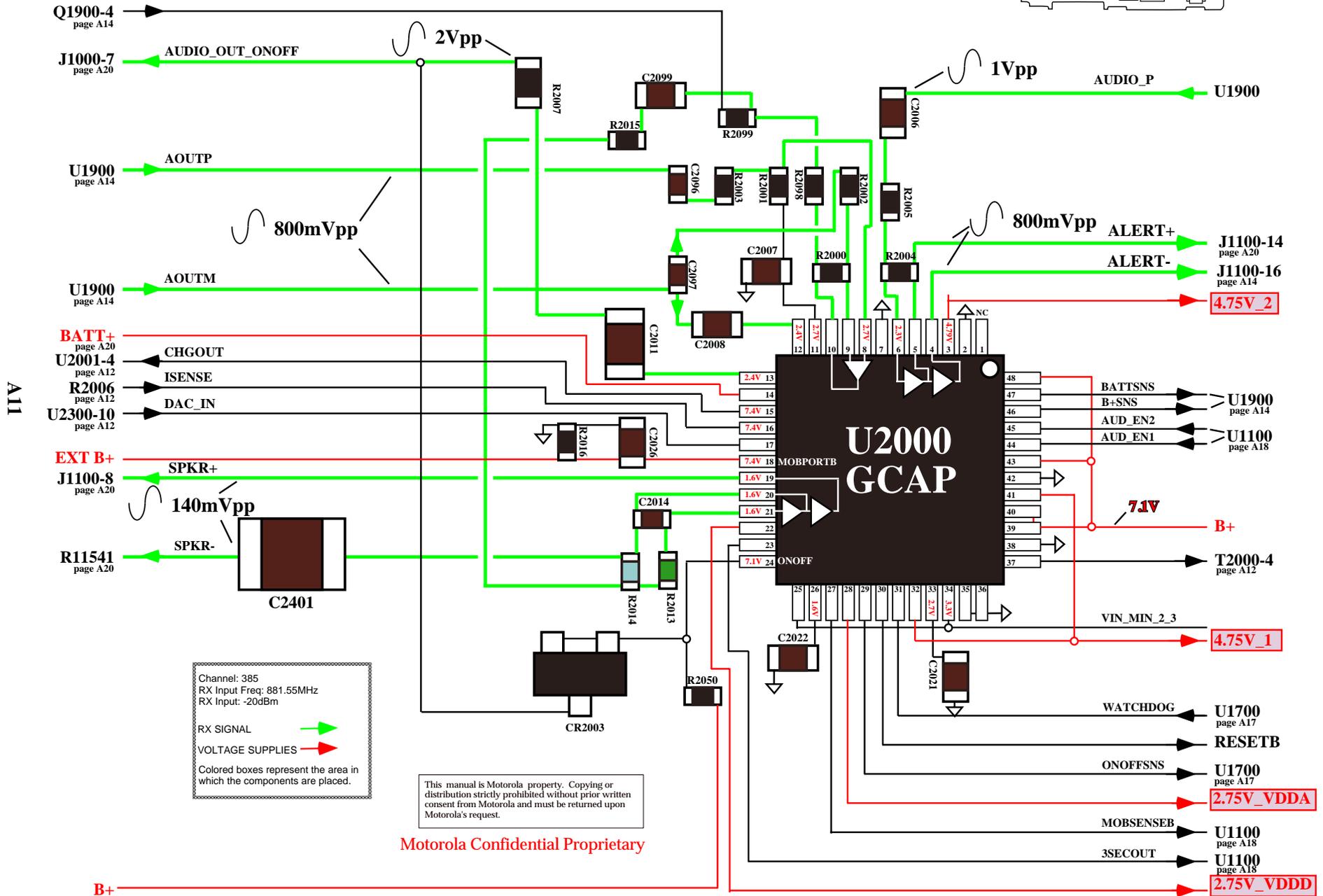
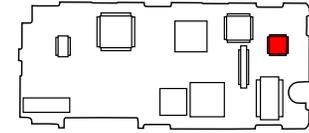
Power Steps	2	3	4	5	6	7
C	1.96V	1.28V	.82V	.53V	.33V	.24V

	Analog	CDMA
D	0V	4.17V

	TX Off	TX On
A	0V	2.6V
B	6.5V	4.9V

TX 4.75V
 NEG 4.75V

CDMA SC725: GCAP(2000)



A11

B+

4.75V_2

4.75V_1

2.75V_VDDA

2.75V_VDDD

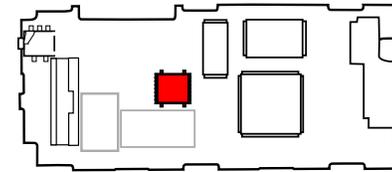
CDMA SC725: Ref Osc/ NEG Regulator

Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm
 TX Power Level 2

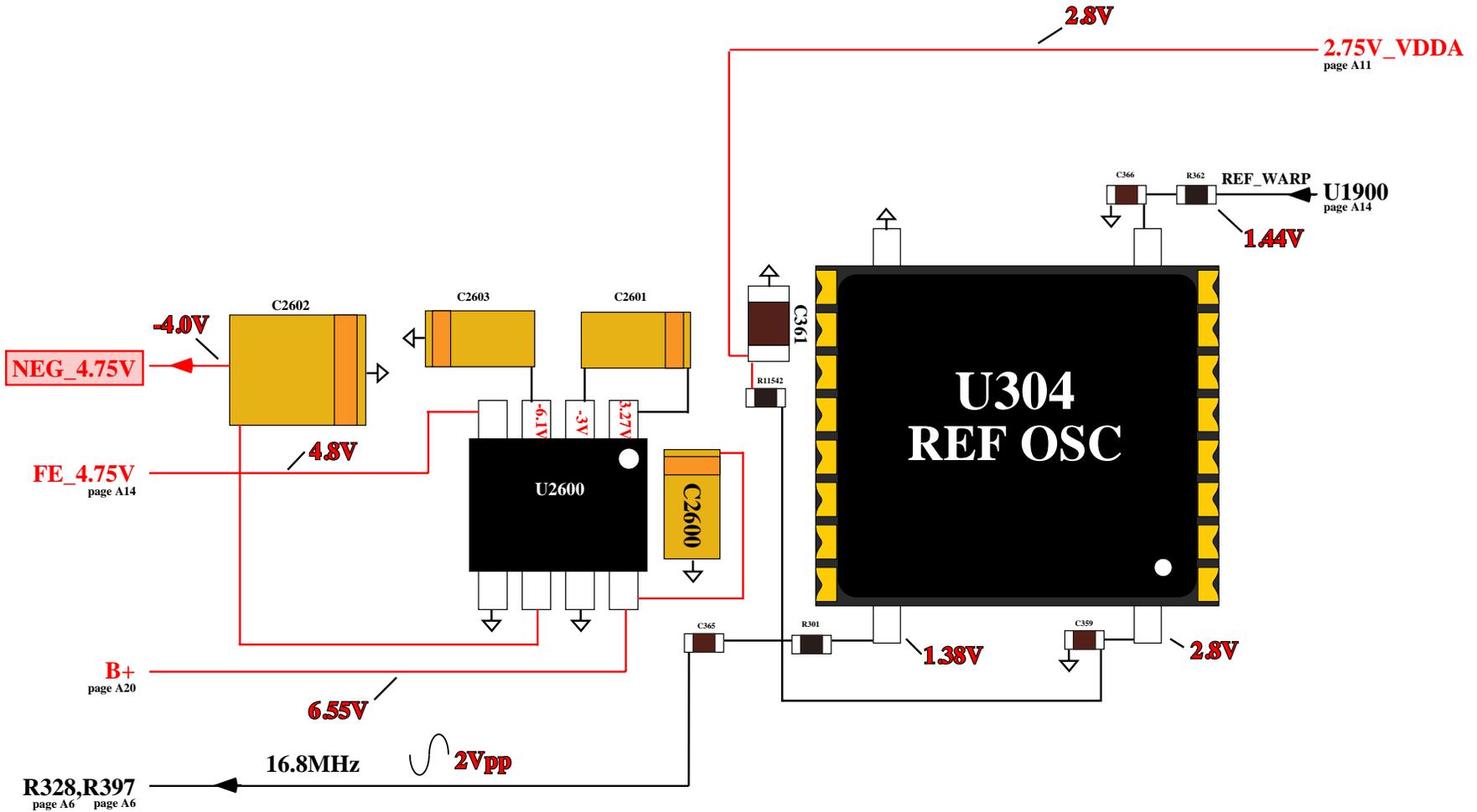
Voltage Supplies →
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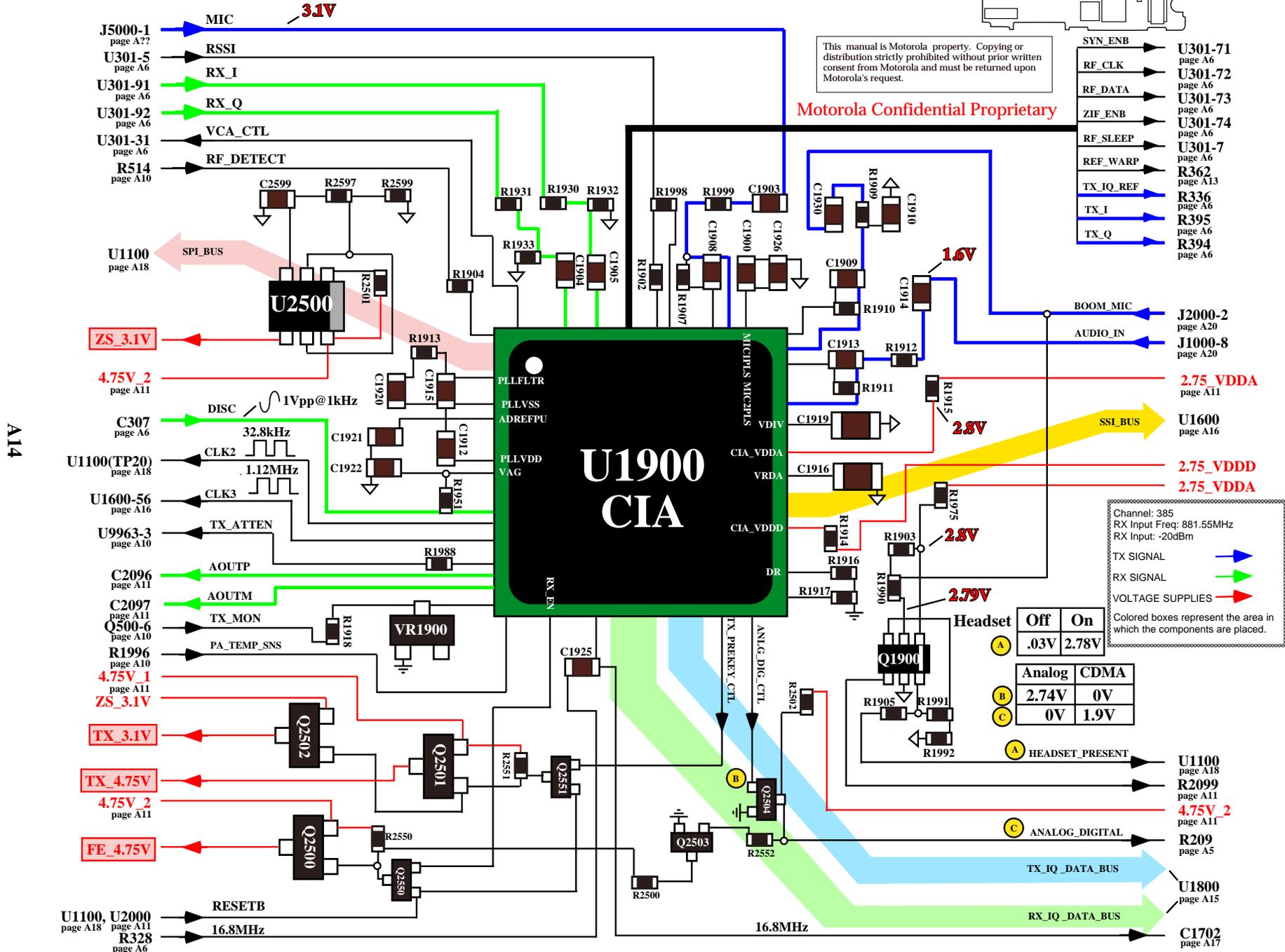
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A13



CDMA SC725: CIA (U1900)



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- SYN_ENB → U301-71 page A6
- RF_CLK → U301-72 page A6
- RF_DATA → U301-73 page A6
- ZIF_ENB → U301-74 page A6
- RF_SLEEP → U301-7 page A6
- REF_WARP → R362 page A13
- TX_IQ_REF → R336 page A6
- TX_I → R395 page A6
- TX_Q → R394 page A6

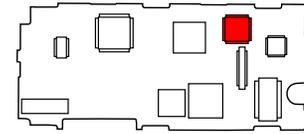
Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

	Off	On
(A)	.03V	2.78V
(B)	Analog	CDMA
(C)	2.74V	0V
(A)	0V	1.9V

Colored boxes represent the area in which the components are placed.

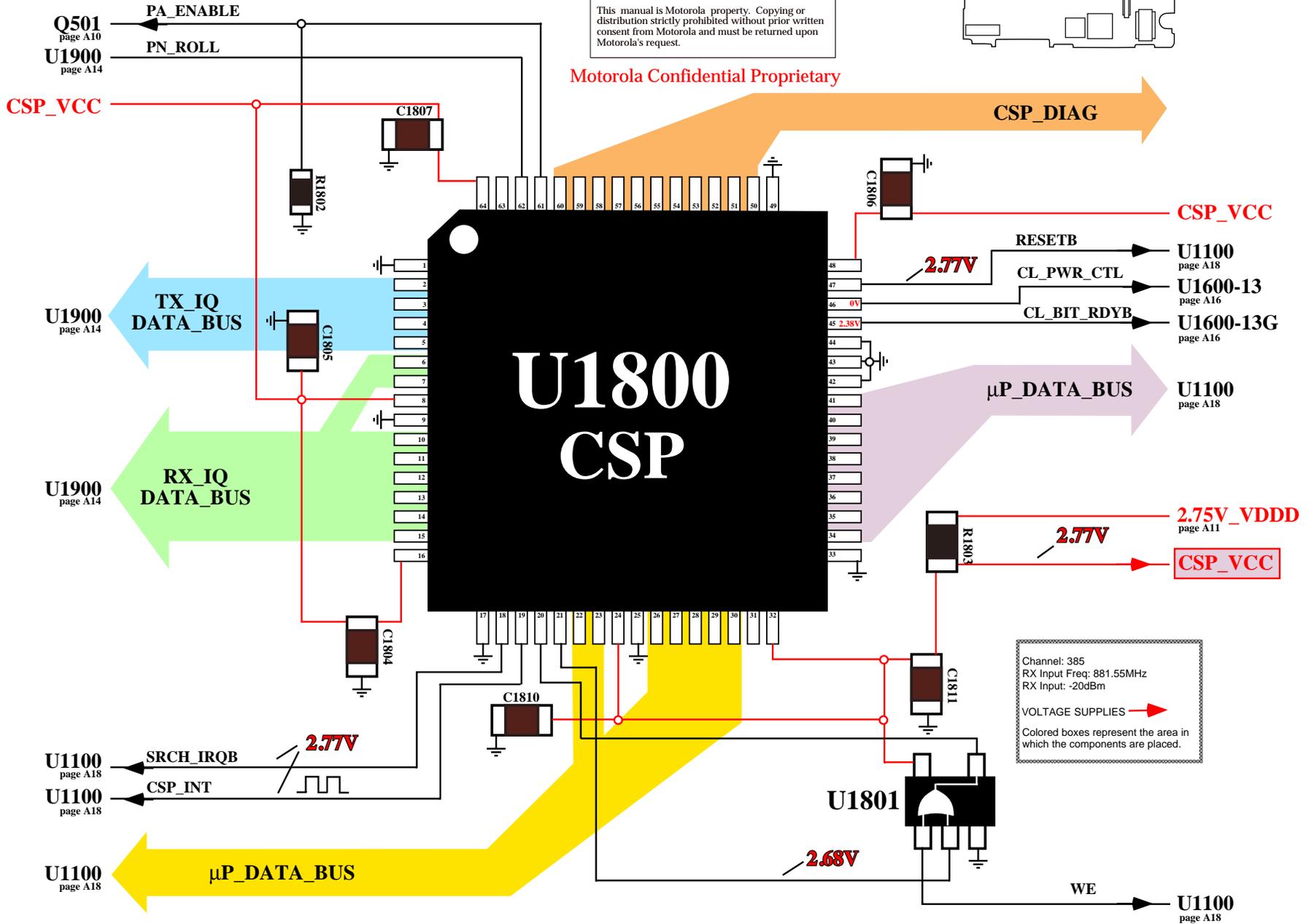
CDMA SC725: CSP(U1800)

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515

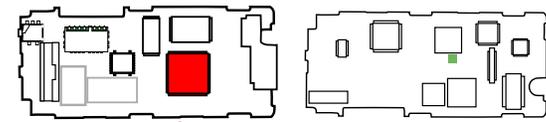


Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

VOLTAGE SUPPLIES →

Colored boxes represent the area in which the components are placed.

CDMA SC725: DSP(U1600)



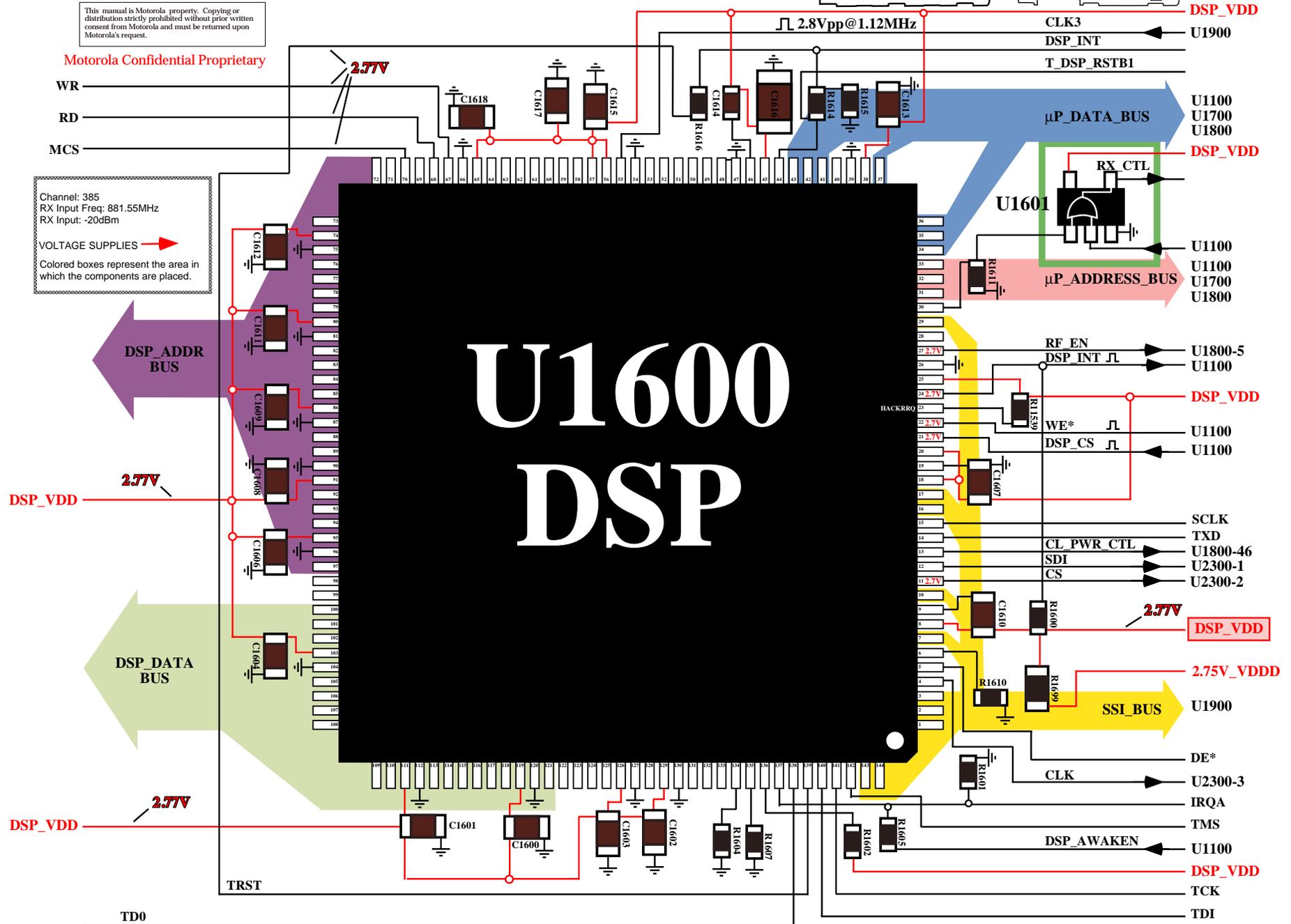
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Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

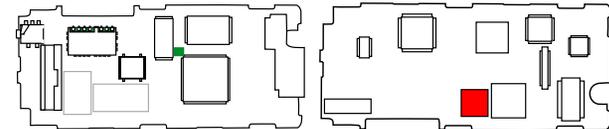
VOLTAGE SUPPLIES →
 Colored boxes represent the area in which the components are placed.

A16



U1600 DSP

CDMA SC725: RIB(U1700)



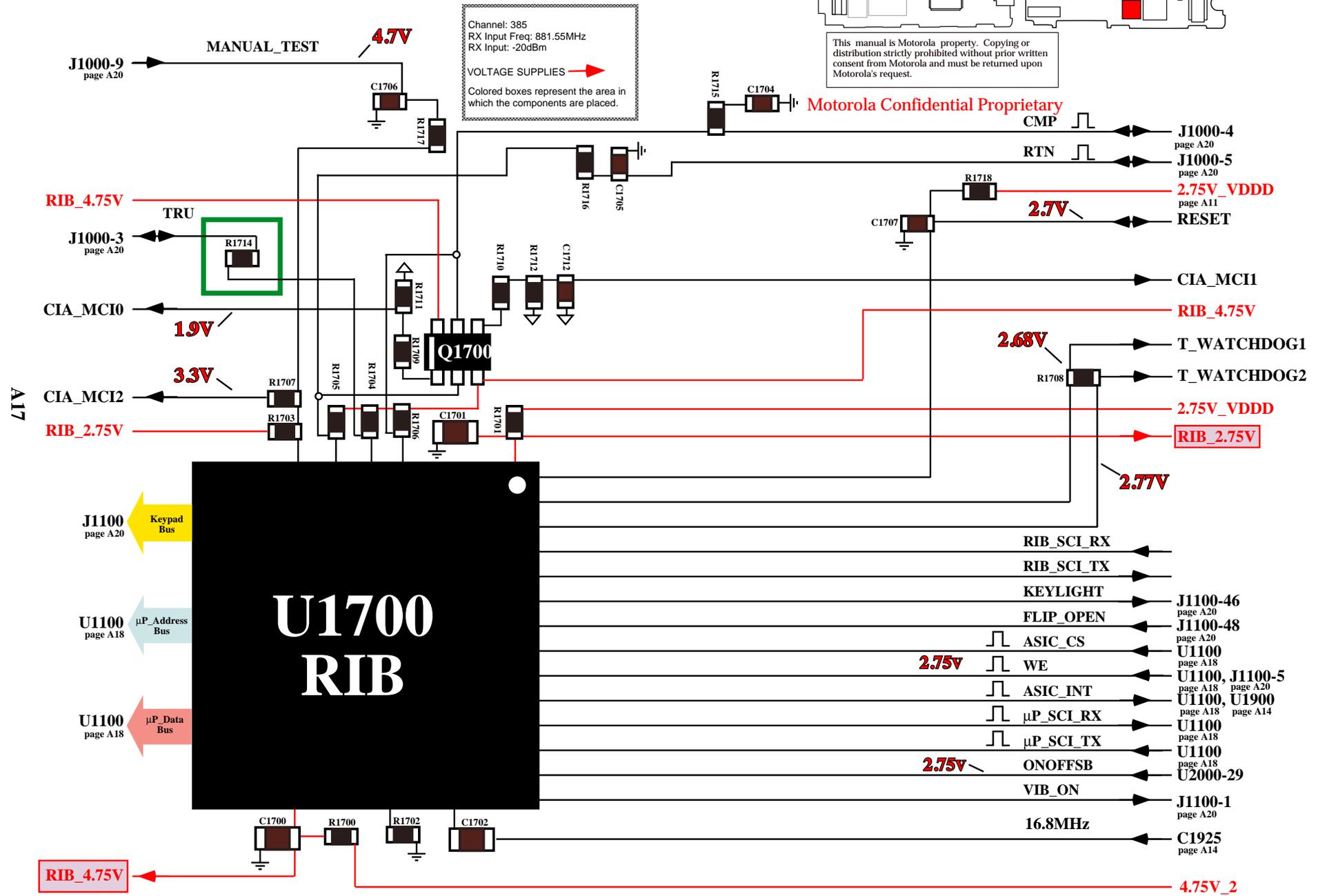
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Channel: 385
 RX Input Freq: 881.55MHz
 RX Input: -20dBm

VOLTAGE SUPPLIES →

Colored boxes represent the area in which the components are placed.

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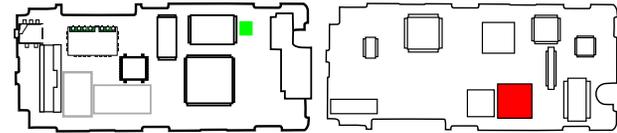
RIB_4.75V

4.75V_2

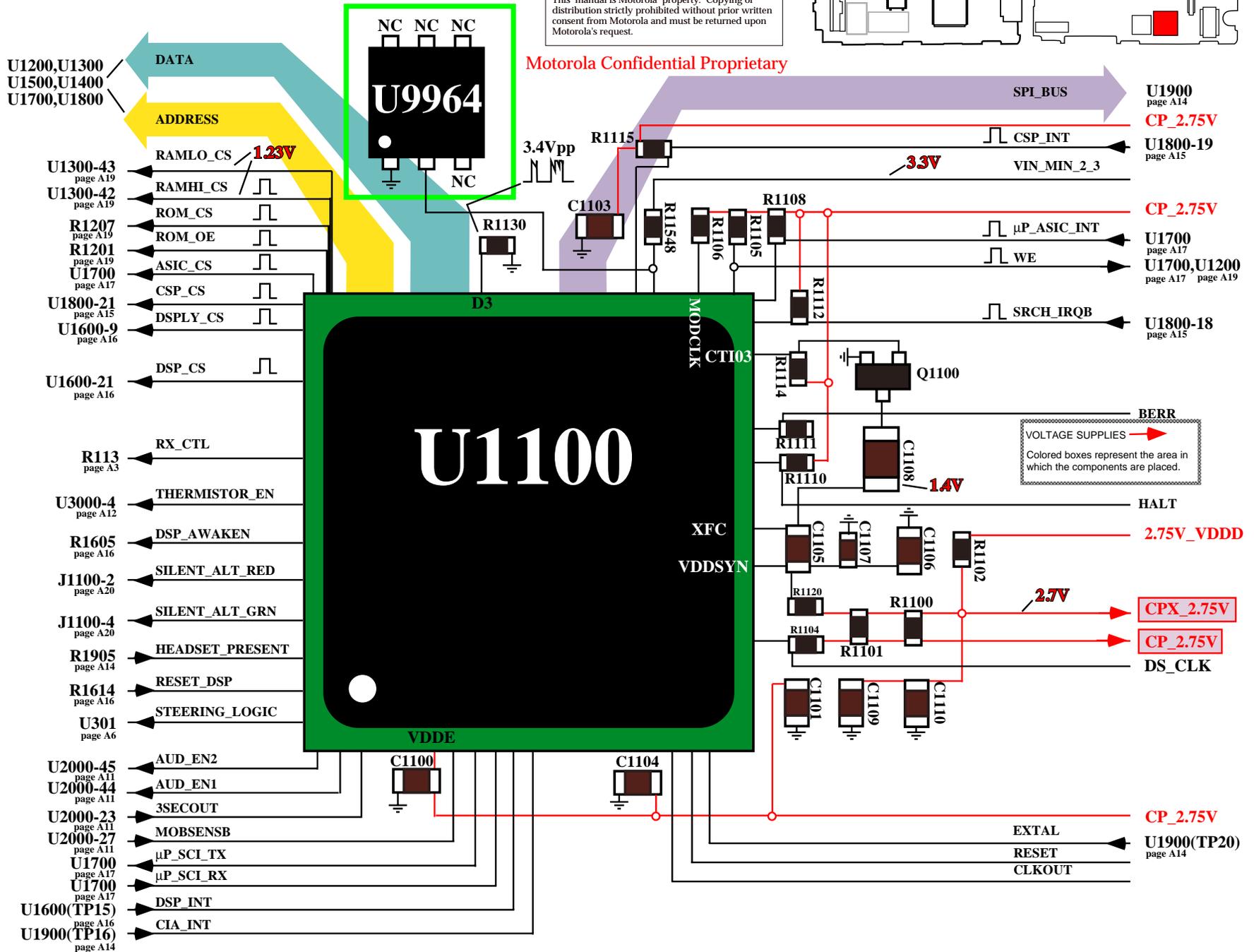
CDMA SC725: μ P(U1100)

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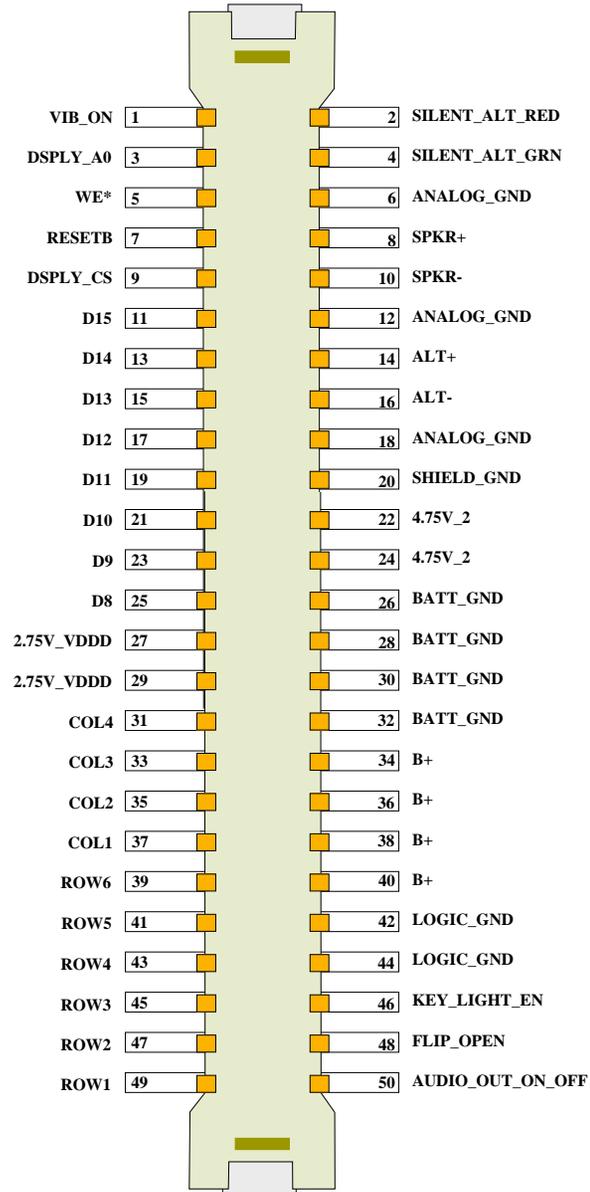


A18

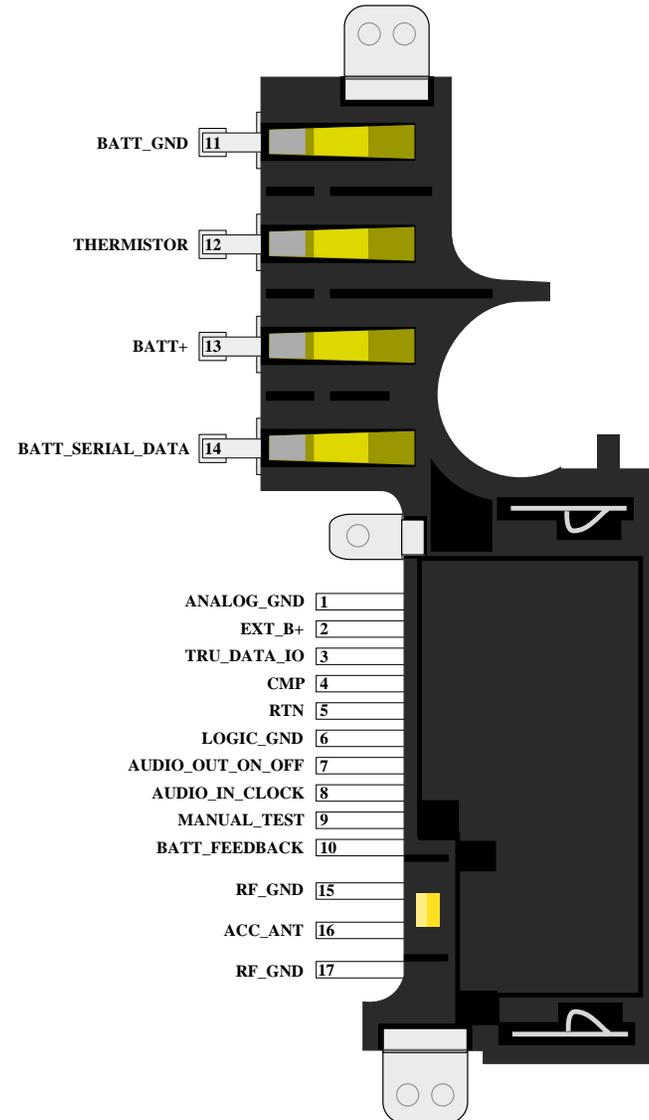


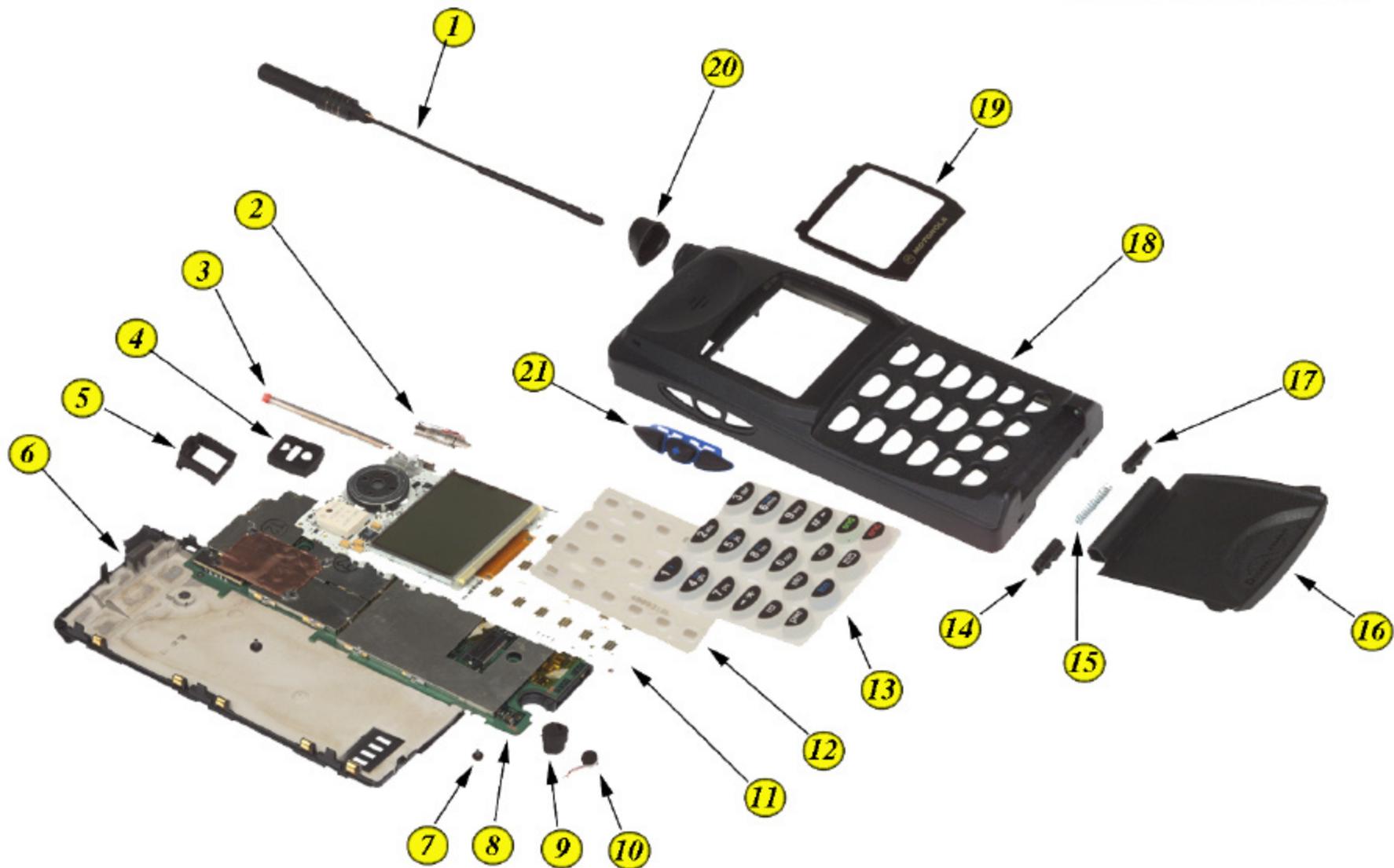
CDMA SC725: Connectors

J1100



J1000





1	ANTENNA	0109374D01	9	MIC GROMMET	4309075R01	17	RIGHT SHAFT	4709080C02 #
2	VIBRATOR	5909127D05	10	MIC.	5009536H25	18	FRONT HSG.	0109313U10 #
3	ANTENNA TUBE	0109189C03	11	KEYBOARD W/DIS	SYN6212A	19	LENS	6109112L01
4	GROMMET ALERT	3209385U01	12	MYLAR	4009312L01	20	ANTENNA CAP	3809110L01
5	GROMMET H/J	3209106L01	13	KEYPAD	3809109L01	21	GROMMET VOL.	3809111L01 #
6	BACK HSG.	0109121M01	14	LEFT SHAFT	4709080C01 #			
7	SCREW	0309002M02	15	SPRING	4183879P27 #			
8	R/F BOARD	SYN6192B *	16	FLIP	1509103L01 #			

*NOT SOLD AS SEPERATE PIECE PARTS
 #PART SOLD AS COMPLETE ASSY.

CDMA SC 725 Mechanical Parts List

Description	Part#	SWF3263B	SWF3264B
FRONT HOUSING	0109313U10	X	
FRONT HOUSING	0103909K08		X
BACK HOUSING	0109121M01	X	
BACK HOUSING	0109330M06		X
LENS	6109112L01	X	
LENS	6109494L01		X
KEYPAD	3809109L01	X	
KEYPAD	3809491L07		X
SW. KEYPAD MYLAR DOME	4009312L01	X	
SW. KEYPAD MYLAR DOME	4009404M02		X
ANT. CAP	3809110L01	X	
ANT. CAP	3809281R01		X
DISPLAY	7209005C06	X	
DISPLAY	7209005C11		X
MIC	5009536H25	X	X
MOTOR VIB	5909127D05	X	X
SCREW	0309002M02	X	X
MYLAR BARRIER	1403895K01	X	X
USER LABEL	5409582B16	X	X
ANTENNA	0109374D02	X	X
MIC. GROMMET	4309075R01	X	X
SPKR EARPC 20MM GSKT	5009076E17	X	X
MIC BOOT	3209107L01	X	
GASKET DISPLAY	3209405T02		X
BRACKET DISPLAY	0709160T01	X	
HEAD SET JACK GASKET	3209126T01		X
ALERT GASKET	3209385U01	X	
ALERT GASKET	3209385U02		X
EARPHONE JACK BOOT	3209106L01	X	
FLIP	1509103L01	X	
FLIP	1509493L01		X

