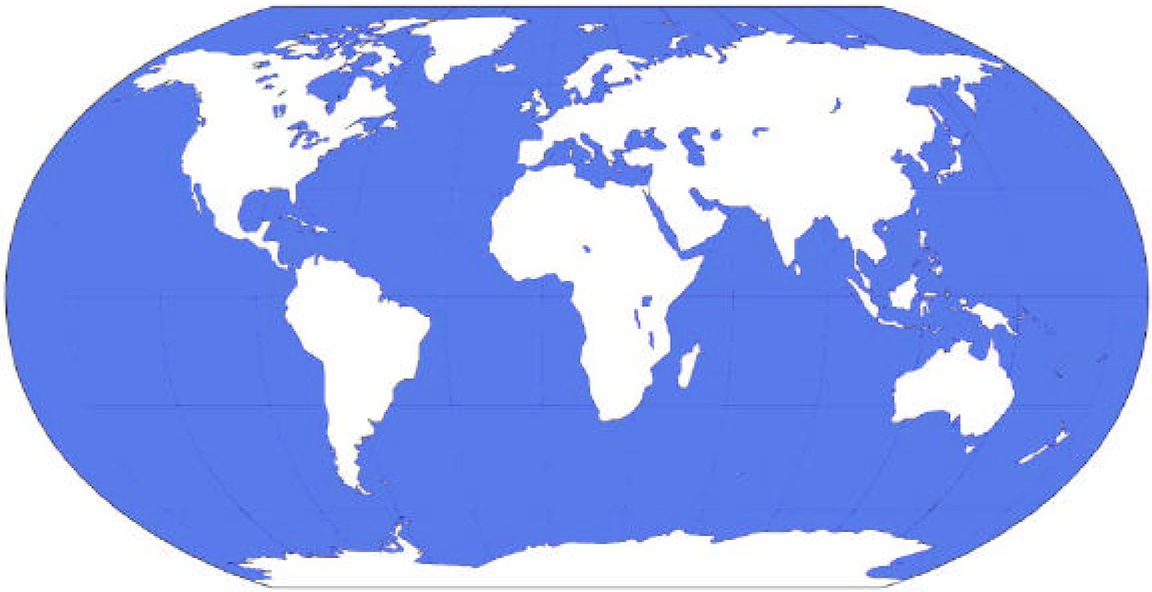
CDMA SC3160



The World's Leading Cellular Manufacturer

Service Manual
Level III

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Preface

Forward

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 regional Cellular Subscriber Support Centers offer some of the Þnest repair capabilities available to Motorola Subscriber equipment users. The Cellular Subscriber Support Centers are able to perform computerized adjustments and repair most defective transceivers and boards. Contact your regional Customer Support Manager for more information about MotorolaÕs 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.

Specifications

General Information

Name of equipment			TDC-500E (CDMA/AMPS DUAL MODE)	
Mode			CDMA	AMPS
Working Frequency Range			Tx: 824.64~848.37MHz Rx: 869.64~893.37MHz	Tx : 824.04~848.97MHz Rx : 869.04~893.97MHz
Duplex Frequency Separation			45MHz	45MHz
Modulation			Offset QPSK	Analog FM, 8KHz Dev
Chip Rate			1.2288Mbps	N/A
RF Bandwidth per Carrier			1.23MHz	30KHz
RF Output Power			300mW max	600mW max
Battery Type			Standard Capacity : Li-ion 750mA/h Large Capacity: Li-ion 1350mA/h	
Battery Working Hour	Talk-Time	Standard Capacity	180 Minute	120 Minute
		Large Capacity	320 Minute	240 Minute
	Standby	Standard Capacity	60 Hours	12.5 Hours
		Large Capacity	109 Hours	22.5 Hours
Operation Temperature			-30°C ~ +60°C	
Size			120 X 46 X 28	
Weight			155g (Standard Battery)/ 188g(Large Capacity Battery)	
Antenna			50 ΩW 1/4λl Retractable	

Specification of Transmitting Section

Frequency Range	CDMA	824.64 ~ 848.37MHz
	AMPS	824.04 ~ 848.97MHz
Lo Frequency Range	966.88 ± 12.5MHz	
Intermediate Frequency	85.38MHz	
Output	CDMA	300mW max
	AMPS	600mW max
Frequency Stability	CDMA	± 300Hz
	AMPS	± 2.5 PPM
Open Loop Output Power Range	@ RX = -25dBm	-57.5 ~ -38.5 dBm
	@ RX = -65dBm	-17.5 ~ 1.5 dBm
	@ RX = -104dBm	+18 ~ +30 dBm
Open Loop Power Control Time Response	20dB/100ms	

Specification of Receiving Section

Frequency Range	CDMA	869.64 ~ 893.37MHz
	AMPS	869.04 ~ 893.97MHz
Lo Frequency Range	966.88 ±12.5MHz	
Sensitivity	CDMA	-105 dBm (C/N 13dB or more)
	AMPS	-116 dBm (12dB SINAD)
Intermediate Frequency	85.38MHz	
Selectivity	CDMA	30dB C/N Degration (at Fch ± 900KHz : -30dBm)
	AMPS	16dB at Fch ± 30KHz, 60dB at Fch ± 60KHz
CDMA Input Signal	In 1.23MHz, –105dBm to –25dBm 80dB or more Dynamic Range	
Conductive Spurious Radiation	At the time of RX	< -81 dBm
	At the time of TX	< -61dBm
	Others	< -47dBm
Spurious Suppression	Max –80dBm	
Interference Rejection	Single Tone	-30dBm at 900KHz
	Two Tone	-43dBm at ± 900KHz & ± 1700KHz

Section A

Section B

NAM Programming

Introduction

The Number Assignment Module (NAM) is a section of memory that retains information about the phone's characteristics, such as the assigned telephone number, system identification number, and options information.

Two methods are available to program the NAM using the keypad: Test Mode and User Mode.

Regardless of the method used, the NAM must be programmed before the phone can be placed into service. This chapter covers the NAM Programming steps for Test Mode NAM Programming.

Entering Test Mode NAM Programming

The recommended Manual Test Mode setup for NAM programming phones are described in "Entering Manual Test Mode" on page 11.

Refer to "Connections for Testing and Adjustments" on page 16 to see the recommended test setup for performing Servicing Level manual tests.

To enter NAM Programming mode, enter 5 5 #. The phone will now be in Step 1 of the NAM.

NAM Programming Steps

There are 26 steps in the NAM. For each step, the display shows factory default NAM data. When new data is entered via the keypad the display scrolls from left to right.

Use the * key to sequentially step through the NAM data fields, entering new data as required, or skipping past factory default values for parameters that do not need to be changed.

Table 1, "Minimum Required Test Mode NAM Programming Steps", shows the minimum required Test Mode NAM programming steps. The programming steps not listed in this table can be "stepped through", retaining the factory default values for those steps.

Table 2, "Test Mode NAM Programming Sequence," on page 3 lists all NAM programming steps, complete with parameters and definitions.

Table 1: Minimum Required Test Mode NAM Programming Steps

Service Type	Minimum Required Programming Steps
Single NAM	1, 3, 4, 6, 18
Multiple NAM Enable	10
Dual NAM	1, 3, 4, 6, 18, 27, 29, 35

NAM Data

NAM Data is specified by the system operator. For most NAM steps, the information specified by the system operator is the same as the factory default data.

The factory default System ID (step 01) and User Telephone Number (step 03) must always be changed.

Other portions of the factory default NAM data must sometimes be modified to conform to special system requirements, or to enable/disable certain features.

If numerous phone numbers are to be programmed, step 10 C Option Byte, bit C6 and C7 must be set according to the quantity of numbers which are going to be programmed. Refer to page 6.

User Mode Programming

User Mode NAM programming requires a special key sequence to enter, but can be accomplished through the telephone keypad without the use of any specialized hardware.

Some models may be available with a "User Mode NAM Programming Manual" which describes the entry key sequences and the programming steps for User Mode NAM programming.

User Mode NAM programming steps are different from Test Mode NAM programming steps, and do not include all of the option bits available in Test Mode NAM programming.

IMPORTANT

Consult with the System Operator regarding NAM information. Incorrect NAM entries can cause the phone to operate improperly or not at all.

Test Mode NAM Programming Sequence

*	Advances to the next programming step; also programs the NAM after the last programming step is entered.
CLR	Clears the entered information and displays previously entered data for the current programming step.
STO	Stores the entered information and exits the programming mode.
#	Exits the programming mode without programming the NAM.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
01	00020	**System ID Number.** Number assigned by system operator for system identification.
02	00000000 (A7-A0)	**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). 0TA = 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 MSB (Bit A3).** Enter 0.
	0	**Bit not used (Bit A2).** Enter 0.
	0	**Markov test override LSB (A1).** 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.
03	0111234567	**User 10 digit radiotelephone phone number.** Number is assigned by system operator.

Table 2: Test Mode NAM Programming Sequence**Test Mode NAM Programming Sequence**

Step	Factory Default	Description
04		**Station class mark.** A 2 digit number assigned by the system operator. Indicates maximum power step, VOX capability, and number of channels used.
	010	CDMA only & Non slotted mode configuration
	042	CDMA only & Slotted mode configuration
	074	Dual mode & non slotted mode configuration
	106	Dual mode & slotted mode configuration
05	00	**Access overload class.** Specifies the level of priority assigned to the phone when accessing the system. Assigned by system operator.
06	00000	**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	004	**Service level.** This 1 digit number supplied by the user allows various call placement restrictions if desired.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
09	00000000 (B7-B0)	**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.
	0	**Display call processing statistics (Bit B7).** Enter 0. 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. 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. 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. 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. **WARNING: Turning on this option makes it difficult to see the Markov error rate statistics in a call.** 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.

	0	**Enable Test Menu / 2 second # to suspend (Bit B6).** Enter 0.
		This bit allows the user to enable or disable the FCN key Test Menu. Refer to "Test Menu" on page 12 for further information on Test Menu. Also allows the user to suspend the unit by pressing and holding the # key for 2 seconds.
		1 = enabled, 0 = disabled.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
9 cont'd	0	**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.
	0	**Portable Data Logging (Bit B4).** Enter 0.
	0	**Single System Scan (Bit B3)**. If set to 1, phone will scan only one system based on the setting of the preferred system bit (option bit A6). 1 = enabled, 0 = disabled.
	0	**Auto Recall (Bit B2).** When set to one, the user may access repertory by a one or two digit send sequence (speed dialing).
	0	**Disable Service Levels (Bit B1).** If set to 1, the service level (call restrictions) cannot be changed by the user.
	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 (C7-C0)	**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	**Number of active NAMs (Bit C7).** Normally set to 0. Bit C7 Bit C6 NAMS Enabled 0 0 1 0 1 2 1 0 3 1 1 4
	0	**NAMs active - least significant bit (Bit C6).** Normally set to 0. Bit C7 Bit C6 NAMS Enabled 0 0 1 0 1 2 1 0 3 1 1 4
	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.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
10 cont’d	0	**Bit not used (Bit C3).** Enter 0.
	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	**Bit not used (Bit C0).** Enter 0.
11	0334	**Initial Paging System.** There are 4 significant bits for the initial paging channel. For system A enter 0333 and system B enter 0334.
12	0333	**Initial A system channel.** To initialize system A enter 0333.
13	0334	**Initial B system channel.** To initialize system B enter 0334.
14	021	**Dedicated Paging Channels.** Number of dedicated paging channels is 21. Enter 021.
15	00000000 (D7-D0)	**D OPTION BYTE** The display for step 15 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 left.
	0	**Motorola Enhanced Scan Enable (Bit D7).**
	0	**Bit not used (Bit D6).** Enter 0.
	0	**Long DTMF Enable (Bit D5).** Enter 0.
	0	**Bit not used (Bit D4).** Enter 0.
	0	**Bit not used (Bit D3).** Enter 0.
	0	**Handset Test Mode Disable (Bit D2).**
	0	**Bit not used (Bit D1).** Enter 0.
	0	**Word Sync Scan Disable (Bit D0).**

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
16	00101000 (E7-E0)	**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	**Force Preferred Vocoder Mode (Bit E7).** Enter 0.
	0	**Preferred mode (Bit E6).** Normally set to 0. Bit E6 Bit E5 Preferred Call Processing Mode 0 0 CDMA Only 0 1 CDMA Preferred (Recommended) 1 0 Analog Only 1 1 CDMA Selected (Alternate)
	1	**Preferred mode (Bit E5).** Normally set to 1. Bit E6 Bit E5 Preferred Call Processing Mode 0 0 CDMA Only 0 1 CDMA Preferred 1 0 Analog Only 1 1 CDMA Selected
	0	**Extended Address Method Enable (Bit E4).**
	1	**Preferred Analog Serving System (Bit E3).** Normally set to 0.
	0	**Config bit: mob term using home SID, NID pair (Bit E2).** Enter 0. 1 = Allow mobile terminated call while using a home (SID, NID) pair. 0 = Disallow mobile terminated call while using a home (SID, NID) pair.
	0	**Config bit for mob term while SID roamer (Bit E1).** Enter 0. 1 = Allow mobile terminated call while a SID roamer. 0 = Disallow mobile terminated call while a SID roamer.
	0	**Config bit for mob term while NID roamer (Bit E0).** Enter 0. 1 = Allow mobile terminated call while a NID roamer. 0 = Disallow mobile terminated call while a NID roamer.
17	1	**CDMA: Slot Cycle Index.**
18	Entry Required	**CDMA: SID (of SID_NIDp).** Up to 5 decimal digits.
19	65535	**CDMA: Network ID Number (NID of SID_NIDp).** Up to 5 decimal digits.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
20	11111	**Mobile Country Code (first 3-digits), IMSI 11 (1-digit), IMSI 12 (1-digit).**
21	283	**CDMA: Primary Channel.** System A up to 4 decimal digits.
22	384	**CDMA: Primary Channel.** System B up to 4 decimal digits.
23	691	**CDMA: Secondary Channel.** System A up to 4 decimal digits.
24	777	**CDMA: Secondary Channel.** System B up to 4 decimal digits.
25	00000	**CDMA: SID 2 (of SID_NIDp).** Up to 5 decimal digits.
26	65535	**CDMA: Network ID Number 2 (NID of SID_NIDp).** Up to 5 decimal digits.

NOTE: Additional steps after step 26 will be displayed depending on the settings of step 10, bits C7 and C6.

27	00020	**NAM 2: System ID Number.** Number assigned by system operator for system identification.
28	00000000 (A7-A0)	**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 (Refer to step 2).
29	0111234567	**NAM 2: User 10 digit radiotelephone phone number.** Number is assigned by system operator.
30		**NAM 2: Station class mark.** A 2 digit number assigned by the system operator. Indicates maximum power step, VOX capability, and number of channels used.
	010 042 074 106	CDMA only & Non slotted mode configuration CDMA only & Slotted mode configuration Dual mode & non slotted mode configuration Dual mode & slotted mode configuration
31	00	**NAM 2: Access overload class.** Specifies the level of priority assigned to the phone when accessing the system. Assigned by system operator.
32	0334	**Initial Paging System.** There are 4 significant bits for the initial paging channel. For system A enter 0333 and system B enter 0334.

Table 2: Test Mode NAM Programming Sequence

Step	Factory Default	Description
33	00101000 (E7-E0)	**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 (Refer to step 16).
34	1	**NAM 2: CDMA: Slot Cycle Index.**
35	Entry Required	**NAM 2: CDMA: SID (of SID_NIDp).** Up to 5 decimal digits.
36	65535	**NAM 2: CDMA: Network ID Number (NID of SID_NIDp).** Up to 5 decimal digits.
37	11111	**NAM 2: Mobile Country Code (first 3-digits), IMSI 11 (1-digit), IMSI 12**
38	283	**NAM 2: CDMA: Primary Channel.** System A up to 4 decimal digits.
39	384	**NAM 2: CDMA: Primary Channel.** System B up to 4 decimal digits.
40	691	**NAM 2: CDMA: Secondary Channel.** System A up to 4 decimal digits.
41	777	**NAM 2: CDMA: Secondary Channel.** System B up to 4 decimal digits.
42	00000	**NAM 2: CDMA: SID 2 (of SID_NIDp).** Up to 5 decimal digits.
43	65535	**NAM 2: CDMA: Network ID Number 2 (NID of SID_NIDp).** Up to 5 decimal digits.

Manual Test Mode

Introduction

Manual Test Mode software allows service personnel to monitor the telephone status on the display, and manually control telephone functions via the keypad.

Manual Test Mode operates at two levels: 1) Call Status display, which allows the phone to operate normally while providing status indications in the display; and 2) Servicing Level, which disables normal call-processing and allows commands to be entered through the keypad to manually control operation of the phone.

Entering Manual Test Mode

Manual Test Mode is entered by entering the following keypad sequence:

FCN 0 0 * * T E S T M O D E STO
(8 3 7 8 6 6 3 3)

Once this key sequence is completed, US' appears on the screen indicating that the unit is now in Manual Test Mode.

Figure 4: "Connections for Testing and Adjustments" on page 32 shows the recommended test setup (Method 2 and 3) for performing Servicing Level manual tests.

Call Status Screen

The Call Status screen will display information about the current status of the unit while in service. In this level of manual test mode the phone will place and receive calls as normal, but the display shows four lines of status information.

The display the following stus information:

- Mobile's state
- Current RF channel
- TX Power
- Best Active Pilot energy
- RSSI
- FER
- Vocoder Rate
- SID and NID

The format of this status information is shown in Figure 1: "Test Mode Status Display (Analog Mode)" on page 12 and Figure 2: "Test Mode Status Display (CDMA Mode)" on page 12.

When dialing a phone number, the status display ceases when the first digit of the phone number is entered. The telephone number is then displayed as it is entered. When the Snd, End, or Clr button is pressed, the status information display resumes.

Servicing Level

The Servicing Level of Manual Test Mode allows service personnel to manually control operation of a phone by entering commands through the telephone keypad. Parameters such as operating channel, output power level, muting, and data transmission can all be selected by entering the corresponding commands.

In the Servicing Level, automatic call processing functions are disabled, and the phone is instead controlled manually by keypad commands.

Table 3, "Test Commands For Manual Test Mode," on page 23 lists the commonly used manual test commands and the resulting display and telephone function for each command.

Figure 1. Call Status Screen (Analog Mode)

A	A	A	A	A		B	B				
C	C	C	C		D		E				

A	SID
B	Reserved
C	Current RF Channel
D	TX Power
E	Reserved

Figure 2. Call Status Screen (CDMA Mode)

	A	A	A	A	A	A	A	A	A	A	
B	B	B	B			C	C	C	D	D	D
E	E	E			F	F	F		G	G	G
H	A	J	J	J	J	J	K	K	K	K	K

A	Mobile's State
B	Current RF Channel
C	TX Power
D	Best Active Pilot Energy (Ec/Io)
E	PN OFFSET strongest active pilot
F	RSSI
G	FER
H	Vocoder Rate
J	SID
K	NID

Test Commands

Each command consists of at least two digits entered from the telephone keypad with the entry terminated using the (#) key.

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.

For commands that initiate an action that requires a response or that accumulates error counts, the (#) key terminates the test.

Table3: Test Commands for Manual Test Mode

Keypad Entry	Command Description	Status Display	Result
01#	Restart		Equilavent to turning power off, then on again.
02#-04#		(NOT USED)	
05#	Carrier On		Turn carrier on. HANDSET: 05# turns the carrier on with a nominal value for the DAC for an output power level. In CDMA mode, the carrier can not be turned on if extended Test Commands is disabled.
06#	Carrier Off		Turn carrier off
07#	Rx Mute		Mute the receive audio
08#	Rx Unmute		Unmute the receive audio
09#	Tx Mute		Mute the transmit audio
10#	Tx Unmute		Unmute the transmit audio
11X#	LOAD-SYNTH		Load the specific channel into the synthesizer. HANDSET: X - Enter up to 4 digits for the channel number. Channel numbers must be in the range of 1 to 1023. In AMPS mode, when extended test command bit is cleared, only the valid channels can be loaded. Narrow mode channel numbers not currently supported.
12X#	Set-Attn		Set the RF power attenuation to the value specified, where X is a value from 0 to 7.
13#		(NOT USED)	

Table3: Test Commands for Manual Test Mode

Keypad Entry	Command Description	Status Display	Result
14#	ST On		Transmit a continuous signalling tone.
15#	ST Off		Stop transmitting signaling tone.
16#-18#		(NOT USED)	
19#	VERSION		Display software version number and date.
20#-24#		(NOT USED)	
25X#	SAT		Enable SAT transponding (analog mode only), where X is a value from 0 to 2. X=0: 5970 Hz X=1: 6000 Hz X=2: 6030 Hz
26#	SAT OFF		Disable the transponding of SAT
38#	SEND-SN	AA BB	Read the hexadecimal ESN, where AA = Address (00-03), and BB = ESN data. Press the ***** key to scroll through the four ESN bytes.
45#	RSSI		Returns the currernt compesated and filtered RSSI value (in dBm) from the DSP.
55#	PROG-NAM	NAM	Displays the contents of the NAM, one step at a time, advanced by depressing the ***** key. Only the last 7 digits of data are displayed. Refer to “NAM Program-ming” on page 5 of this manual for programming details.
58#	CMPD-ON		Compandor ON.
59#	CMPD-OFF		Compandor OFF.
60#-67#		(NOT USED)	
68#	READ-MODEL	XX YY ZZ	Return Radio model type. Displays three radio model bytes: XX= hardware (model) byte YY= flex (type) byte ZZ= factory byte

Introduction

The CDMA SC3160 allows keypad controlled testing.

This chapter includes the keypad button functions and recommended equipment setup to use when testing.

Automatic Call-Processing Tests

Most communications analyzers can simulate a cell site in order to perform automatic call-processing tests. Automatic call processing tests can be performed while the phone is in its power-up state. However, it is useful to do the tests with the phone in Test Mode Status Display.

Refer to the communications analyzer's manual for details about performing call-processing tests. The following call-processing test sequence is recommended:

1. Inbound call, analog mode
2. Outbound call, analog mode
3. Analog-to-Analog channel handoff
4. Analog-to-Digital channel handoff
5. Inbound call, digital mode
6. Outbound call, digital mode
7. Digital-to-Digital channel handoff
8. Digital-to-Analog channel handoff

Handoffs should be performed between low, middle, and high frequency channels.

Analog Test Measurements

- RX Sensitivity (SINAD)
- RX Audio Distortion
- TX Power Out
- TX Frequency Error
- TX Audio Distortion
- TX Maximum Deviation
- TX SAT Deviation
- TX ST Deviation

Digital Test Measurements

- Digital RX Sensitivity (FER)
- Digital Power Out
- TX Frequency Error
- Waveform Quality (Rho)

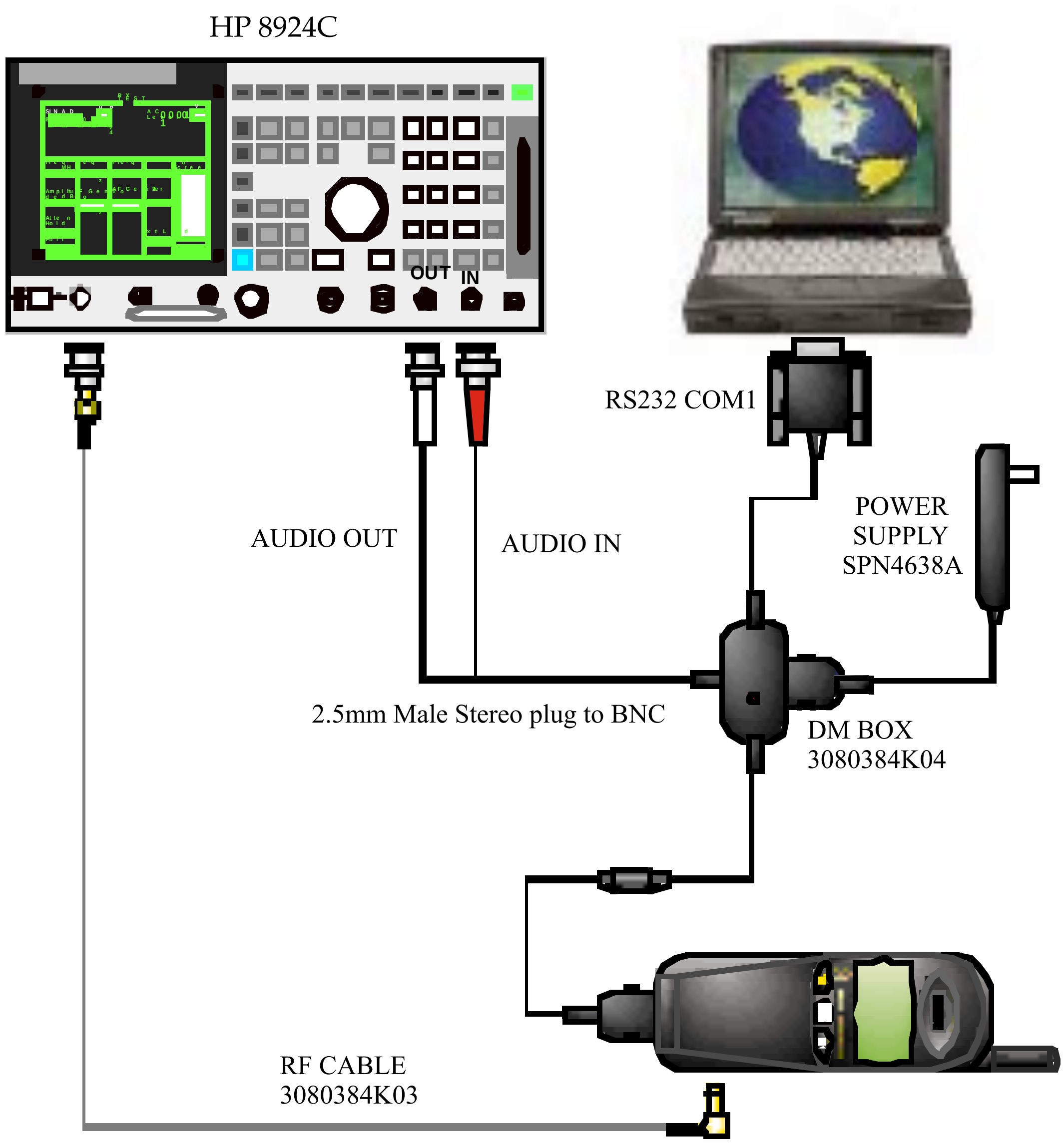
The analog and digital parameters are stored in EEPROM on the Transceiver Board. Each transceiver is shipped from the factory with these parameters already calibrated. However, if a board is repaired, these parameters should be measured and, if necessary, adjusted. Checking and adjusting calibration parameters is also useful as a troubleshooting/diagnostic tool to isolate defective assemblies.

Connections for performing Tests

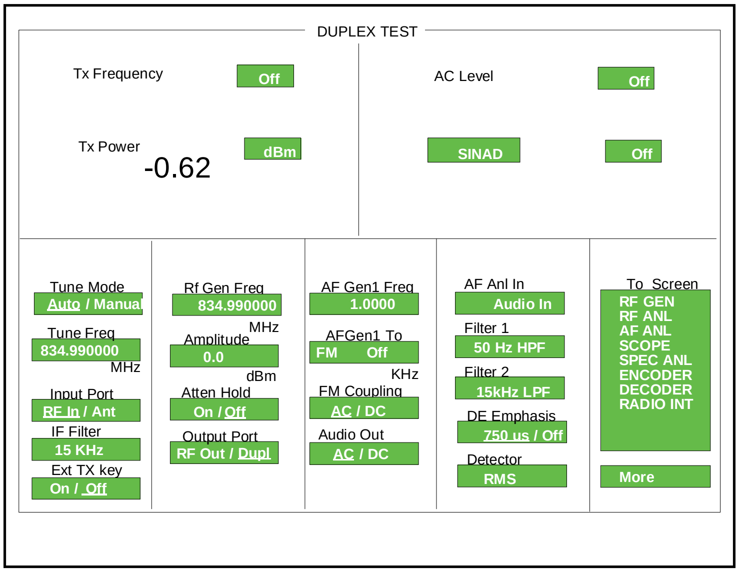
The diagram below shows the recommended connections for testing.

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

Connections for Testing



RF Cable Test



To test the RF cable for proper loss:

- **Tune Freq** should be set to TX frequency: 834.990000 MHz.
- **RF Gen Freq** should be set to same frequency (834.990000 MHz).
- **Tx Power** should be set to read in dBm, not Watts.

In order to properly measure and adjust the parameters of a telephone, it is important that you use RF cabling that has minimal loss. Therefore, it is important that you test the RF cable for proper loss. This can easily be done by using the DUPLEX TEST screen of your HP8920. To test the cable, set up the DUPLEX screen as shown above.

Action:

Take the cable under test and connect it from the RF in/out port to the Duplex Out port. At this point you will be getting some type of power reading for cable loss.

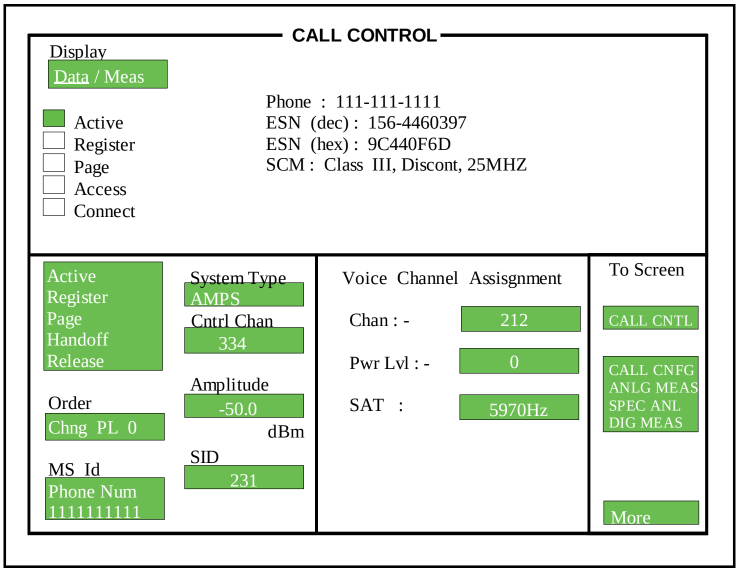
Good range: -.2 dBm through -.8 dBm

Bad cable: More than -.8 dBm

If the reading you are getting shows gain (positive number,) you may need to zero the power meter. This may happen on an HP8920 whose memory has just been cleared.

To zero the meter, press the **TX** button on the 8920 panel. Bring the cursor down to the field under **TX Pwr Zero** where it reads **Zero**. Tap the cursor on the Zero field and it will highlight for a moment as it zeroes the meter. Set up the screen as shown above, and test your cable.

Set up for Analog call



Select CALL CNTL button from the Analog Screen Control panel

- Select System type: **AMPS**
- Zero the RF Power meter in the: **Call Config Screen**
- Set Amplitude to: **-50 dBm**
- Set SID: **Your phone's System ID**
- Select: **Active**
- **Voice Channel Assignment Type:**
- Chan: **212**
- Pwr Lvl: **4**
- SAT: **5970Hz**

Registration

1. Put the Test Set in Active state by selecting **Active** from the list on the left side of the screen.
2. Select **<u>Data</u>** from the **Data/Meas** field. This is the default mode.
3. Select **Register** from the list to register phone.
4. If the registration message has been received, the Test Set will display registration data in the upper half of the screen as shown in the sample screen above.

Page

1 Select page from the list on the left side of the screen.

2 If the mobile responds, you will see the Access annunciator light briefly.

3 Answer the call by raising the flip or press SEND on the mobile to start the conversation.

4 The Connect annunciator lights. This is the Connect state.

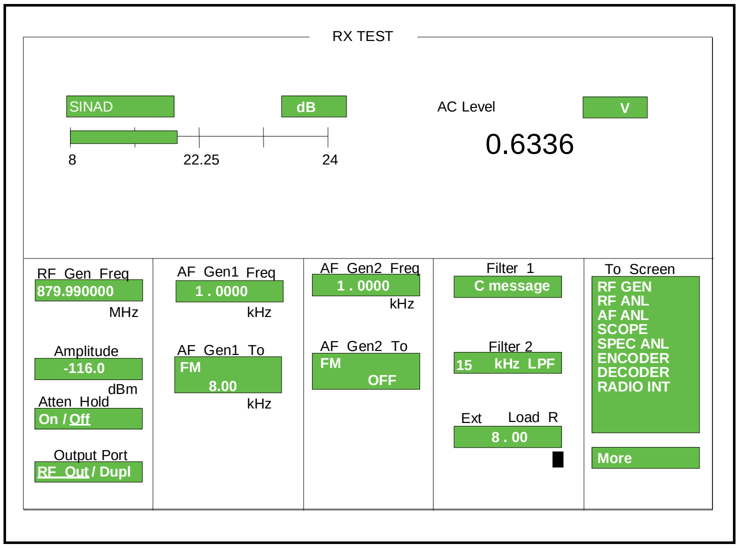
Origination

1 Dial the desired phone number on the mobile station and press SEND.

2 The Access annunciator will light while the Test Set signals the mobile on the assigned voice channel.

3 The connect annunciator will light if the mobile properly signals the Test Set.

RX Sensitivity Test (SINAD)



Communications Analyzer Setup:

- Select **RX TEST** button from the Analog Screen Control panel
- Set **RX frequency** to **879.990 MHz**
- Set **Amplitude** to **-116 dBm**
- Set **AF gen1** to **1 kHz frequency** at **8 kHz deviation**, using **FM modulation** (PLEASE NOTE: this is for AMPS only; NAMPS uses much lower deviation)
- Set **AF Filter 1** set to **C message filtering**
- Set **AF Filter 2** to **15 kHz**

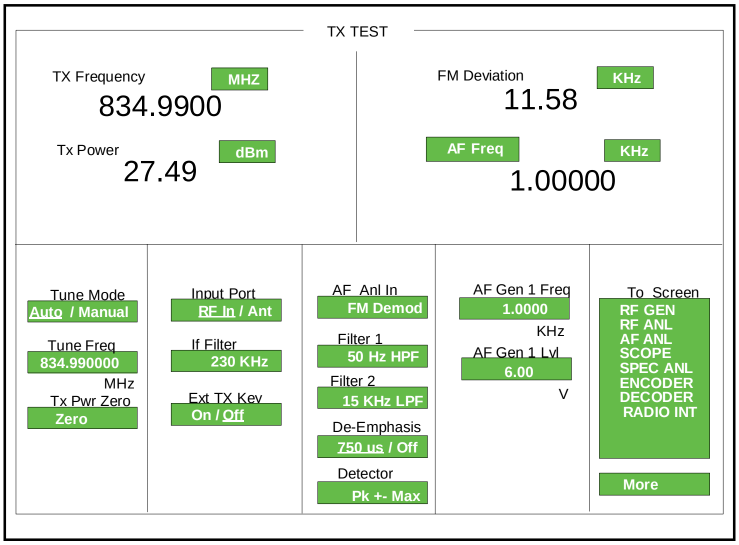
Test Mode Commands:

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 more than 12dB.

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. Narrow band SINAD can be measured by entering 571# and setting the FM Deviation to 3kHz. Refer to the RX troubleshooting section for radios not within the pass specifications.

TX Power Out Test



Communications Analyzer Setup:

• Select **TX TEST** button from the Analog Screen Control panel
• **PWR** is measured in **dBm**
• Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
• Set **TX frequency** to **834.990 MHz**
• Set **IF filter** to **230 kHz**
• Set **AF Filter 1** to **50 Hz**
• Set **AF Filter 2** to **15 kHz**
• Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

Test Mode Commands:

11333# Load synthesizer to channel 333
12X# Set power level to step X, where X is a power level from 1 to 7.
05# Turn on transmit carrier

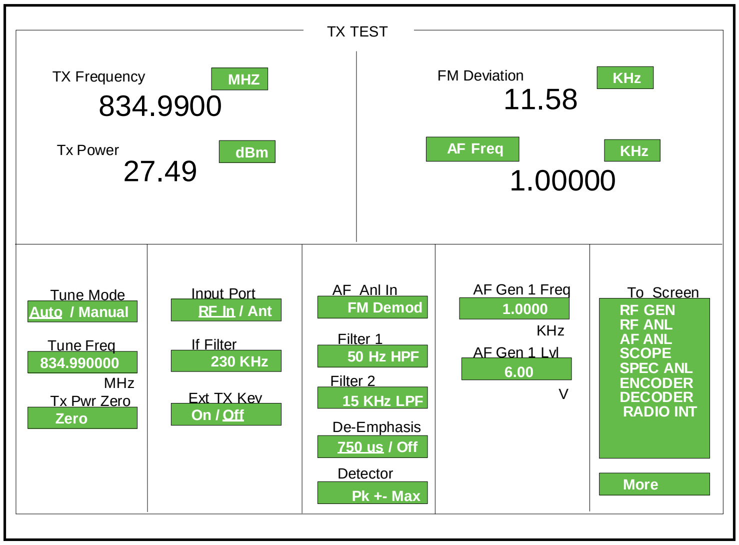
The TX Power Out specification for each portable power level is as follows:

Power Step 2 25dBm - 29dBm
Power Step 3 21.5dBm - 25.5dBm
Power Step 4 17.5dBm - 21.5dBm
Power Step 5 13.5dBm - 17.5dBm
Power Step 6 9.5dBm - 13.5dBm
Power Step 7 5.3dBm - 9.5dBm

Refer to the TX troubleshooting section for radios not within the pass specifications.

Note: When taking measurements, remember to compensate for cable loss.

TX Frequency Error Test



Communications Analyzer Setup:

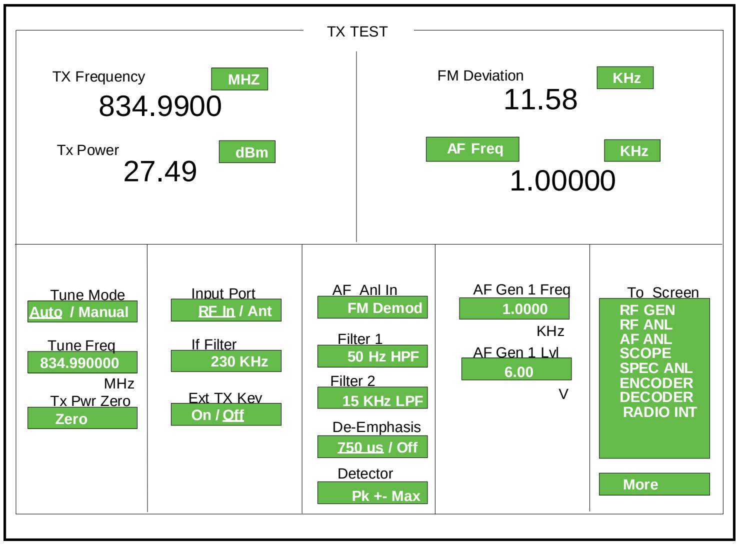
- Select **TX TEST** button from the Analog Screen Control panel
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **TX frequency** to **834.990 MHz**
- Set **IF filter** to **230 kHz**
- Set **AF Filter 1** to **50 Hz**
- Set **AF Filter 2** to **15 kHz**
- Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

Test Mode Commands:

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

The frequency error measured on the communications analyzer must be less than ±1 kHz.

TX Maximum Deviation Test



Communications Analyzer Setup:

• Select **TX TEST** button from the Analog Screen Control panel
• **PWR** is measured in **dBm**
• Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
• Set **TX frequency** to **834.990 MHz**
• Set **IF filter** to **230 kHz**
• Set **AF Filter 1** to **50 Hz**
• Set **AF Filter 2** to **15 kHz**
• Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

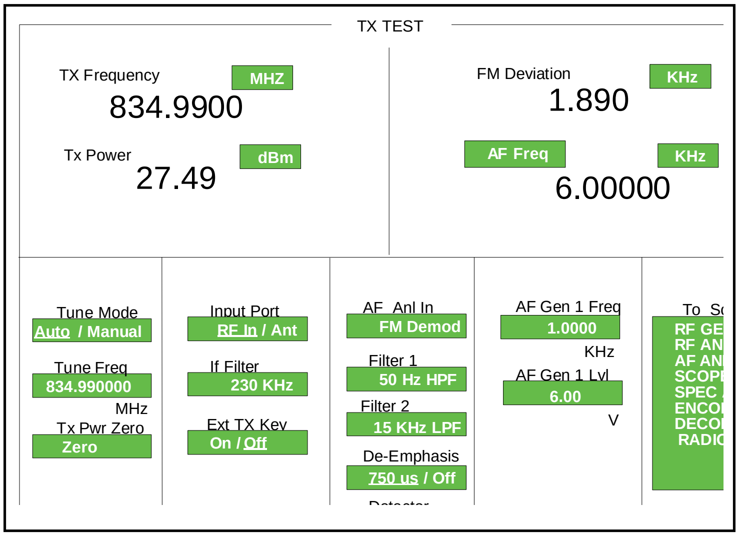
Test Mode Commands:

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

View FM Deviation for reading.

TX Maximum Deviation Pass Specifications: 9.8 kHz - 12 kHz

TX SAT Deviation Test



Communications Analyzer Setup:

- Select **TX TEST** button from the Analog Screen Control panel
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **TX frequency** to **834.990 MHz**
- Set **IF filter** to **230 kHz**
- Set **AF Filter 1** to **50 Hz**
- Set **AF Filter 2** to **15 kHz**
- Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

Test Mode Commands:

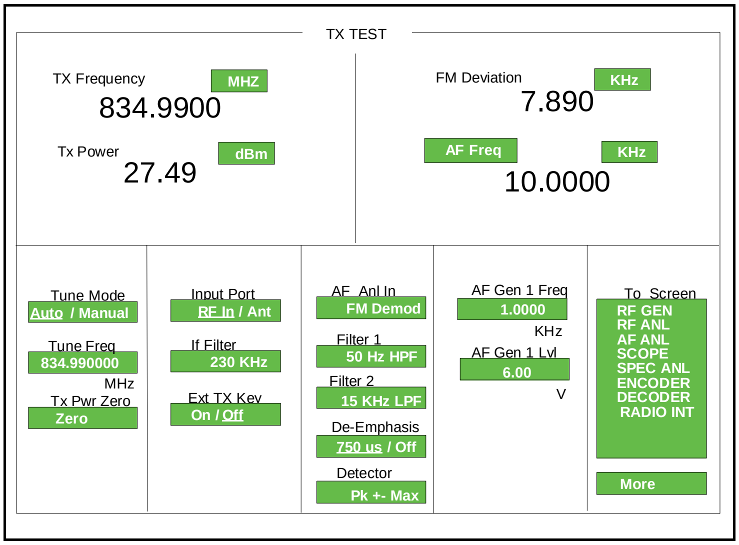
11333# Load synthesizer to channel 333
122# Set power level to step 2
05# Turn on transmit carrier
251# Enable 6000 Hz SAT tone

View FM Deviation for the reading.

The transponded peak SAT FM deviation should be 2 kHz ±200 Hz.

The demodulated signal on the communications analyzer should have an audio frequency of 6000 Hz.

TX ST Deviation Test



Communications Analyzer Setup:

- Select **TX TEST** button from the Analog Screen Control panel
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **TX frequency** to **834.990 MHz**
- Set **IF filter** to **230 kHz**
- Set **AF Filter 1** to **50 Hz**
- Set **AF Filter 2** to **15 kHz**
- Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

Test Mode Commands:

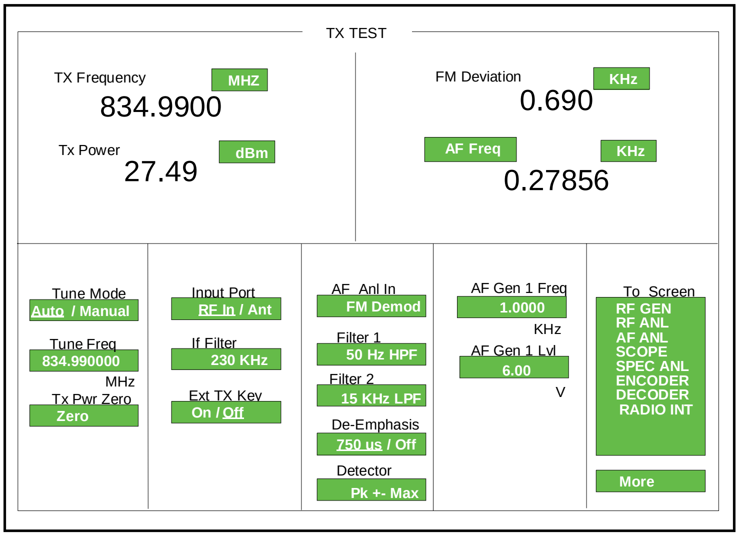
11333# Load synthesizer to channel 333
122# Set power level to power step 2
05# Turn on transmit carrier
14# Enable signaling tone

View FM Deviation for reading.

The peak ST deviation measured on the communications analyzer should be 8 kHz ±800 Hz deviation.

The demodulated signal on the communications analyzer should have an audio frequency of 10 kHz.

TX DSAT Deviation Test



Communications Analyzer Setup:

• Select **TX TEST** button from the Analog Screen Control panel
• **PWR** is measured in **dBm**
• Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
• Set **TX frequency** to **834.990 MHz**
• Set **IF filter** to **230 kHz**
• Set **AF Filter 1** to **50 Hz**
• Set **AF Filter 2** to **15 kHz**
• Set **AF gen1** for **1 kHz frequency** at **6V level** (output will go to the **audio** port)

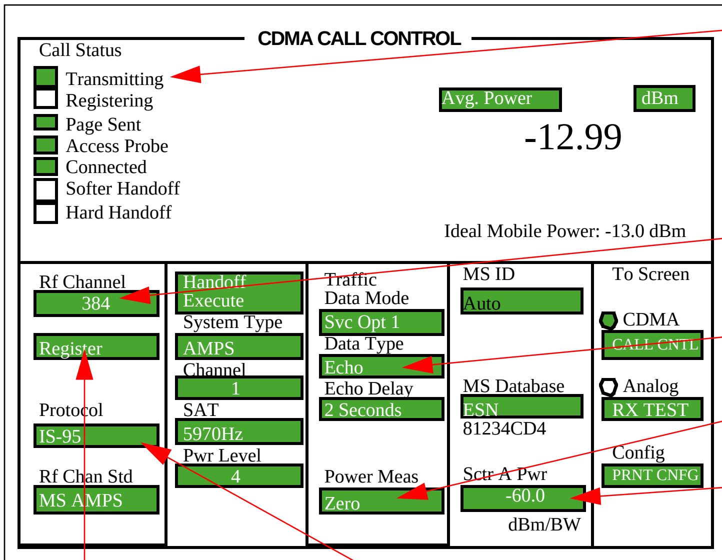
Test Mode Commands:

571#　Enable NAMPS signalling
11333# Load synthesizer to channel 333. NCHAN prompt will be displayed.
1　To select center frequency (0-Low, 1-Center, 2-High)
122#　Set power level to power step 2
05#　Turn on transmit carrier
253#　Enable DSAT code 25AD4D

View FM Deviation for the reading.

TX DSAT Deviation Pass Specifications:
.630 kHz - .770kHz

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

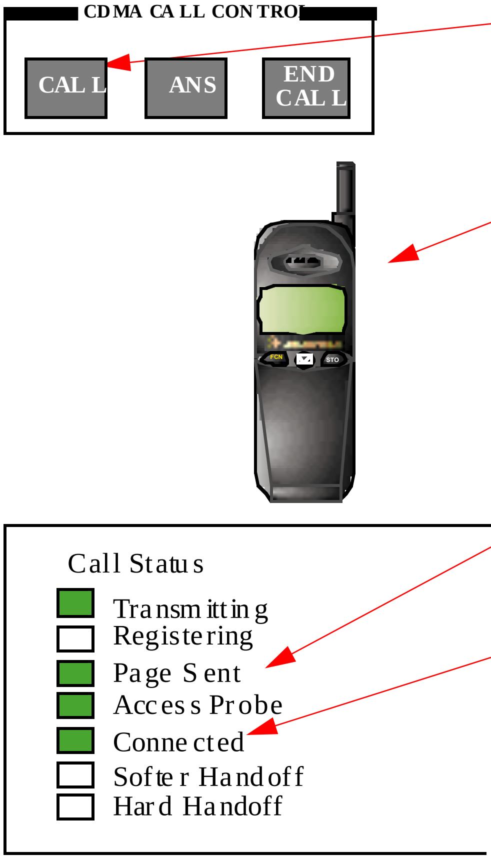
Set CDMA Generator Power to -60 dBm/1.23MHz

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 and777 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.

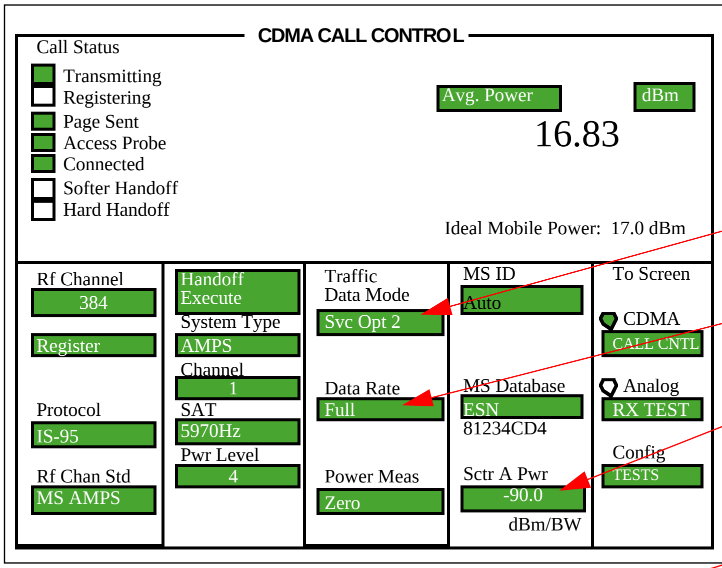
Answer the call on the CDMA Phone. Then speak into the phone and wait to hear your voice echoed back to you by the HP8924C.

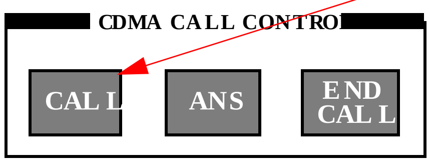
Each light activates as the call processing proceeds.

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

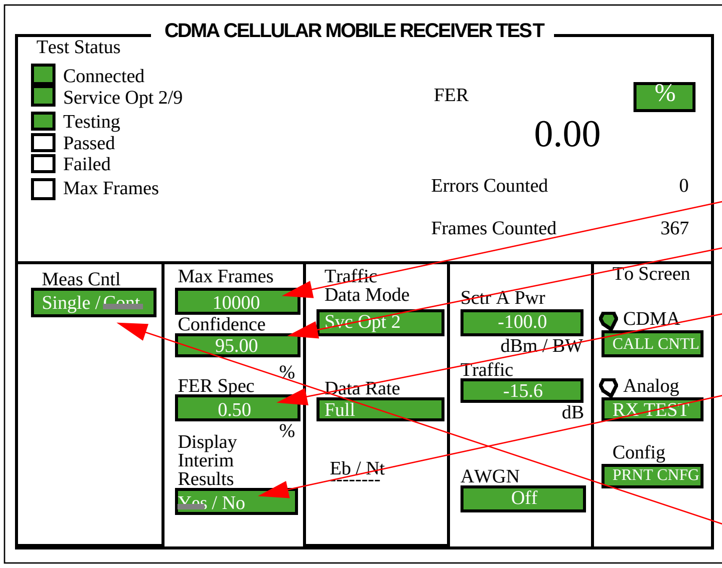
While service option 001 calls are useful for the verification of CDMA mobile functionality, parametric tests cannot be accurately made in this mode. The TIA IS-98A minimum performance standard recommends that testing be made using service option 002. In service option 002, the mobile under test demodulates 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 Loopback 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



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

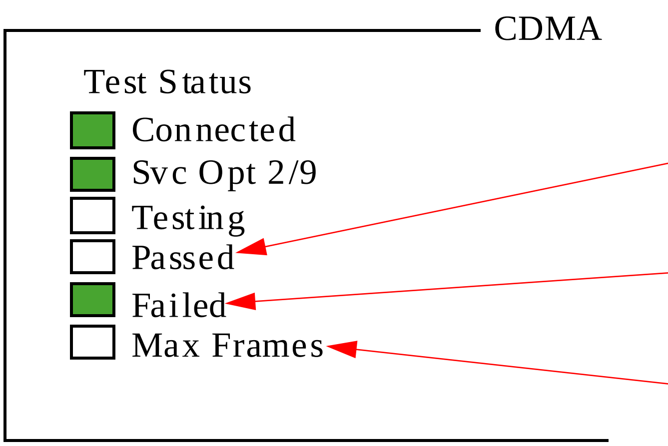
Arm the Measurement

- 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



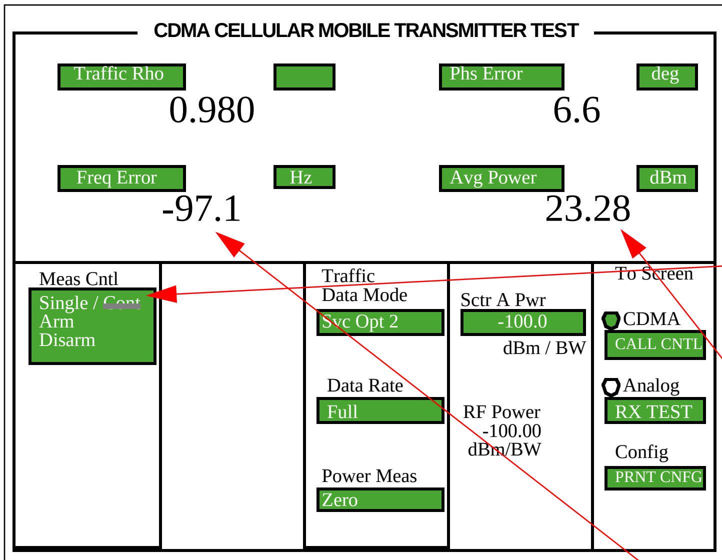
There are 3 possible outcomes to an FER Test:

- **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

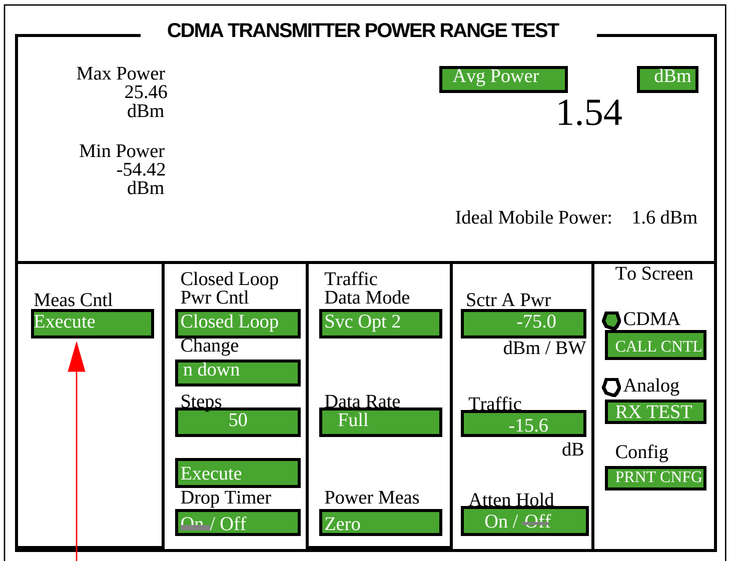
- Waveform Quality
- Frequency Error
- Amplitude & Phase Error

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 field 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

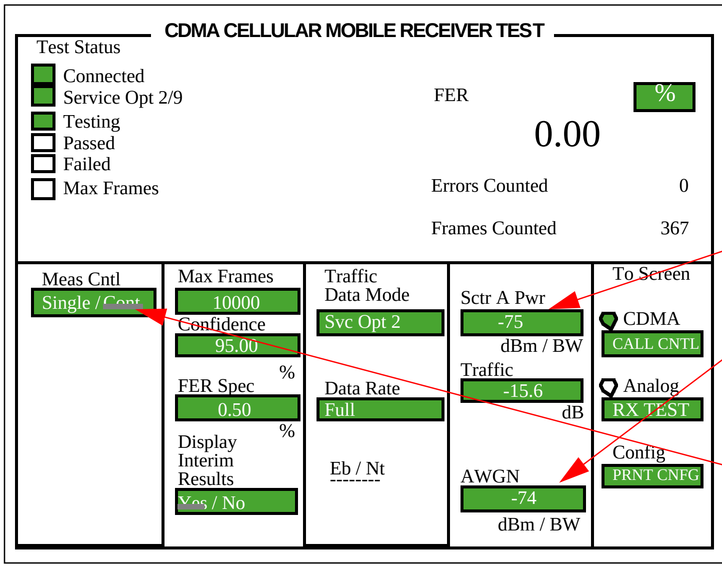


Select Execute

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.

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.

Opening Housing:

Step 1: Remove battery from phone by pressing on the tab on the back of the phone and sliding the battery off.

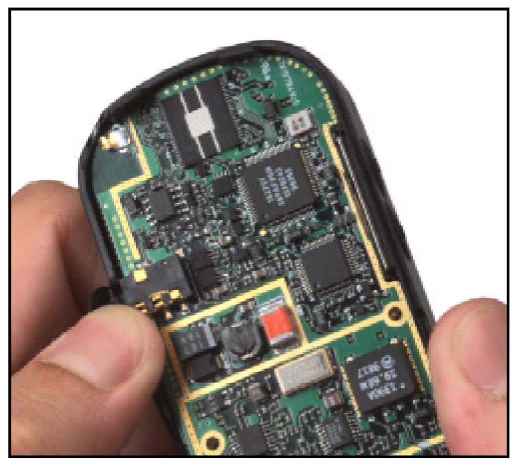
Step 2: Unscrew the antenna by holding it with the thumb and index finger and turning counterclockwise.

Step 3: Using a torx driver with a T7 it,unscrew all four (4) screws from the back housing

Step 3: While holding the phone firmly with one hand, gently pry off the rear housing using the left thumb and forefinger.

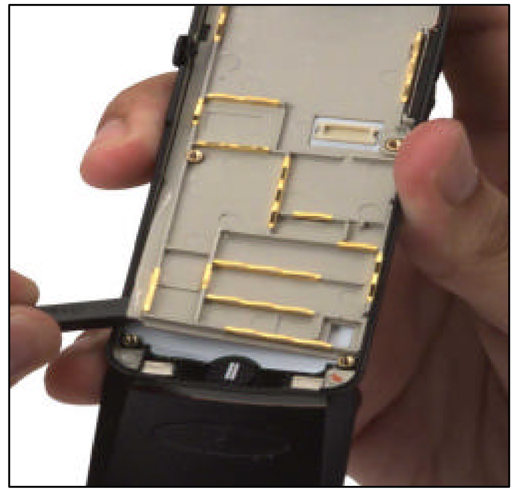
Board Removal

Step 1: While holding the phone with one hand , gently lift the board from the phone using the left thumb and forefinger. Please observe caution around the flap that covers the headset jack. Use your left thumb to slighly bend the flap. This allows the board to be removed completely



Spacer Removal

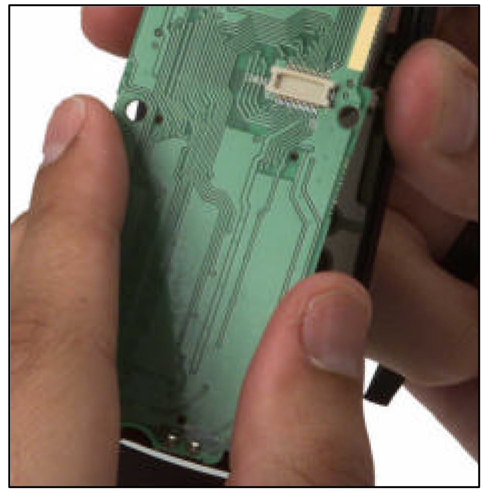
Step 1: While holding the phone firmly with one hand, insert the plastic disassembly tool between the housing and the spacer and



Keyboard Removal

Step 1: Using the plastic disassembly tool, lift the flex connector tab to allow the flex cable to be disconnected.

Step 2: Lift the keypad board using the plastic disassembly tool.



Step 3: Remove the keyboard by pulling it away from the housing while holding the phone firmly with one hand.

Step 4: Remove the keypad by grabbing one of the corners and pulling it out of the housing.

Flip removal

Step 1: Use one hand to pull one side of the flip out of the hinge. Do this while firmly holding the phone with the other hand.

Step 2: Carefully slide the flip to the side to fully release it from the other hinge.

Step 3: To remove the hinges ,use the plastic disassembly tool to push them out from the inside.

Circuit Description

Receiving Section

Received signals of 869-894MHz through antenna before being transmitted to the low noise amplifier terminal of receiving section IC41 go through the DUP1 duplexer which receives 881 ± 12.5 MHz of frequency bandwidth during receiving and transmits only 836 ± 12.5 MHz of frequency bandwidth during transmitting. This unit attenuates image interfering the received signal and transmitting signals from the transmit section by around 50dB for proper reception.

The received signal passed through DUP1 having 2dB of loss in the transient bandwidth passes through IC41 LNA having 15dB of gain against a reception frequency having 1.6dB of noise figure. If the strength of the received signal detected from IC7 (RX AGC) is stronger than -85 dBm slightly, it controls LNA input level of the received signal by switching ON/OFF TR7, D6 after controlling DC voltage with LNA-BYPASS signal at MSM of baseband section.

Signal which has gone through LNA goes through FL2 SAW Filter reducing at least 20dB additionally against the transmitting signal and the out-band signal. This filter has the bandwidth of 25MHz with the center frequency of 881.5 ± 12.5 MHz. Signal gone through FL2 is divided into FM and CDMA through D5. IC28 mixes the FM signal with the local oscillating frequency generated at VCO1 to generate the 1st IF of 85.38 MHz. CDMA signal goes through IC 29, Down Converter through FL3 having 25 MHz bandwidth with 881.8 MHz of center frequency and TR5 composed of noise figure of 1dB and 20dB of gain. IC29 generates CDMA-RX signal of 85.38 MHz of 1st IF by mixing it with the local oscillating frequency of VCO1. IF signal generated this way enters RX AGC IC7 through FM SAW Filter F2 and CDMA SAW Filter F1 of 1.26 MHz of bandwidth with center frequency of 85.38 MHz.

RX AGC amplifier IC7 can control gain up to -45 ~ +45dB by the power level of RX_AGC_ADJ of baseband of gain control input. In normal operation IF output of baseband is maintained in the range of 5mV rms.

Transmitting Section

CDMA or FM transmitting signal output from baseband goes through PAD composed of R6, 7, 10 and 12 having 27dB of attenuation to supply proper power to IC24 (TX AGC). Therefore it is output to the TX AGC amplifier. IC24 with the frequency of 130.38 MHz having fixed level of - 20 dBm in CDMA mode, - 26dBm in FM mode.

To control the transmitting power accurately, IC24 gain is changed by the TX_AGC_ADJ controlled by baseband MSM. In this case, gain in this section is an adjusted between -50 ~ +40dB.

Output adjusted at IC24 goes through 130MHz SAW BPF having 3dB bandwidth of ±15 MHz in order to improve the transmitting noise flow. Output of this filter is up-converted to the RF output range of 824~849 MHz at 130.38 MHz after being mixed with VCO_BUFF (954~979MHz) local oscillator frequency which was used at the time of RX in the IC1 CDMA/FM Up-converter.

In order to make the power AMP Module (PAM1) is amplified fully, proper level of signal should be input and this function is performed in the internal block of IC1. As a power driver, the amplifier in the IC1 provides high driver level to POWER AMP PAM1. SAW Filter FL3 with frequency band of 836.5 ± 12.5 MHz connected to IC1 attenuates typically the unwanted frequency and noise out of transmitting band up to 30 dB before amplifying power at the amplifier of PAM1.

Output from the output amplifier is transmitted to the transmitting port of Duplex Filter through the isolator of ISO1. Isolator regardless of duplex load or antenna's impedance provides stable load impedance to the power amplifying to suppress the reflective wave damaging power and also provides reverse isolation to the external interference signal performed from antenna to PA output. Ceramic Duplexer DUP1 provides attenuate minimum 47dB to the transmitting noise generated in the receiving band, 50dB to 894~1500 MHz, 20dB to the 2nd harmonics and 30dB to the frequency band below 750 MHz.

PA Detection Circuit Section

Purpose of power control is to make signals of all mobile stations accurately be transmitted to the base station with same power under the environment that all the mobile stations in a cell use the same frequency. To detect this transmitting power, PA detection circuit is required. Power AMP output circuit uses diode detector type detecting the peak power. Function of detector is to detect linear DC voltage against RF voltage existing on AMP output line.

This circuit uses D7A, B dual diode in the same package and forms a symmetric circuit. One of these diodes is used for the half-wave rectification, the other one for temperature detection.

PLL Section

Synthesizer is divided into VCTCX1, VC01, and IC2 frequency synthesizer. VCTCX1 as a temperature compensation crystal oscillator controlled by TRK-LO-ADJ output from MSM of baseband, provides a reference frequency of 19.68 MHz to Divider in the frequency synthesizer IC2 in RF section and simultaneously provides this reference frequency to RX, TX PLL circuit for the 2nd mixer in the baseband section. Control pin for the fine voltage control of VCTCXO is pre-adjusted at the factory through DAC of baseband in case of FM and CDMA, it is controlled by TRK-LO-ADJ signal of MSM producing reference frequency based on the "OFF AIR" correction. This signal is smoothed into voltage input controlling TCXO oscillator by RC low pass filter having 1 ms time constant.

In FM mode. Frequency has the accuracy of 2.5ppm against all kinds of temperature condition while in CDMA mode, the accuracy is in the range of 0.5ppm assuming the accuracy of the base station.

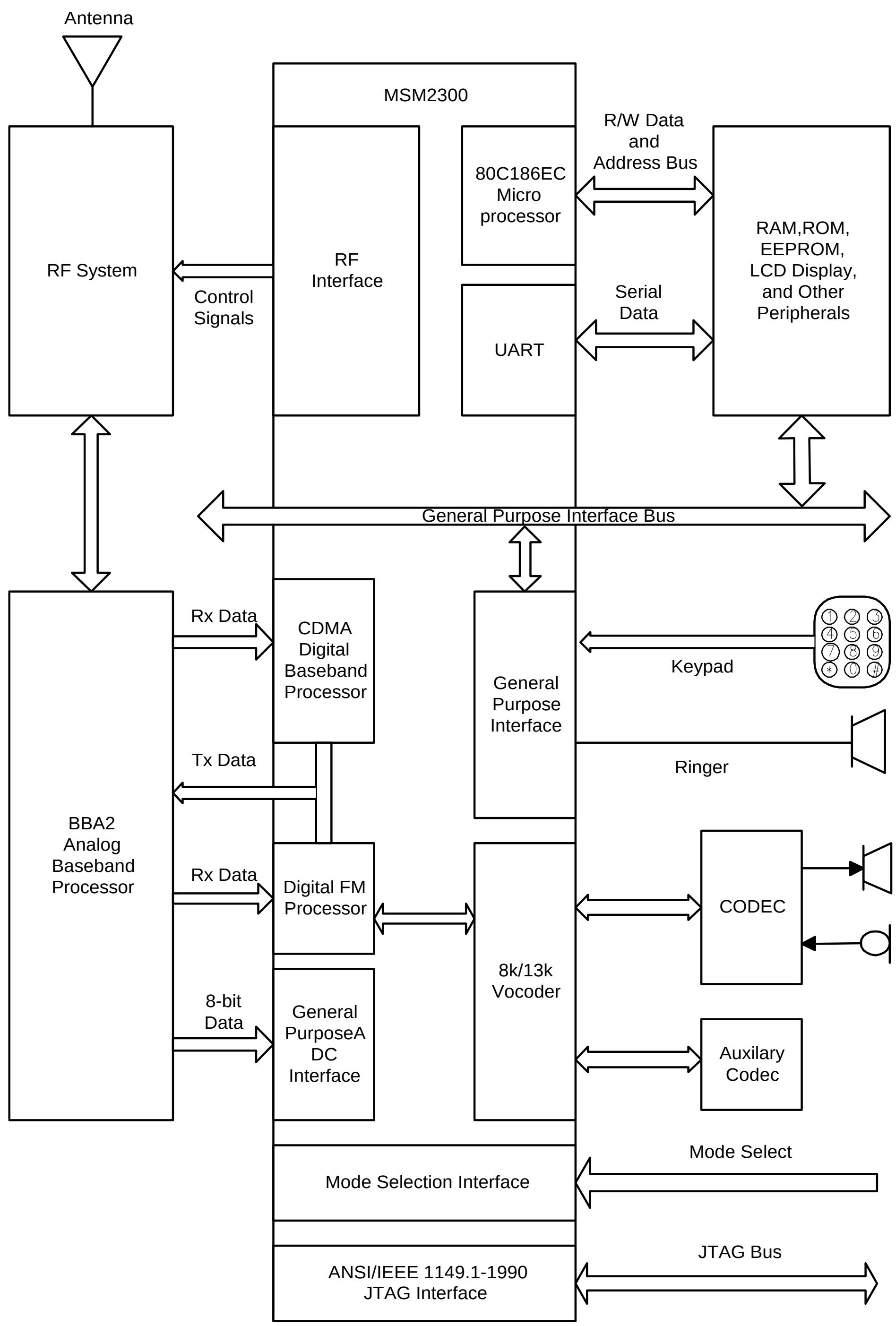
When RF operates, the reference frequency of 19.68 MHz is supplied to the phase comparator after being divided by 14 BIT divider in synthesizer IC2 .

VCO output is input to the phase comparator through 18-bit divider after being feedback to pin number 13 of IC2 in order to supply the comparison input to this phase comparator and this comparison output is transmitted to the voltage control pin of VCO phase through the manual RC loop filter (loop band width approximately 500Hz) composed of R15 and C21 via the charge pump. In VC01, VCO_BUFF frequency corresponding to this DC voltage is produced.

Programming of dividing number to IC2 synthesizer is made of 3 serial interface (data, clock, and latch enable) from MSM of baseband section. If unlock situation is detected, SYN_LOCK_DET output is provided and hardware internal LOCK to block the transmitting is the baseband section.

Logic Section

MSM(Mobile Station Modem)



MSM performs all digital-processing functions of CDMA/FM cellular phone. This is composed of integrated CDMA, CORE, QCELP algorithm VOCODER, i186 microprocessor CORE (functionally based on INTEL 80186) and interface of peripheral equipment. It supports Logic and H/W to support enough CDMA digital cellular phones. MSM has most digital interface including the execution of system software. Figure 1 shows the interface with main block of MSM and system's peripheral circuits.

Each section of MSM has functions as follows;

1) CDMA CORE

RF interface is connected to the external RF circuit. It has data bus interface to transmit-receive I&Q data which are input/output through A/D, D/A converter of IC6 BBA2. Here power AMP control, AGC feedback, i.e. receiver AGC adjustment, transmitter's AGC and frequency are controlled. It supports CDMA signal, demodulation, pilot signal generation, data interference, non-interference, and local oscillating adjustment and lock state.

2) MICRO - PROCESSOR CORE

MSM is in i186 one chip processor and provides external peripheral devices, especially memory (FLASH MEMORY, SRAM, and EEPROM) control interface. I186 processor controlling most functions of phone provides possible general signals (GPIOs). Parts of GPIOs are used to interrupt process and the rest support other interrupt functions or compose KEYPAD interface. Microprocessor has interrupt controller, multiple timer, DMA (Direct Memory Access) controller and 16-bit data bus path and can address up to 64KByte of I/O.

3) VOCODER CORE

MSM has vocoder processing the transmit-receive voice signals at the rate of 8kbits / 13kbits internally and interfaces with the external CODEC IC connected to microphone and speaker through PCM signal. Vocoder provides two functions.

QCELP Encoding/Decoding: QCELP encoding of reverse direction link CODEC data and QCELP decoding of forward direction link data

Analog signal processing: Process of data row of transmit-receive

4) Serial Data Port to External Serial EEPROM Memory

MSM provides a non-synchronous UART in order to connect with the external non-synchronous serial device EEPROM. It has 64Byte FIFO serial data port for the hardware handshake signal, where 32 Bytes are for transmitting and 32 Bytes for receiving.

In addition, there are universal ADC interface, universal interface, interface separating voice and data against FM Mode. 27 MHz of one chip ceramic oscillator for microprocessor and internal WatchDog Timer are available.

Memory Circuit

Operation functions of peripheral memory devices of MSM

1) FLASH Memory
As an 8MBit-memory device it contains S/W and program for each device. You can change program by using of download program.

2) SRAM
Its capacity is 2MBit and in this memory stored are internal flag information, call-processing data, and timer data from FLASH to SRAM by MCU.

3) EEPROM
This ROM stores factory calibration data, ESN, NAM, power level, volume level, Tel No, SMS as the user's data and its capacity is 128Kbits.

4) KEY PAD
Store signal of SCAN 0-6 and four input port of MSM KEY 0-3 are used for key input and formed a key Matrix. Power key is not related to Matrix and 20 keys including this are available.

5) LCD Module
LCD display is composed of 7 icons and 5 x 7 dot matrix and in 12 characters with 4 lines. And support double rate character. Controller is built in the module and all data are handled by 8-bit serial. Temperature compensation circuit is built in for proper working under the unfavorable working condition like -20? ~ + 78?.

Base Band ASIC

IC6 analog baseband processor ASIC is directly connected to the digital section of RF section or IC19 MSM and is made of CMOS VLSI for performing all digital signals of phone. Accurate analog circuit is adopted by using low power CMOS and 3.3V is used for the operating voltage.

Generally its characteristics are maintained under the temperature of -40? ~ +85? and its type is 80 lead TQFP type.

Major functions of this chip are as follows;

- CDMA/FM dual mode
- Receiving Section
  - Down-conversion from IF single to baseband signal
  - CDMA/FM filter and ADC are separated
  - Conversion of analog baseband to digital
  - CDMA Sampling Clock Synthesizer

- I - Q Mixer Local Oscillator
- OFFSET control loop

- Transmitting Section
  - Conversion of digital I - Q data to analog baseband signal
  - Up - conversion of baseband signal
  - I - Q Mixer Local Oscillator
  - Mode Control Logic for idle mode, R/TX sleep
  - Universal ADC built-in for system monitor
  - Low power consumption

Here are more functions except the above;

- Conversion of analog signal to digital

  This signal is multiplied by RSSI of FM mode, telephone's temperature, battery temperature, RF PA detection voltage, IC11, 16 capable of measuring battery voltage.
- Detection and Input of Synthesizer LOCK
- Distributor's function to the reference of 19.68 MHz TCXO providing reference signal to TCX0/4 and CHIPX8

Audio Section

1) TX AUDIO PATH

Voice signal generated from MIC is transmitted to IC19 MSM through being converted into PCM data after being amplified through IC15 OP AMP filtered with CODEC, BBA.

2) RX AUDIO PATH

PCM data generated from MSM is output to the speaker after being converted to voice signal via ADC in IC6 BBA and amplified to speaker AMP IC14 through voice adjustment.

3) FM Path : All the FM processes are made in MSM

A. FM TX PATH

a. Pre-Emphasis circuit and frequency characteristics

Pre-Emphasis circuit has the characteristic of +6dB/oct in order to remove the loss and noise of the signal on the transmission line.

b. Compressor

It has 2:1 level characteristic used to remove the loss and noise of the signal on the transmission line together with pre-Emphasis. In other words, pre-Emphasis remove noise with the frequency characteristic while compressor has the function to remove noise with level characteristic. Compressor's zero crossing level is ± 2.9 KHz/ dev, attack time is 3ms and release time is 13.5 ms.

c. Limiter

It cuts out the audio signal level exceeding ± 0.53 Vp-p in order to maintain the deviation ratio under ±12 KHz/dev. In other words, it is used to avoid the crosstalk with the adjacent channel. There is a LPF to remove the high frequency component of the limited signal.

B. RX AUDIO PATH

a. De-Emphasis

De-Emphasis circuit has the characteristic of -6dB/oct to remove loss or noise on the transmission line.

b. Expander

It has 2:1 level characteristic used to remove the loss and noise of the signal on the transmission line together with De-Emphasis. In other words, De-Emphasis removes noise with the frequency characteristic while Expander has the function to remove noise with level characteristic. Expander's zero crossing level is ± 2.9KHz/dev, attack time is 3ms and release time is 13.5 ms.

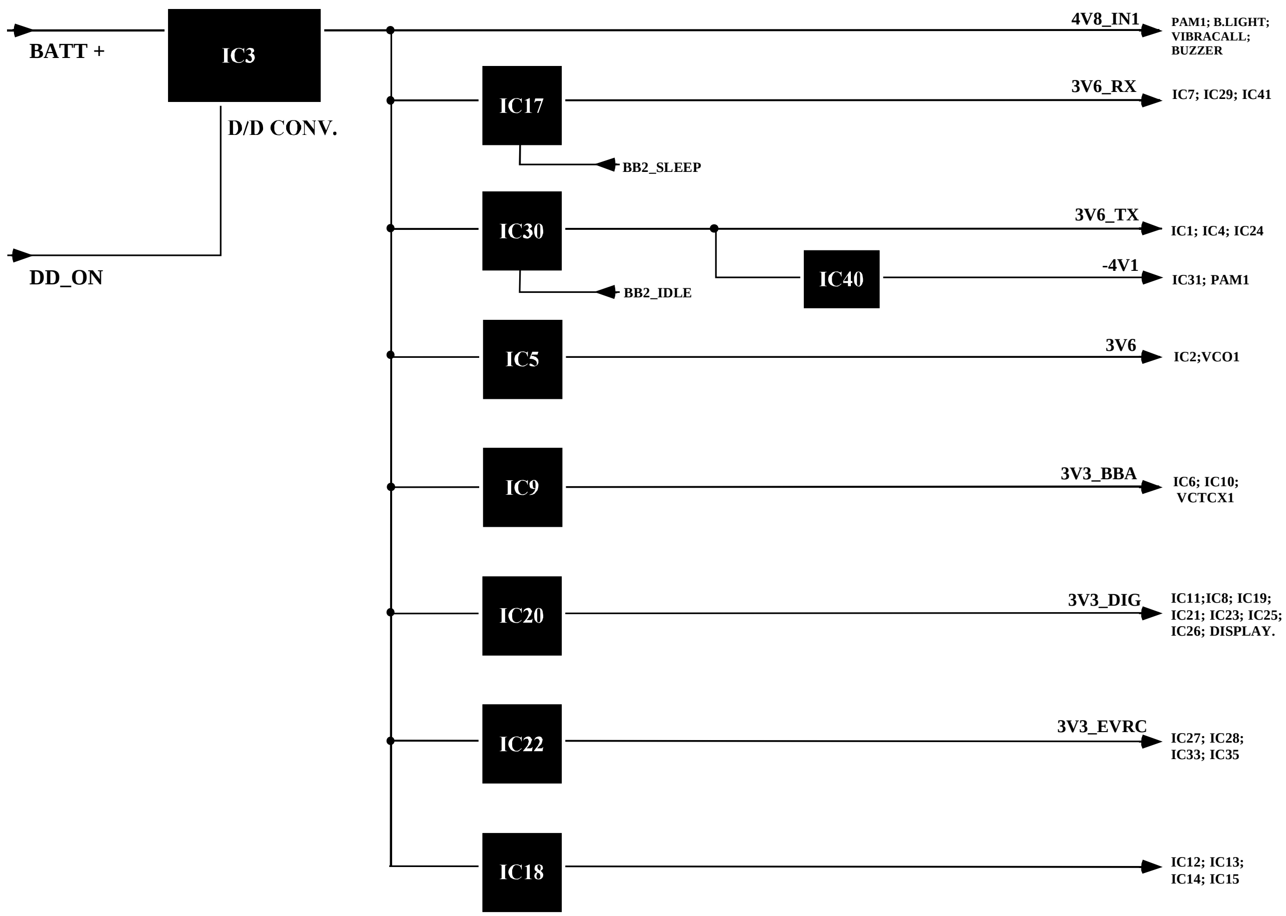
c. Volume Adjuster

It is used to adjust the volume of the dialog partner for the convenience of user. Four-step adjustment is possible.

C. TX WBD, ST, SAT

TX WBD, ST, SAT are generated inside MSM. Modulation level of TX WBD and ST is ± 8KHz/dev and that of SAT is ± 2KHz/dev.

Power Circuit Section



If PWR key is pressed with battery power on, PWR_ON_SW is short, D1 is turned On, DD_ON becomes low and finally DC-DC converter IC3 is activated.
If simultaneously D3 is turned on, ON_SW_SENSE of MSM senses whether PWR key is pressed.

Once this signal is detected, MSM turns on the TR3 with high signal and maintains the self-keeping circuit.

IC17 having 3.6V_RX is controlled by BB2_SLEEP of MSM; IC30 having 3.6V_TX is controlled by BB2_IDLE signal of MSM.
IC 9 is a power source for BBA and IC 20 is a power source for MSM, LCD and memory.
General circuit block diagram is shown in Figure 10.

Other Circuits

1) Buzzer Activation Circuit

As a device to generate alarm, buzzer activates the generated signal from the timer of MSM by TR 10 and TR 23 to trigger alarm.

2) Key Tone Activation Circuit

Amplifying the Ringer signal of MSM to the IC speaker AMP generates Key tone.

3) Vibration Circuit

In the mode of vibration, MSM receives the VIBRATOR/CATHOD signal and activates D180 and TR26 to activate motor for vibration.

4) Ear Jack Circuit

This block is arranged for the external ear phone through CON1 Ear Jack. Once ear Jack is connected, internal MIC and Speaker are switched to earphone and communication through earphone is possible.

Troubleshooting

Introduction

Known good replacement parts and assemblies should be available to be used for troubleshooting by substitution, and for replacement of defective parts/assemblies.

Defective circuit boards should be forwarded to the appropriate Motorola service facility for repair.

Refer to the "Replacement Parts" section of this manual for a list of replacement part descriptions and part numbers.

Troubleshooting and Repair

The troubleshooting chart in page , "Assembly Replacement Level Trouble-shooting and Repair Chart," on page 56 shows some typical malfunction symptoms and the corresponding verification and repair procedures. Refer to the disassembly instructions located in the "Disassembly" section of this manual for instructions on removing parts/assemblies.

Most of the troubleshooting procedures on the following pages require temporarily connecting DC power to the battery connector with the phone disassembled. The figure below shows the polarity of the battery connector.

CAUTION

Many of the integrated circuit devices used in this equipment are vulnerable to damage from static charges. An ESD-safe workstation should be used whenever a transceiver is opened.

Analyzing Procedures

Defect Type : No Receive (RX)

Test Conditions:	Generator Signal Input : –25 dBm Channel: 385 (Frequency = 881.55 MHZ) Test Mode commands: 11385# ; 08#

- Verify input to filter DUPLEX , pin 2 . Reference :01

- Verify RX output , from filter DUPLEX , pin 1. Reference: 02

- LNA (Low Noise Amplifier) measurements:
  Digital mode:
  From -104 dBm to -80 dBm , LNA ON , TR7 LNA_BYPASS is “0”
  Greater than -80 dBm , LNA OFF , TR7 LNA_BYPASS is “1”
  Analog Mode: LNA always ON

LNA ON:

- Verify IC41 , pin 3 , LNA IN . Reference 3.

- Verify IC41 , pin 6 , LNA OUT. Reference 4.

- Verify FL02. Reference 5.

- Verify TR5 , PRE_AMP. Reference 6.

- Verify TR09 , A_D BUFFER . Reference 7
  Digital mode: TR09 ON , pin 1 is “1” , TR26 ON - D9 short
  Analog Mode: TR09 OFF , pin 1 is “0” , TR26 OFF - D9 open

- Verify IC28 , Analog mixer. Reference: 8.
  Pin 6 : IN
  Pin 1: VCO RX (FM_LO)
  Pin 3 : OUT (Analog IF)

Defect Type : No Receive (RX) - Cont'd

- Verify IC29 , Digital mixer. Reference: 9.
  Pin 1 : IN
  Pin 3 : VCO RX (FM_LO)
  Pin 6 : OUT (Digital IF)
  OBS.: FM_LO minimum: -5 dBm

- Verify TR13 , RX_LO BUFFER. Reference: 10.

- Verify Digital IF filter F1. Reference: 11.

- Verify Analog IF filter F2 . Reference: 12

- Verify IC07 (IF Buffer) . Reference: 13.
  Pins 9 & 10 : RX_IF
  Pin 16 : AGC_ADJ (check voltage level)

- Verify BBA , IC6 , pins 07 & 08 , RX_IF IN. Reference: 14.

- Verify BBA , IC6 , pins 63 & 64 , FM_RX_DATA_I/Q . Reference: 15.

- Verify MSM , IC19 , pins 7 & 8 , FM_RX_DATA_I/Q . Reference: 16.

- Verify MSM , IC19 , pins 134 & 137 , PCM_OUT. Reference: 17.

- Verify IC12 , CODEC IC , IN , PCM_OUT , pins 15 & 16. Reference: 18.

- Verify IC12 , CODEC IC , OUT , AUDIO_OUT , pin 44 . Reference 19.

- Verify IC14 , AUD_AMP , IN , pin 4. AUD_AMP , OUT , pins 5 & 8.
  Reference : 20.

<u>Defect Type: No Transmit (TX)</u>

Test Conditions:	Channel 385 (frequency = 836.55MHz) Power level 7 Test Mode commands: 11385# ; 122# ; 05#

- Verify output to BBA IC6, pin 12 (130,38MHz). Reference 21
- Verify input to IC24, PRÉ_AMP, pin 1 (130,38MHz). Reference 22
- Verify output to IC24, pin 9 & 10. Reference 22
- Verify input to IC1, MIXER_TX, pin 11 & 12 (130,38MHz). Reference 23
- Verify pin 8 to IC1 (VCO-IN, 966,93MHz). Reference 23
- Verify output to RF IC1, pin 15 (836,55MHz). Reference 23
- Verify input and output to PAM1 (PA) pins 1 & 5 (836,55MHz/28dBm). Reference.24
- Verify duplex filter, DUP1. Insertion loss should not be greater than 3dB.

Defect type: NTO (No Turn On)

Test Conditions: None

- Verify supply output 4V8_IN, pin 8 of IC3 and inductor L29. Reference 25.
  If the supply is not present, the proceeding measurements will be affected:

- Verify supply to IC13 pins 1, 2 & 13 (˜ 7,2V). Reference 25.

- Verify pin 14 of IC 3, it should measure the following value: ˜ 10Vpp 400KHz.
  If this reading is not present, replace IC3. Reference 25.

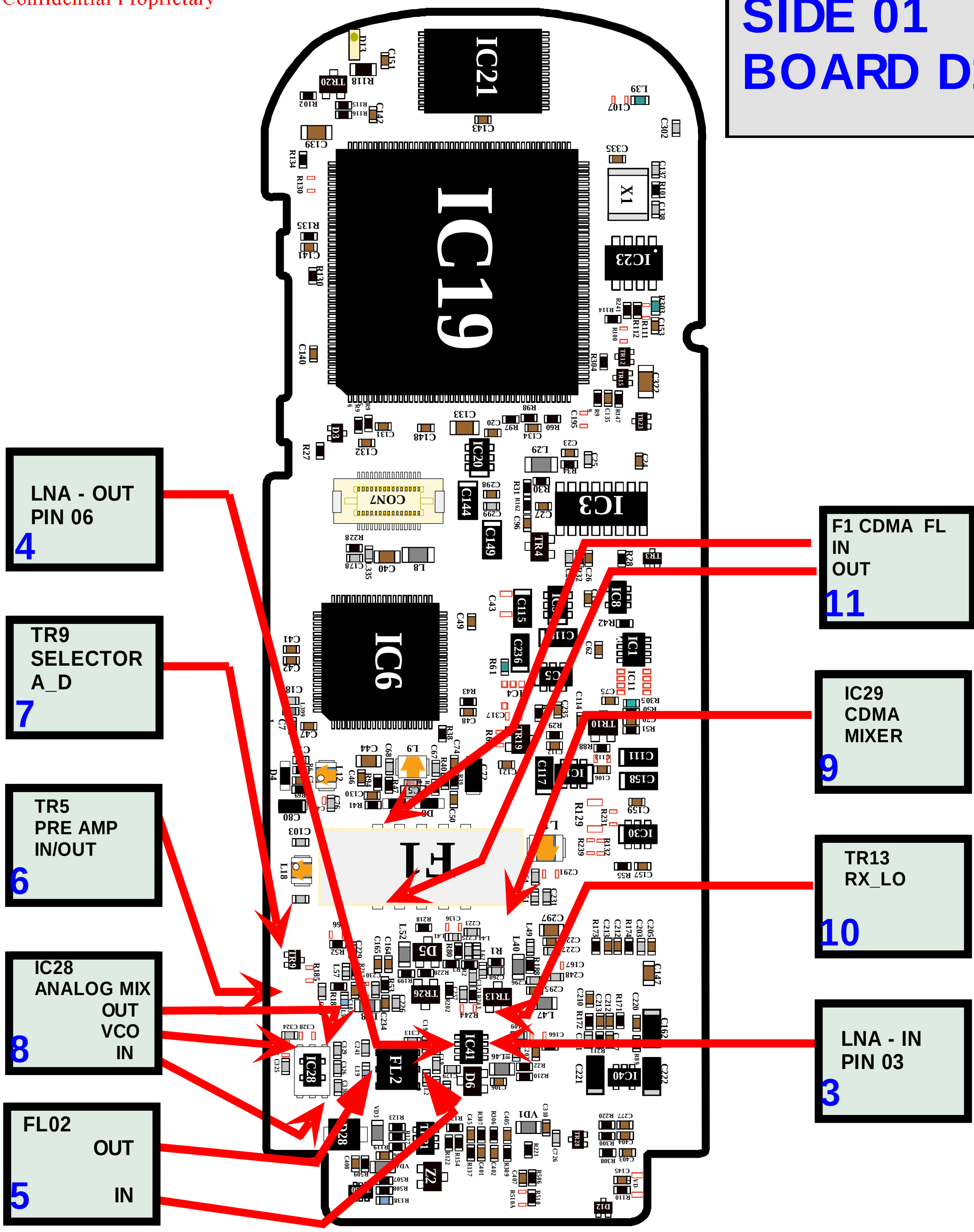
- If the signal is present at pin 14, verify that the same signal is present at the input of inductor L3. If the signal is present, the output of L3 should read 4,8VDC. If the voltage level is not present, verify the state of L3 and capacitor C30. Reference 26.

- Verify X1, it should read a clock signal of 27MHz. Reference 27.

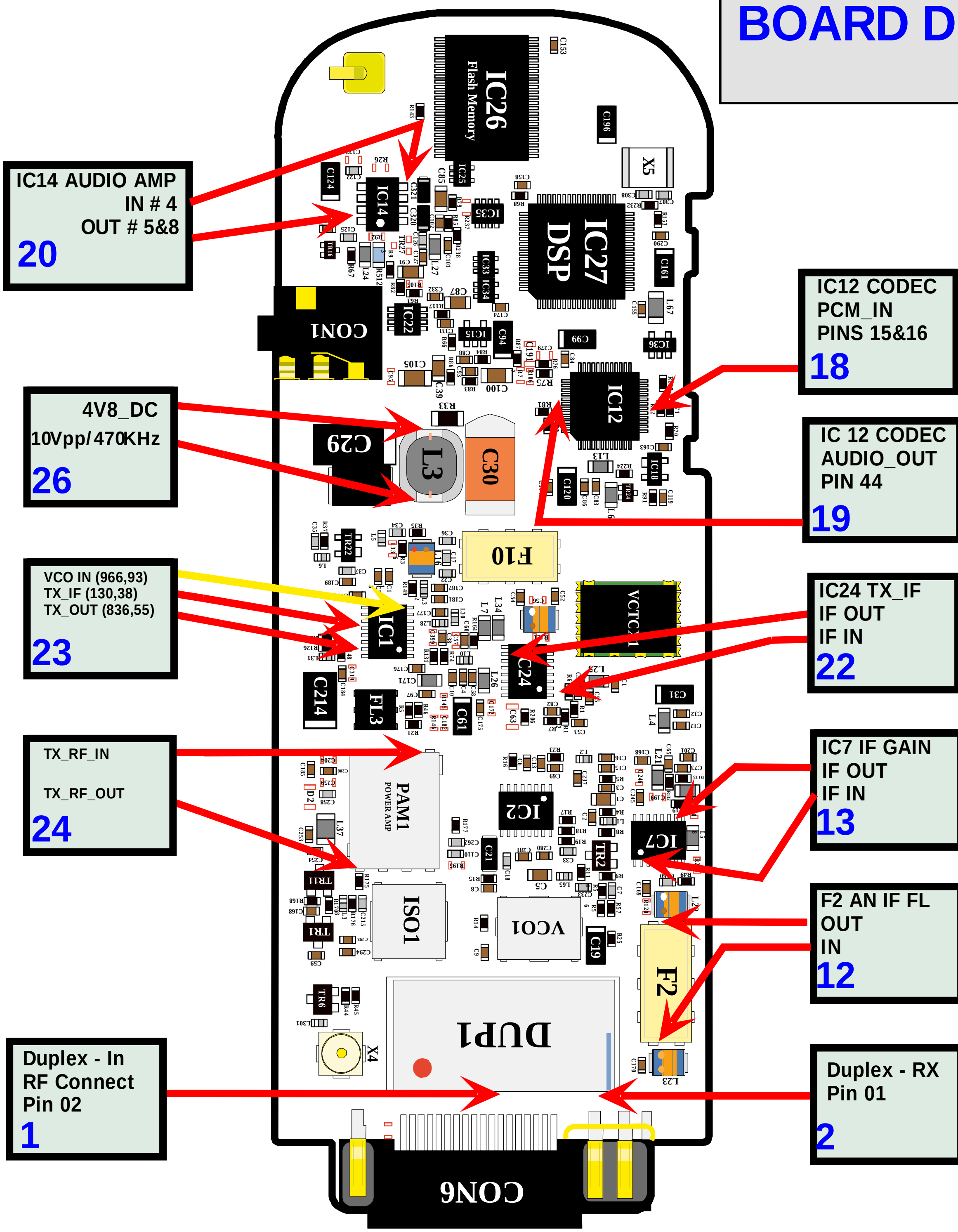
- Verify IC20, pin 4. It should read 3,3VDC. Reference 27.

- Verify IC19/MSM, pin 75(reset). Reference 27.

CDMA SC3160 SIDE 01 BOARD D1



SC3160 SIDE 02 BOARD D1



Troubleshooting Chart

Possible Failure	DESIGNATOR	Descriptior
LOW RX SENSITIVITY SINAD – FER	DUP1 IC41 F1/F2 D5 D6	DUPLEX FILTER LNA FILTERS - FI DIODE DIODE
NO SERVICE	IC29 IC28 IC6 D4 VCO1 IC2	MIXER CDMA MIXER AMPS BBA VARICAP VCO PLL
NO SERVICE IN CDMA MODE	VCTCX1	REF OSC (19,64MHz)
LOW TX POWER	IC24 DUP1	PRÉ-AMP DUPLEX FILTER
NO TX POWER	IC1 PAM1 IC40 IC19 VCO1 IC2	TX MIXER PA REGULATOR -VC(MSM VCO PLL
FREQUENCY ERROR	VCTCX1	REF OSC (19,64MHz)
DESENSE	DUP1	FILTRO DUPLEX
NO TURN ON	IC3 L3 L29 X1 IC20 IC19	IC DC/DC CONV. INDUCTOR INDUCTOR CLOCK-27MHz IC MSM

Possible Failure	DESIGNATOR	Description
QUALITY OF AUDIO CONTAINS DISTORTION AND/OR ECHO. CAN'T MAKE CALLS IN CDMA MODE	IC27 X5 IC19	DSP-EVRC DSP CLOCK (27MHz) MSM

NO RINGER	TR10 TR23 IC19	RINGER AMP. RINGER SW MSM

NO RX AUDIO	IC14 CON1	IC BOOM MIC

NO TX AUDIO	IC15 CON1	IC BOOM MIC

Replacement Parts

Introduction

In this section a recommended mechanical and electrical parts list is included. Any components not listed may not be available for purchase. If a high demand for unlisted components is presented, an updated parts list will be made available.

To provide a visual of most mechanical components a mechanical explosion is also included in this section. For disassembly procedures refer to the section, "Disassembly" on page 35.

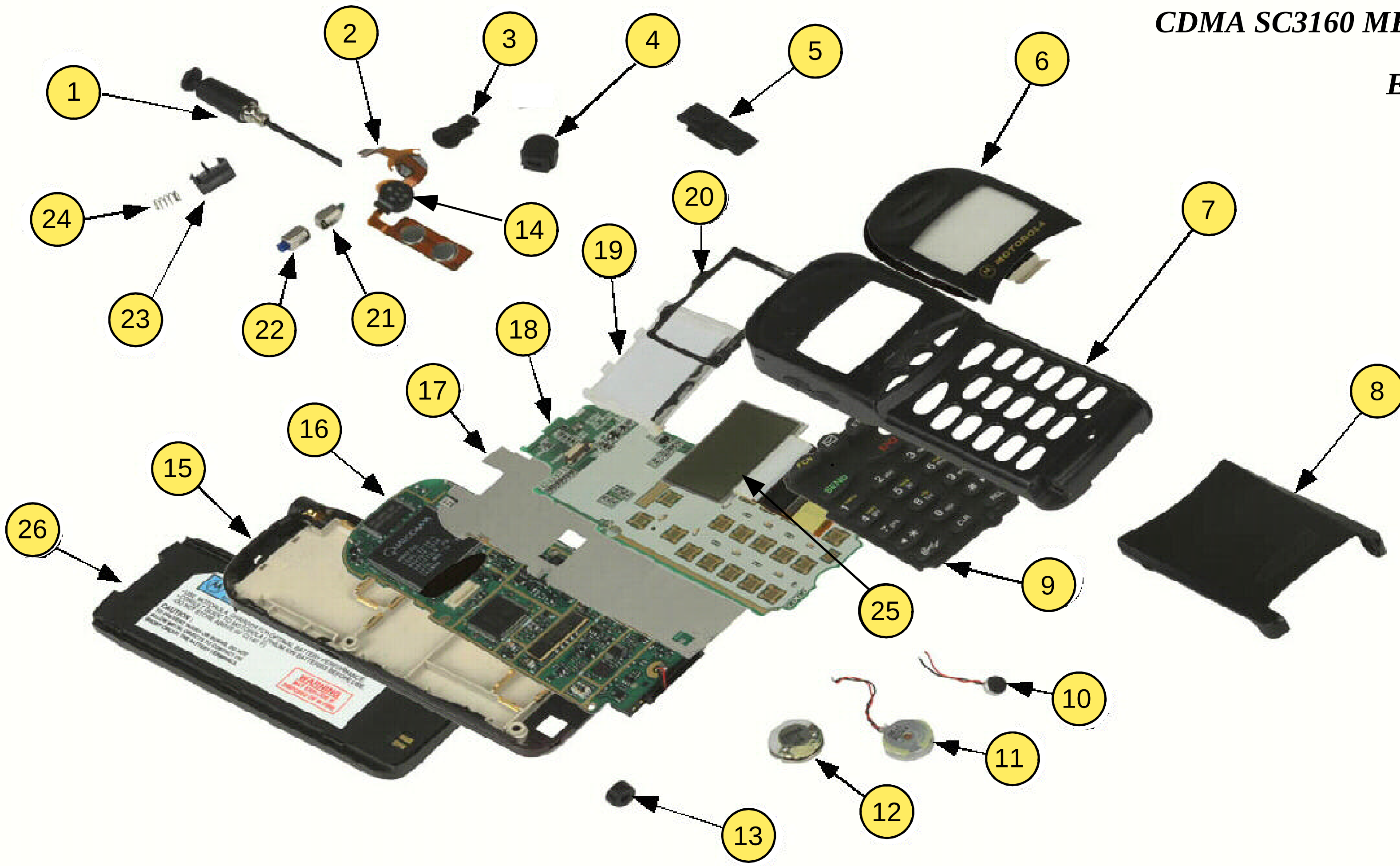
Replacement Parts Ordering

Motorola maintains a parts office staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Cellular products. Orders for all parts should be sent to the Motorola International Logistics Department at thefollowing address:

Accessories and Aftermarket Division
Motorola
Personal Communications Sector
Schamburg, IL 60196
FAX: 1-800-422-4210

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

CDMA SC3160 MECHANICAL EXPLOSION



1	ANTENNA	8580394J83
2	VOL.BUTTON ASSY.	3880384J74
3	EARPHONE COVER	1580384J91
4	BUZZER GASKET	7580384J75
5	CONN.COVER	1580384J69
6	LENS	6180384J72
7	FRONT HSG.	1580384J64
8	FLIP	1580384J67

25	DISPLAY	7280384J84

9	KEYPAD	3880384J73
10	MIC	5080384J88
11	MOTOR	5980384J85
12	SPEAKER	5080384J86
13	GROMMET	7580384J76
14	BUZZER	8080384J87
15	BACK HSG.	1580384J65
16	RF BOARD	N/A

26	BATTERY	SLIM-SNN5448A EXT.-SNN5449A

17	MIDDLE COVER	1580384J66
18	KEYBOARD	0180305H51
19	BACK LIGHT	6580384J70
20	GASKET	7580384J78
21	RIGHT HINGE	5580384K06
22	LEFT HINGE	5580384K07
23	BATTERY LOCK	1580384J68
24	SPRING	4180384J81

A2

Mechanical Parts List

Part#	Description	Reference Designator
1580384J64	FRONT HOUSING PC (BLACK)	
1580384J65	REAR HOUSING PC (BLACK)	
1580384J66	MIDDLE COVER ABS (BLACK)	
1580384J67	FLIP PC (BLACK)	
1580384J68	BATTERY LOCK PC (BLACK)	
1580384J69	SYSTEM COVER PVC (BLACK)	
6580384J70	BACK LIGHT	
6180384J71	LED LENS ACRYL (MILK)	
6180384J72	LCD LENS W/REMOVAL TAPE ABS (CLEAR)	
3880384J73	KEYPAD	
3880384J74	VOLUME KEYPAD SILICON RUBBER (T=0.9)	
7580384J75	BUZZER BUSHING RUBBER (09)	
7580384J76	MIC BUSHING RUBBER (7.6*6)	
7580384J77	ANT S/W CAP RUBBER (4.9*3.4)	
7580384J78	LCD CUSHION CR SPONGE (100U)	
7580384J79	SPEAKER CUSHION	
7580384J80	BUZZER FELT FELT (4*5,T=0.2) BLACK	
4180384J81	BATTERY LOCK SPRING SUS (0.4*7)	
2980384K08	ANTENNA TERMINAL	
1580384K05	COVER ASSY GB-TYPE 1.5*3.4*4 (GOLD)	
5580384K07	HINGE (LEFT)	
5580384K06	HINGE (RIGHT)	
0380384J82	SCREW M2*6	
8580394J83	ANTENNA	
0180305H51	KEYBOARD	
8480314E31	MAIN PC BOARD	
7280384J84	LCD DISPLAY	
5980384J85	MOTOR WIRE:20	
5080384J86	SPEAKER	
8080384J87	BUZZER	
5080384J88	MICROPHONE	
1180384J89	LENS TAPE	
0980384J90	CONNECTOR HOLDER	
1580384J91	EARPHONE COVER URETHANE (BLACK)	
7580384J92	MIDDLE PROTECT SHEET	
6480384J93	SHIELD PLATE 'TOP' NSP (2/1H)T=0.2	
6480384J94	SHIELD PLATE 'BOTTOM' NSP (H)T=0.2 (C7701-P)	
5080384J95	EARPHONE JACK FELT 15*3, T=0.3 (BLACK)	
1180384J96	MESH TAPE - TOP CONDUCTIVE FABRIC (5*8*1T)	
2980384J97	SPEAKER TERMINAL BECU(T=0.1 NI-PLATE)	
4280384J98	FINGER STRAP "A"	
4280384J99	FINGER STRAP "B"	
4280384K01	FINGER STRAP "C"	
5480384K02	HANDY NAME LABEL	
3080384K03	RF COAXIAL TEST CABLE	
3080384K04	DATA LINK KIT (DATA CABLE)	

Electrical Part Lists

Part #	Description	Reference Designator
0980384K48	SW RF (RF SWITCH)	X4
0980384K31	SYSTEM CONNECTOR	CON6
2480384K59	CHIP INDUCTOR	L3
2480384K60	CHIP INDUCTOR	L3
4880384K34	DIODE	D12,TR28
4880384K35	DIODE	D3
4880384K32	DIODE	D2
4880384K36	DIODE	D10, D14
4880384K37	SCHOTTKY DIODE	D28
4880384K33	SCHOTTKY POWER RECTIFIER	Z1
4880384K38	DIODE	D4, D8, D9
4880384K39	DIODE	D5, D6
9180384K55	SAW FILTER	FL3
9180384K54	SAW FILTER	FL2
9180384K56	RX RF SAW	F2
9180384K53	TX RF SAW	F1
9180384K57	SAW FILTER	F10
5180364E76	DUPLEXER	DUP1
5880384K49	ISOLATOR	IS01
5880384K50	ISOLATOR	IS01
5180364E63	DOUBLE BALABCED MIXER	IC28
5180364E48	VOLTAGE REGULATOR I.C	IC18
5180364E49	RX AGC AMP.	IC7
5180364E50	CODEC I.C	IC12
4680384K58	SINGLE INVERTER GATE	IC25, IC33, IC34
5180364E64	CMOS SRAM I.C (2 M)	IC21
5180364E72	VOLTAGE REGULATOR	IC5, IC17, IC30
5180364E65	VOLTAGE REGULATOR	IC9, IC20
5180364E51	MIXER/AMPLIFIER	IC1
5180364E52	8M BIT FLASH MEMORY	IC26
5180364E73	EEPROM	IC23
5180364E53	SINGLE GATE CMOS LOGIC I.C	IC36
5180364E54	RAIL-TO-RAIL OP AMP I.C	IC15
5180364E55	AUDIO AMPLIFIER I.C	IC14
5180364E56	RF CASCODE AMPLIFIER I.C	TR22
5180364E66	MIXER/AMPLIFIER	IC29
5180364E67	HIGH-LINEARITY LNA	IC41
5180364E68	DC/DC CONVERTOR I.C	IC3
5180364E57	POWER AMP MODULE	PAM1
5180364E69	NEGATIVE VOLTAGE CONVERTER	IC40
5180364E74	**NEGATIVE REGULATOR**	IC40
5180364E58	PLL FREQUENCY SYNTHESIZER	IC2
5180364E75	BBA(Analog BaseBand processor Shrink)	IC6
5180364E59	MULTIPLEXER I.C	IC22, IC35
5180364E70	MSM2300	IC19

Electrical Part Lists

Part #	Description	Reference Designator
5180364E70	MSM2300	IC19
5180364E60	PROGRAMMED VOCODER I.C	IC27
5080384K47	EAR PHONE JACK	CON1
6580384K51	LED LAMP(RED)	D13
4880384K40	TRANSISTOR	TR20
4880384K41	CHIP TRANSISTOR	TR5
4880384K42	NPN TRANSISTOR	TR3, TR9, TR15, TR23
4880384K43	TRANSISTOR	TR13
4880384K46	TRANSISTOR	TR11
4880384K44	TRANSISTOR	TR7
4880384K45	TRANSISTOR	TR21
5180364E71	P-CHANNEL ENHANCEMENT-MODE	TR4, TR10, TR19, TR26
8080384K52	CERAMIC RESONATOR	X1
5180364E61	VCTCXO	VCTCX1
5180364E62	V.C.O	VCO1

Service Diagrams - Section B

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 clut-tered diagrams, we excluded some compo-nents 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.

It is strongly recommended that the test equipment calibration schedule be followed as stated by the manufacturer. RF probes should be calibrated for each frequency in which tests are going to be performed.

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, measured 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.

SC3160: Antenna Circuit

BLOCK DIAGRAM NOT NECESSARY
REFER TO PAGE B3

Description

DUP1 is a duplex filter used to isolate the transmit and receive circuit. X4 is a RF tap used when connecting the phone to cellular test equipment.

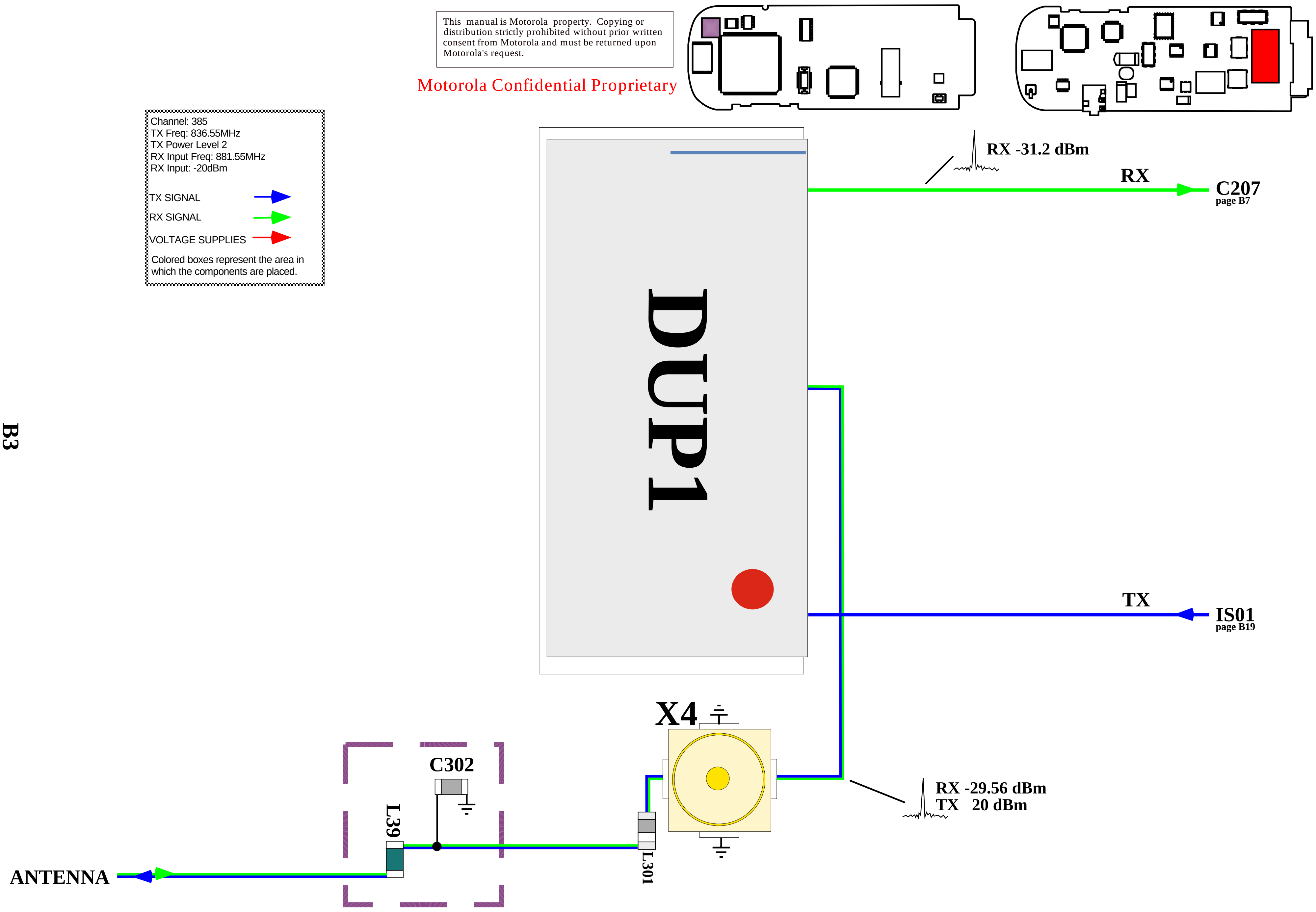
The LC network is an antenna impedance matching network.

SC3160: Antenna Circuit

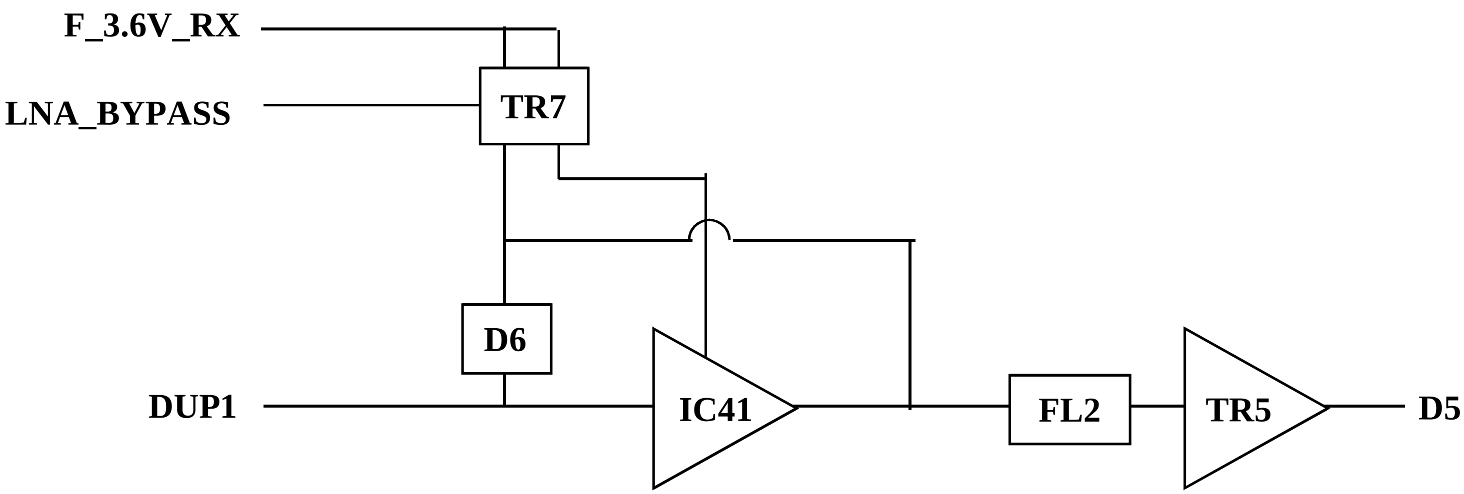
Channel: 385
TX Freq: 836.55MHz
TX Power Level 2
RX Input Freq: 881.55MHz
RX Input: -20dBm

TX SIGNAL
RX SIGNAL
VOLTAGE SUPPLIES

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



SC3160: LNA Circuit



B4

Description

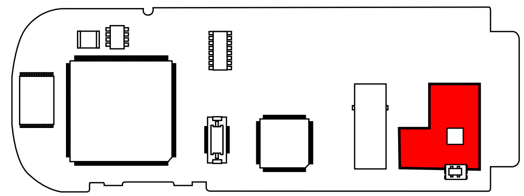
After the receive signal passes through DUP1 it goes to the Low Noise Amplifier(LNA) stage. In analog mode, the receive signal is injected into IC41. The signal is then amplified and filtered by FL2, then amplified again by TR5.

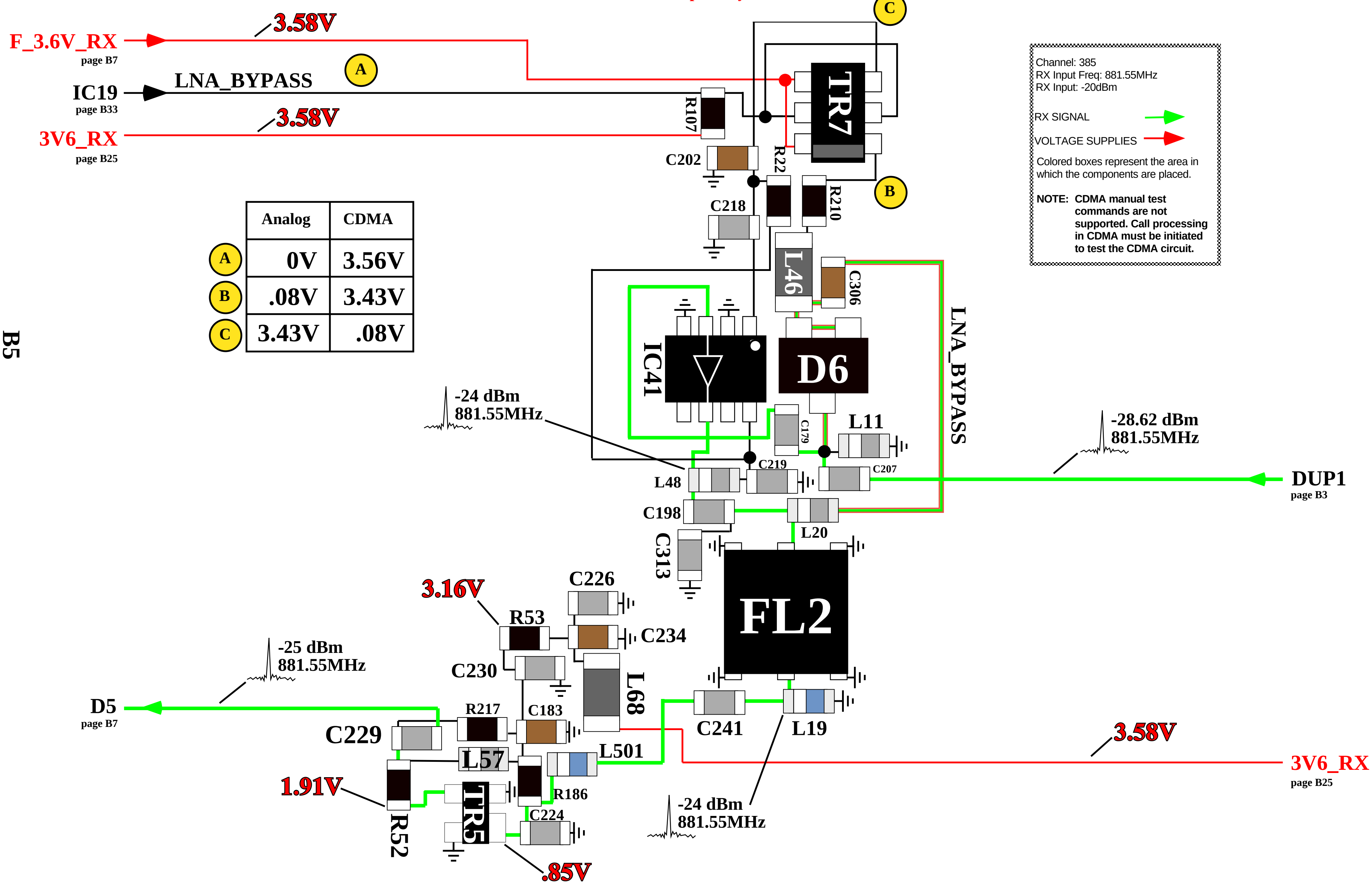
In CDMA mode, the receive signal will follow the same path as the analog signal only when the signal strength is greater than -85 dBm. If the signal strength is less than -85 dBm, the LNA(IC41) will be bypassed. This is done by forward biasing D6 via TR7. The output of TR7 is controlled by the LNA_BYPASS line. The second output of TR7 is switched off to disconnect the supply to IC41, not allowing the use of IC41.

When D6 is forward biased, the receive signal will travel through D6 and bypass IC41. It is then filtered by FL2 and amplified by TR5.

The signal strength of the receive signal is detected by the AGC IC. It reports the strength to the MSM and the MSM will then determine whether the LNA_BYPASS line needs to be activated.

SC3160: LNA Circuit





	Analog	CDMA
A	0V	3.56V
B	.08V	3.43V
C	3.43V	.08V

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

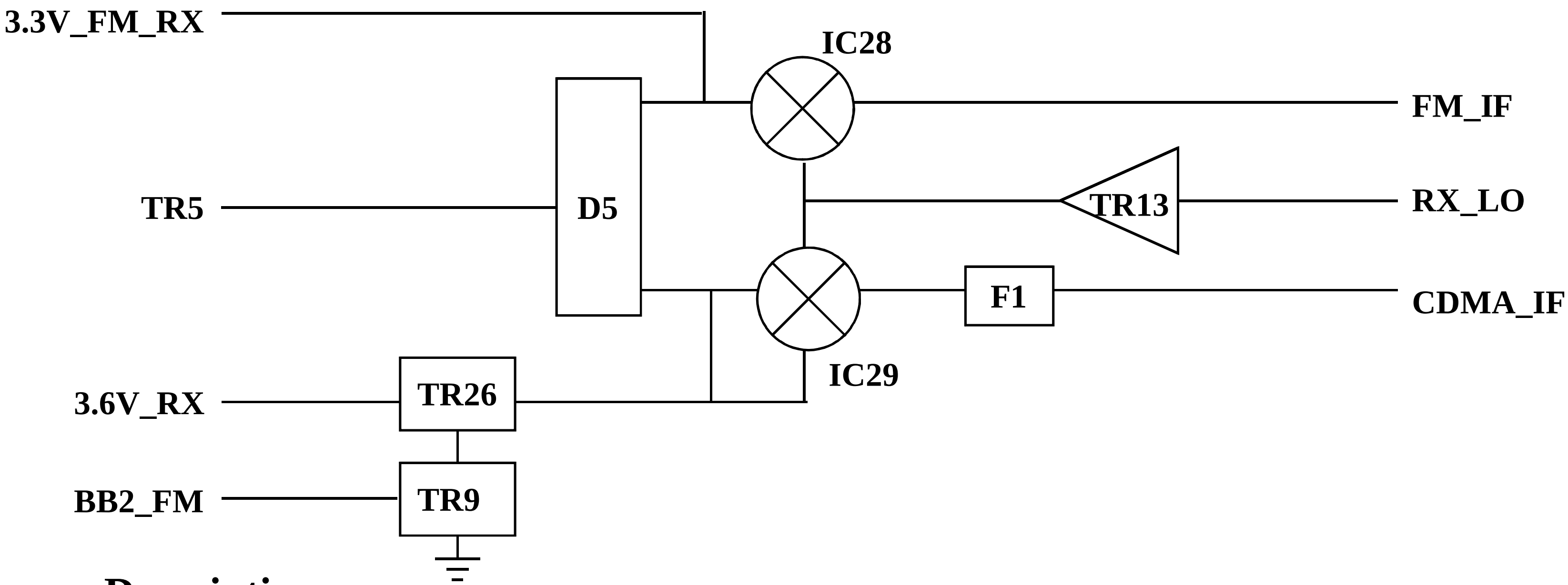
RX SIGNAL

VOLTAGE SUPPLIES

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

NOTE: CDMA manual test commands are not supported. Call processing in CDMA must be initiated to test the CDMA circuit.

SC3160: RX Mixer



Description

Once the receive signal passes through the LNA stage it enters the mixer stage. In analog mode, only the analog side of the dual diode package is forward biased. This is accomplished by providing a 3.3V_FM_RX supply on the analog side. The 3.6V_RX supply is switched off at the CDMA side by switching TR26 off. TR26 is switched off by switching T9 off via the BB2_FM line. As the analog signal passes through the analog side of D5 it is mixed with the local oscillator(RX_LO). The result is the FM intermediate frequency(FM_IF).

In CDMA mode, the CDMA side of D5 is biased by switching TR26 on, allowing the 3.6V_RX supply the CDMA path. TR26 is switched on by switching TR9 on through the BB2_FM line. Once the CDMA signal passes through D5, it is mixed with the local oscillator to provide the CDMA intermediate frequency. The CDMA_IF is then filtered by F1.

Before the local oscillator is mixed with the receive signal, it is buffered by TR13. The purpose of having a local oscillator is to add frequency selectivity to the transceiver.

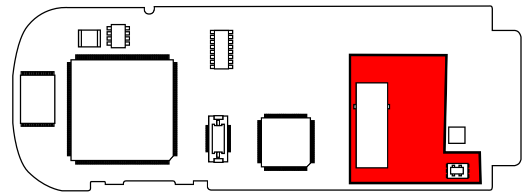
SC3160: RX Mixer

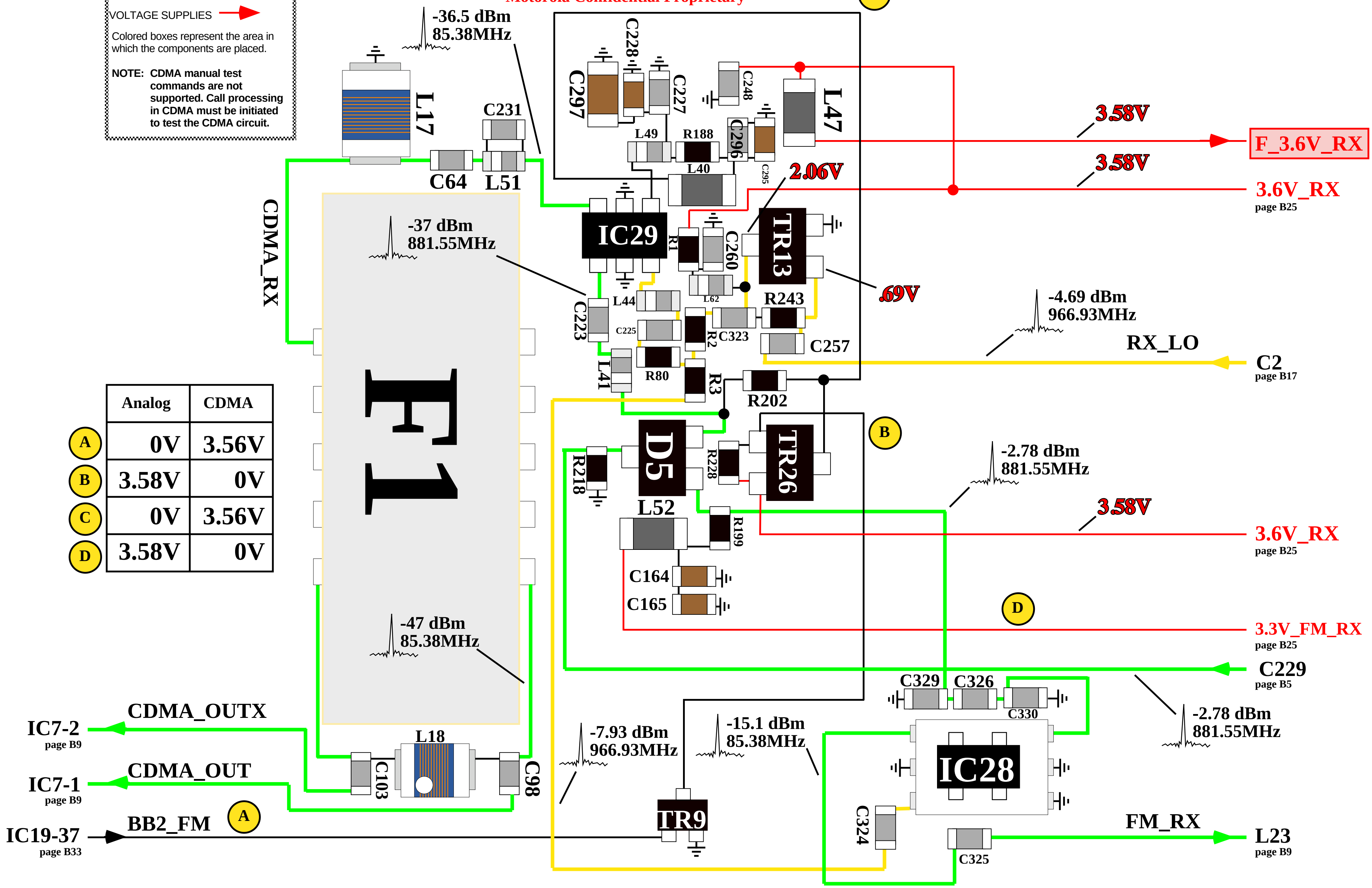
Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm

RX SIGNAL
VOLTAGE SUPPLIES

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

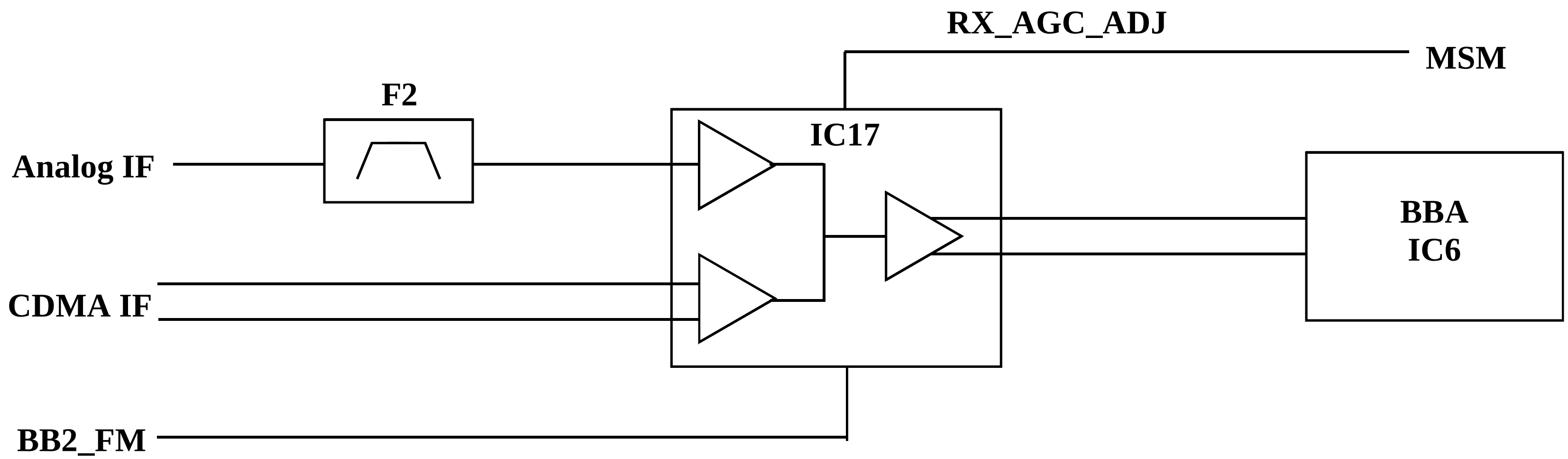
NOTE: CDMA manual test commands are not supported. Call processing in CDMA must be initiated to test the CDMA circuit.





	Analog	CDMA
A	0V	3.56V
B	3.58V	0V
C	0V	3.56V
D	3.58V	0V

SC3160: AGC IC (IC17)



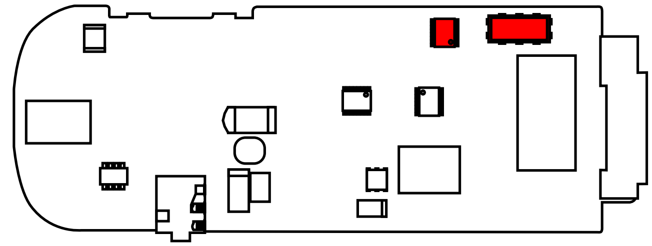
Description

During analog operation, the 85.38MHz analog IF signal is filtered by F2 and then injected into AGC IC(IC7). IC7 will provide a constant output signal level of approximately -52dBm or 5mV rms. IC17 detects the signal level of the receive signal and reports it to the MSM via the RX_AGC_ADJ line. The MSM senses the IF signal level and decides whether the RX LNA should be bypassed or not.

In CDMA mode the signalling path uses the same process as the analog signal. The CDMA IF signal is injected into AGC IC(IC7). As in analog mode, the signal output of IC7 will have a constant output level of -52dBm or 5mV rms.

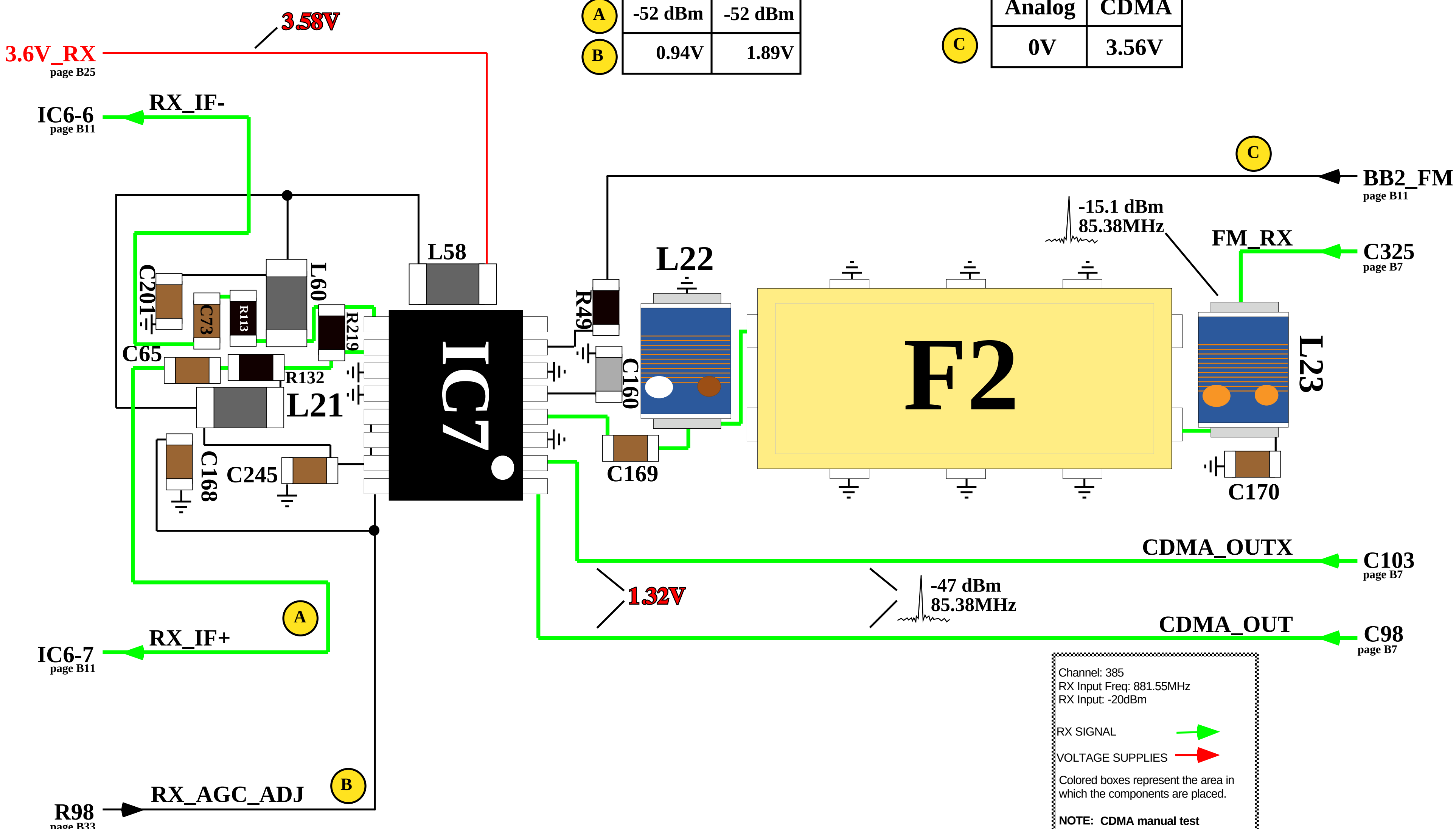
The MSM determines in which mode the transceiver will be operating(Analog or CDMA). The MSM controls which of the two IF signals entering IC7 will be injected into the BBA(IC6) via the BB2_FM line. Refer to the state diagram on page B9.

SC3160: AGC IC (IC7)



RX Input	-20 dBm	-60 dBm
A	-52 dBm	-52 dBm
B	0.94V	1.89V

	Analog	CDMA
C	0V	3.56V



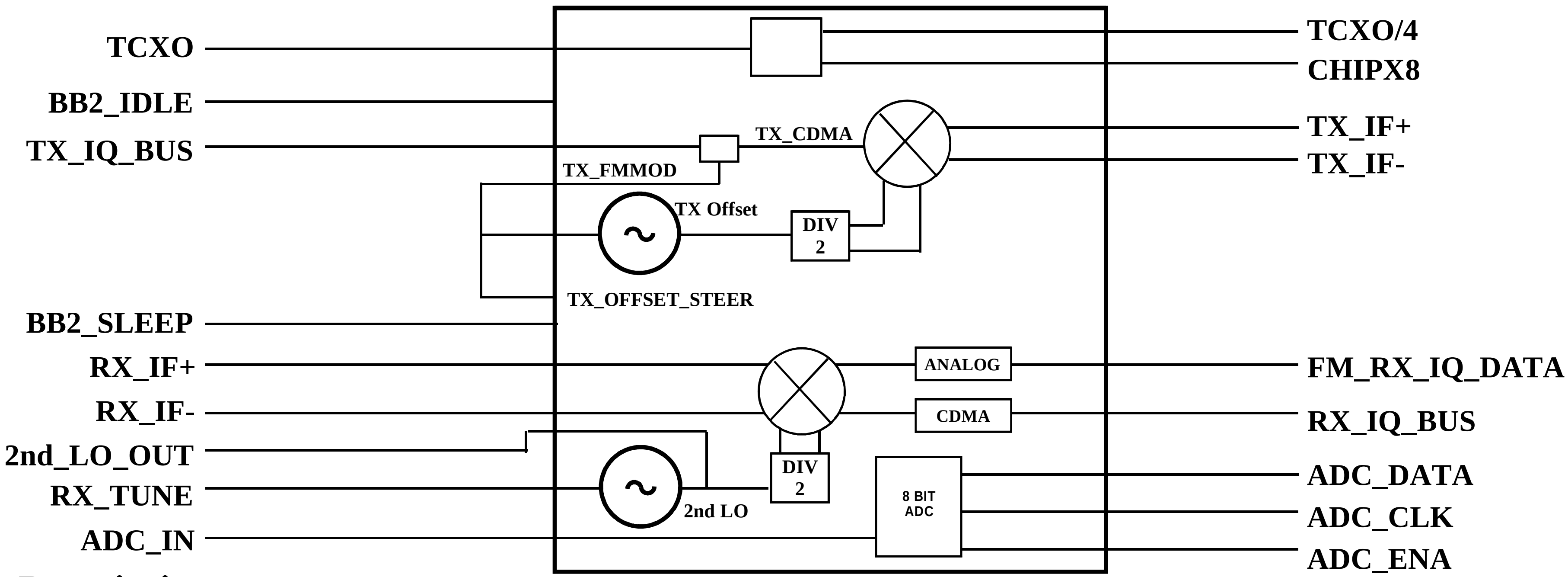
Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm

RX SIGNAL
VOLTAGE SUPPLIES

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

NOTE: CDMA manual test commands are not supported. Call processing in CDMA must be initiated to test the CDMA circuit.

SC3160: BBA(IC6)



B10

Description

IC6 is an analog baseband processor ASIC(BBA). The BBA is used to downconvert an RX IF signal to a baseband signal and upconvert a TX signal in analog and CDMA mode. The RX down conversion is accomplished by injecting an RX IF signal into the BBA and then mixing it with a 2nd Local Oscillator. The result is a baseband signal which is Analog to digital converted. The CDMA and FM use seperate ADCs(analog-digital converter). The digitized baseband signal is then sent to the MSM(IC19) via the RX_I_BUS for CDMA and FM_RX_IQ_DATA for analog.

The frequency of the 2nd LO is controlled via the RX_TUNE lines which come from a tank circuit controlled by a external PLL(IC2). The output of the 2nd LO is feed back to IC2 for frequency locking. Before the 2nd LO is mixed with the RX IF, it is divided and an In-phase(I) and Quadature-phase(Q) signal is used for mixing.

The some RX functions of the BBA can be disabled switching on or off BB2_SLEEP. The MSM makes the desicion of when the RX portion of the BBA is disabled. This function is used during cellular sleep mode conditions to conserve the standby battery life.

The TX upconvertion process is accomplished by sending TX_IQ_ data to the BBA and mixing the signal with a TX Offset oscillator. The result is data modulated in a offset frequency. The TX_IQ data is sent by the MSM in a digital form. The data is then digital-analog converted(DAC). CDMA and FM use seperate DACs(digital-analog converter).

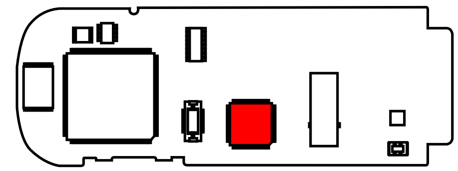
In analog mode, after the TX_IQ data is converted to analog it's modulated with the TX offset oscillator. The result is then divided and an In-phase(I) and Quadature-phase(Q) signal is used to pass thru a mixer and signal summer. The signal is finally sent out on the TX_IF lines.

In CDMA mode, after the TX_IQ data is converted to analog it's mixed with the TX offset oscillator. After the mixer the signals are summed and send out on the TX_IF lines.

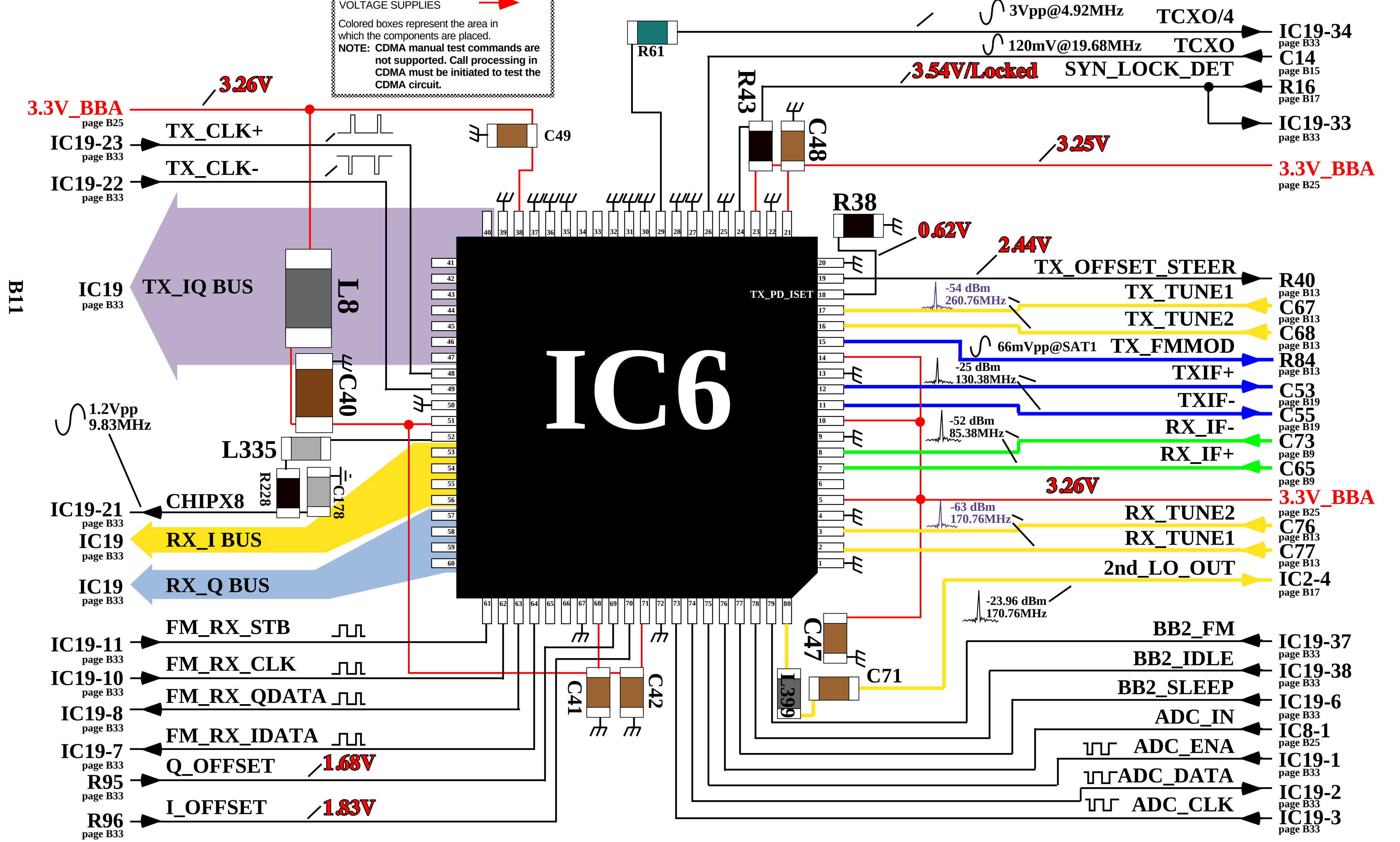
Some of the BBA's TX functions can be disabled via BB2_IDLE. BB2_IDLE is used to conserve Transmit battery life by disabling unnecessary current consumption while the transceiver is not transmitting.

The BBA also contains a general purpose Analog-digital converter which is used to signal specific analog states to the MSM.

SC3160: BBA(IC6)



Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm
TX Power Step 2
TX Freq: 836.55MHz
Measure near area, don't make actual contact to components
VCO SIGNAL
TX SIGNAL
RX SIGNAL
VOLTAGE SUPPLIES
Colored boxes represent the area in which the components are placed.
NOTE: CDMA manual test commands are not supported. Call processing in CDMA must be initiated to test the CDMA circuit.



SC3160: 2nd LO/TX Offset Oscillator

BLOCK DIAGRAM NOT NECESSARY
REFER TO PAGE B13

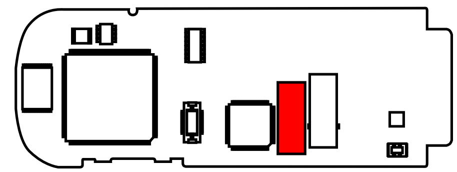
Description

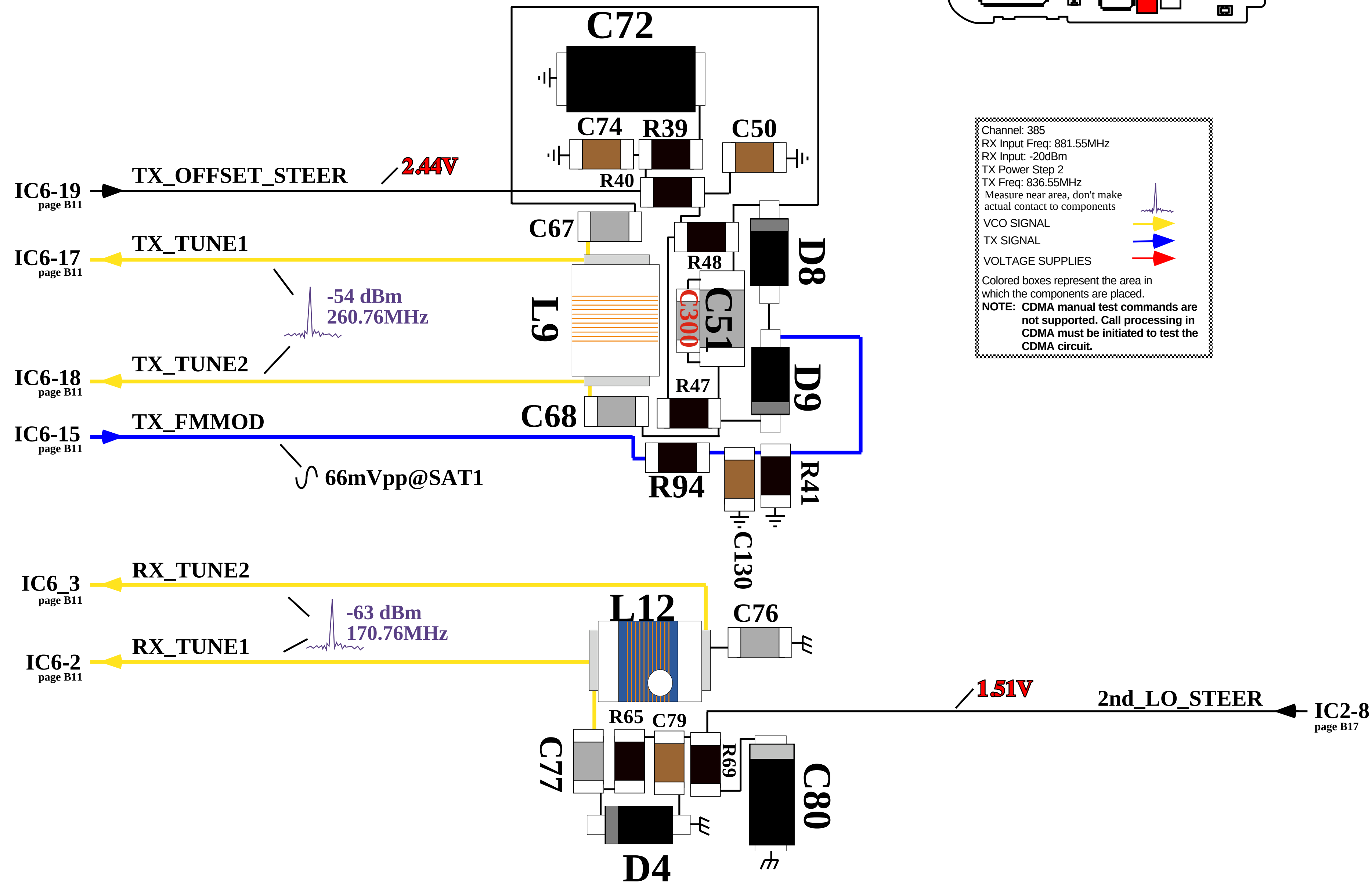
The resonating tank circuit for the 2nd local oscillator uses a varacter(D4) for voltage level frequency tuning. The 2nd_LO_STEER line will have voltage level proportional to the desired frequency of oscillation. PPL IC2 is programmed to control the frequency of the 2nd LO. In this design the frequency of the 2nd LO is always 170.76MHz regardless of what chaannel or mode it's operating. An RC filter is used on the 2nd_LO_STEER line to prevent any noise from disruption the frequency accuracy of the 2nd LO. L12 is part of the resonating tank circuit required for oscillation.

The same concept for the 2nd LO tank is used for the TX offset oscillator tank circuit. TX_OFFSET_STEER is used to control the state of varacter D8, thus, controlling the frequency of oscillation. An RC filter is also used on the TX_OFFSET_STEER line and L9 is part of the resonating tank circuit.

When the transceiver is operating in analog mode, the TX_FMOD line is used to modulate the transmit information in the TX offset oscillator. Varacter D9 is used to assist the frequency modulation process.

SC3160: 2nd LO/ TX Offset Oscillator





B13

SC3160: VCO_BUFF & REF OSC

BLOCK DIAGRAM NOT NECESSARY
REFER TO PAGE B15

Description

The Reference Oscillator VCTCX1 provides a frequency reference for the complete transceiver. The Reference oscillator operates at a frequency of 19.68MHz. The cellular transceiver always fine tunes itself to match the frequency of the base station. This is accomplished by fine tuning the reference oscillator via the TRK_LO_ADJ. When the MSM determines that the cellular transceiver is off frequency, it will send an adjustment level to the reference oscillator.

TR22 is used to buffer the main local oscillator signal level for the transmit circuit. This is used to ensure that an adequate amount of signal level is used to mix the local oscillator with the TX signal.

SC3160: VCO_BUFF & REF OSC

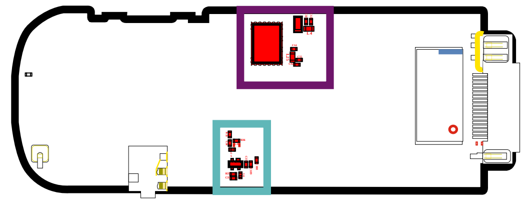
	TX On	TX Off
A	3.56V	0V

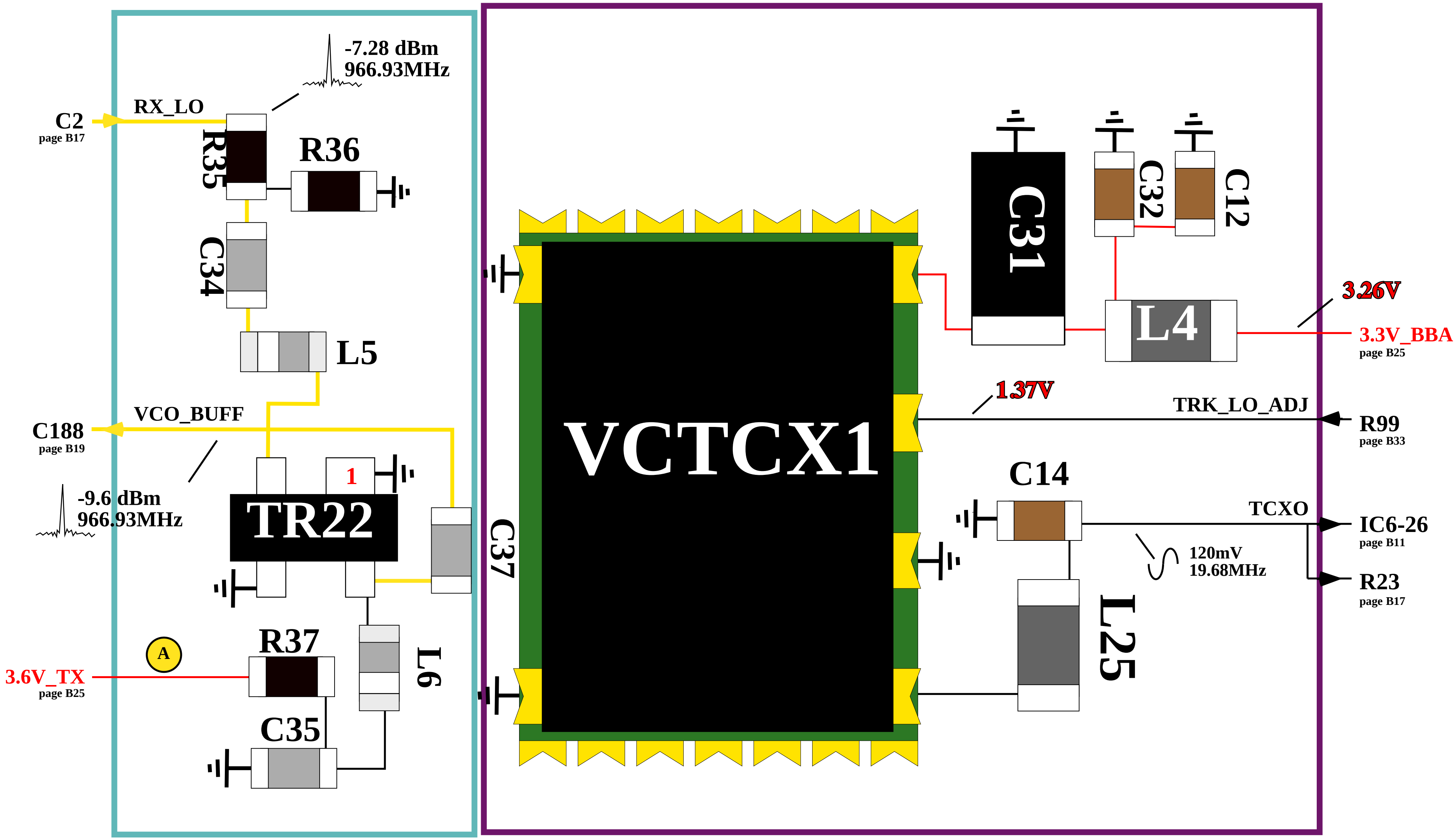
Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm
TX Power Step 2
TX Freq: 836.55MHz

VCO SIGNAL

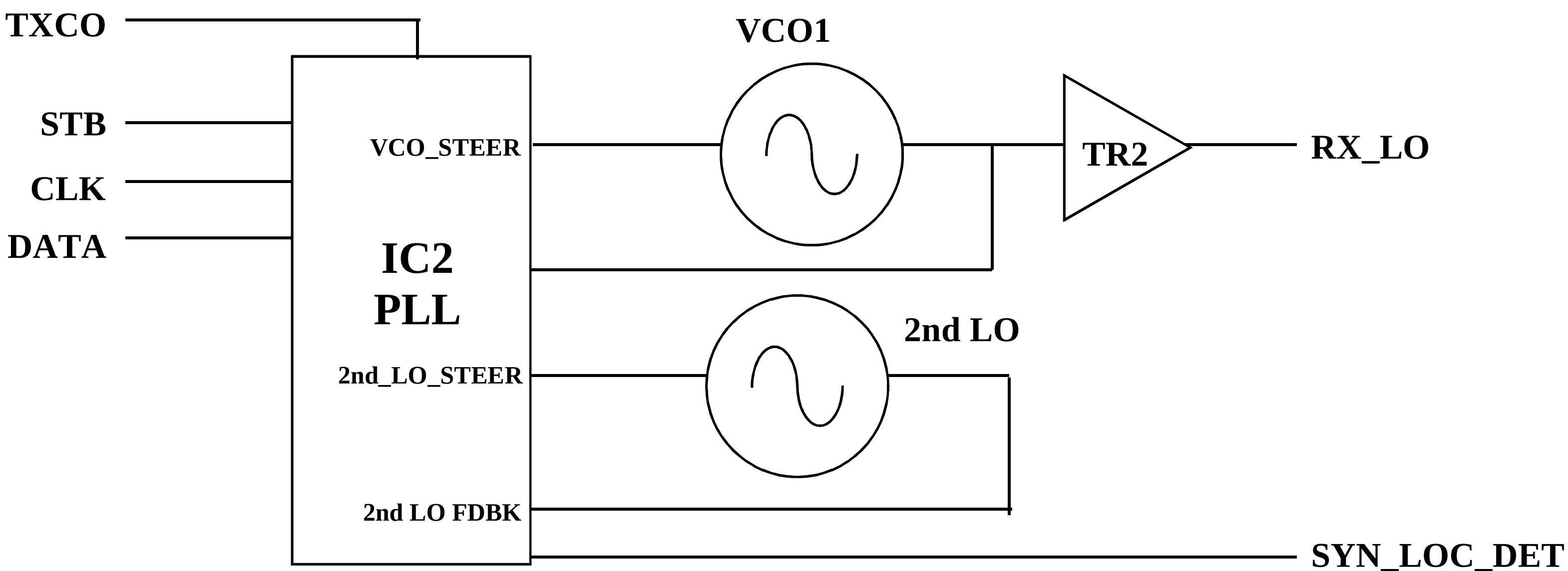
VOLTAGE SUPPLIES

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





SC3160: VCO Circuit



B16

Description

IC2 is a Phase-Lock-Loop device used to lock two oscillators on a specific frequency. The desired frequency which the PLL will lock into is programmed by a serial bus using lines STB, CLK, and DATA. TXCO is used as a reference frequency for the phase detector internal to the PLL.

VCO1 and the 2nd LO are voltage-controlled oscillators, therefore, varying the voltage levels on each oscillator via the STEER line will vary the frequency of opertion. Each oscillator has the resulting frequency fed back into the PLL for frequency locking.

The output of VCO1 is sent to amplifier TR2 to allow a sufficient amount of signal level for mixing with the RX and TX circuits. The SYN_LOC_DET is used to report to the MSM that the oscillators are locked on frequency.

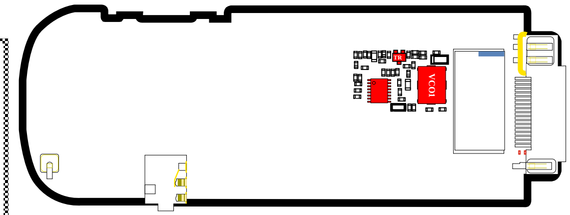
SC3160: VCO CIRCUIT

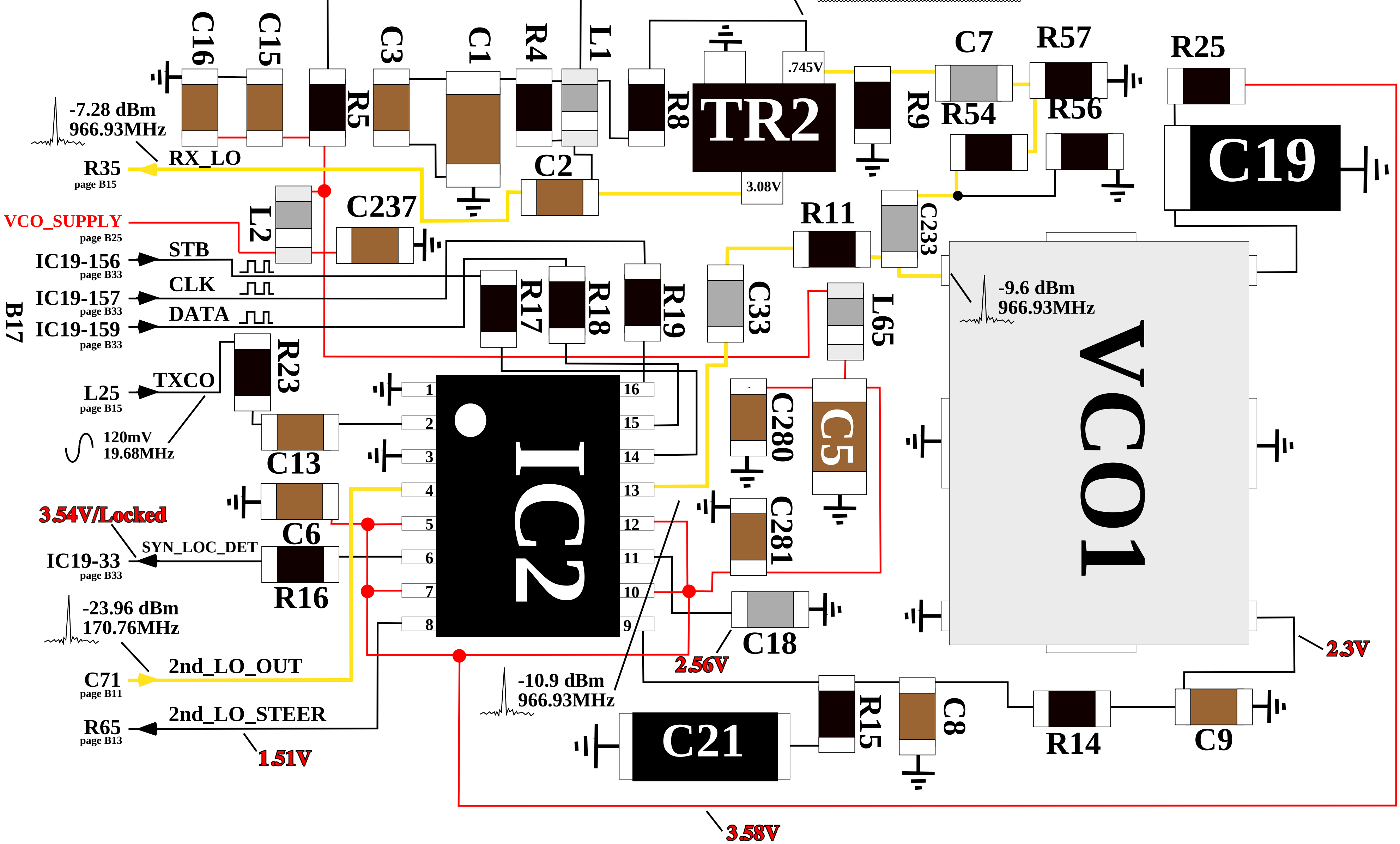
Channel: 385
RX Input Freq: 881.55MHz
RX Input: -20dBm
TX Power Step 2
TX Freq: 836.55MHz

VCO SIGNAL

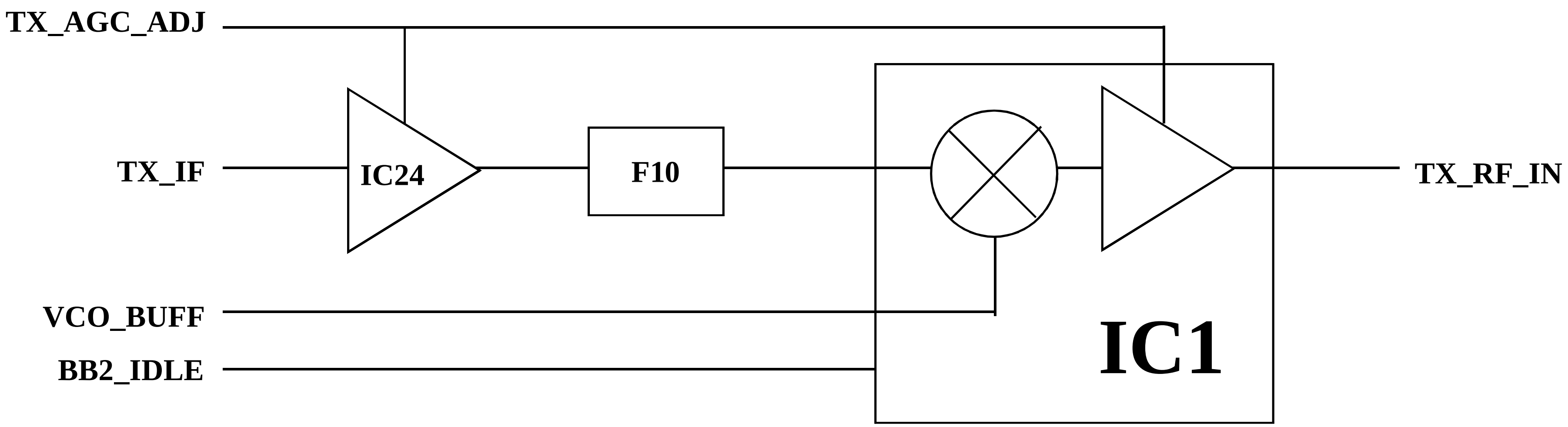
VOLTAGE SUPPLIES

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





SC3106: TX Exciter



Description

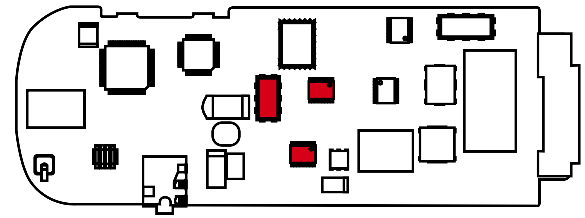
After the transmit information is modulated with the TX offset frequency, the TX signal is amplified by IC24. The gain of IC24 will pertain to the power level that the transceiver will be operating. The gain is controlled by TX_AGC_ADJ. The amplified signal is then filtered by F10 and sent to IC1.

IC1 will mix the VCO_BUFF with the TX offset signal resulting in a carrier with its modulated signal. IC1 also contains an amplifier with a variable gain adjustment. The gain is controlled by TX_AGC_ADJ.

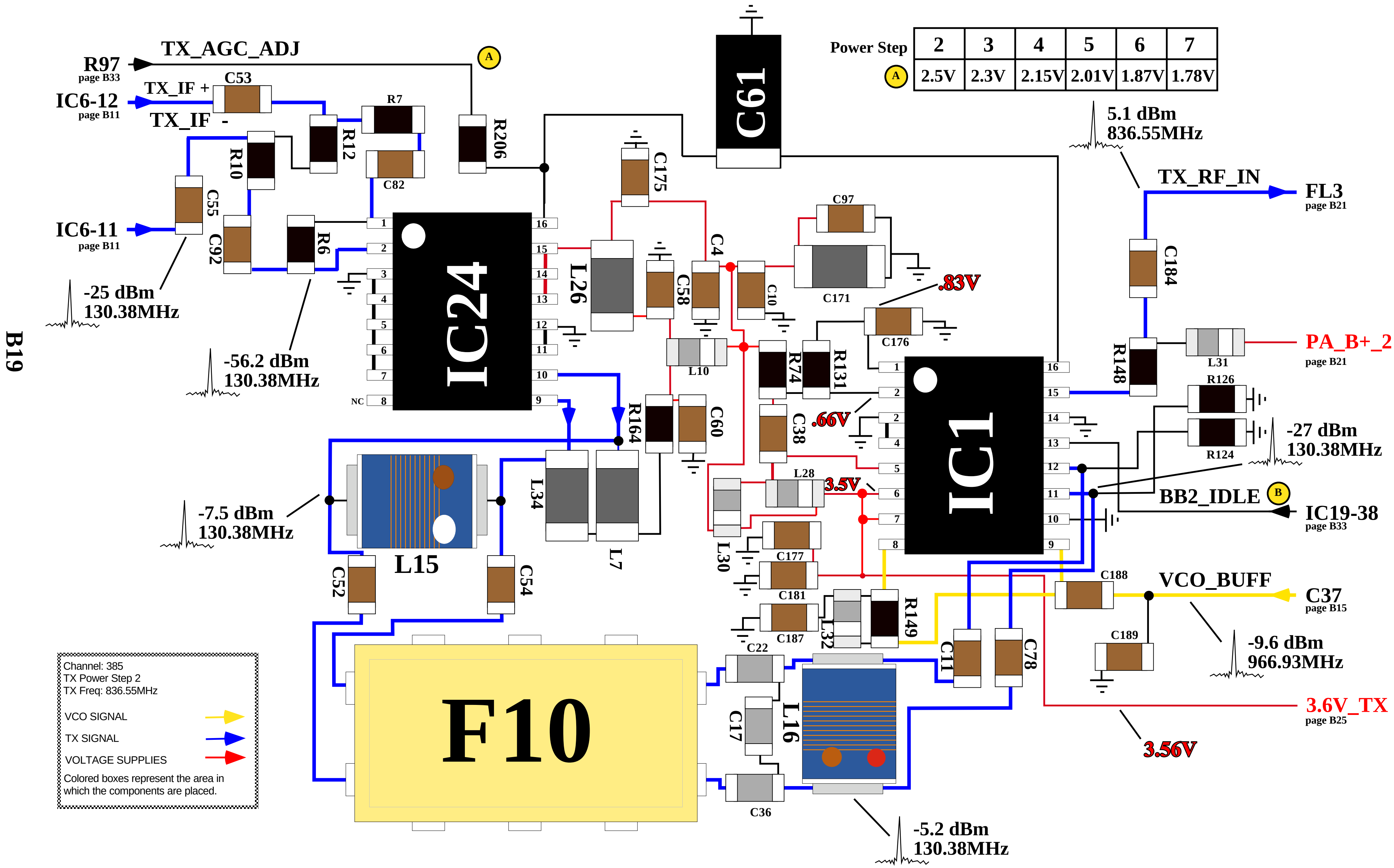
BB2_IDLE is used to disable IC1 during non-transmit conditions. This allows the transceiver not to consume unnecessary current from the battery.

SC3160: TX EXCITER

	TX On	TX Off
B	3.1V	0V



Power Step	2	3	4	5	6	7
A	2.5V	2.3V	2.15V	2.01V	1.87V	1.78V



Channel: 385
TX Power Step 2
TX Freq: 836.55MHz

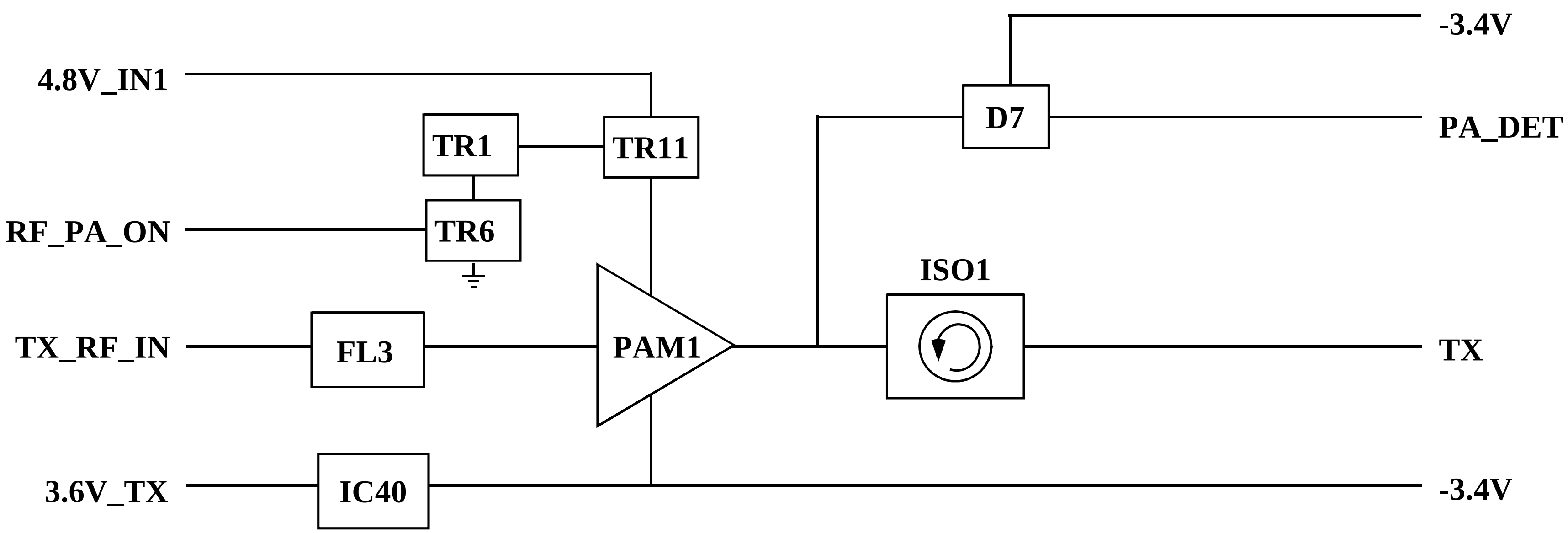
VCO SIGNAL

TX SIGNAL

VOLTAGE SUPPLIES

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

SC3160: PA Circuit



Description

The TX carrier(TX_RF_IN) is filtered by FL3 and then injected into the final stage power amplifier(PAM1). PAM1 has a constant gain factor. The supply to PAM1 is switched on or off via line RF_PA_ON. RF_PA_ON either switches TR6 on or off, resulting in a grounding condition or open circuit for TR1. This also changes the state of the input to TR11 which will either allow 4.8V_IN to pass to PAM1 or cut off the supply.

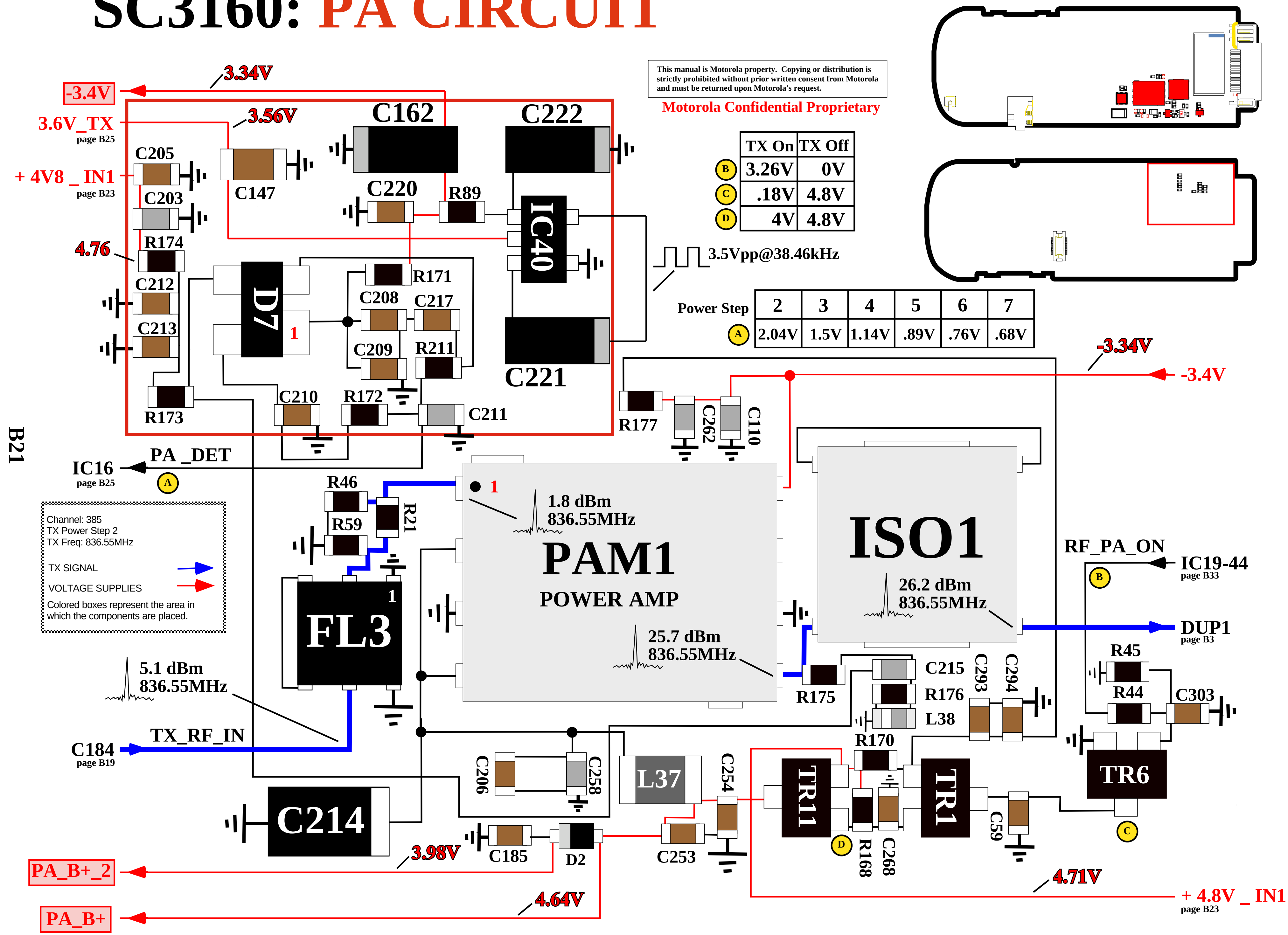
IC40 is a negative voltage generator used for biasing PAM1 and supply for PA detect circuit. IC40 is sourced from 3.6V_TX, therefore, IC40 is active only when the transmitter is on.

The PA DET line is used to sample the TX signal level of PAM1 and feed it back to the power control circuit to ensure that the proper power level is being used.

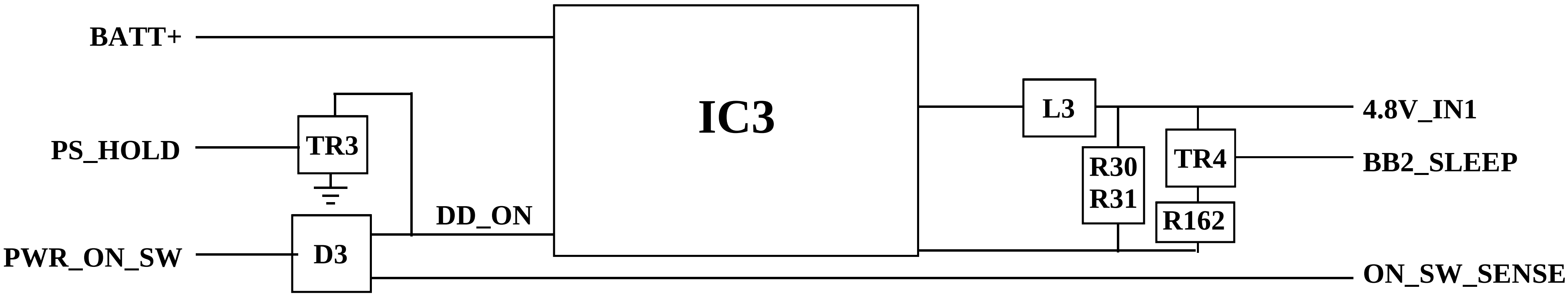
SC3160: PA CIRCUIT

	TX On	TX Off
B	3.26V	0V
C	.18V	4.8V
D	4V	4.8V

Power Step	2	3	4	5	6	7
A	2.04V	1.5V	1.14V	.89V	.76V	.68V



SC3160: DC/DC Converter



Description

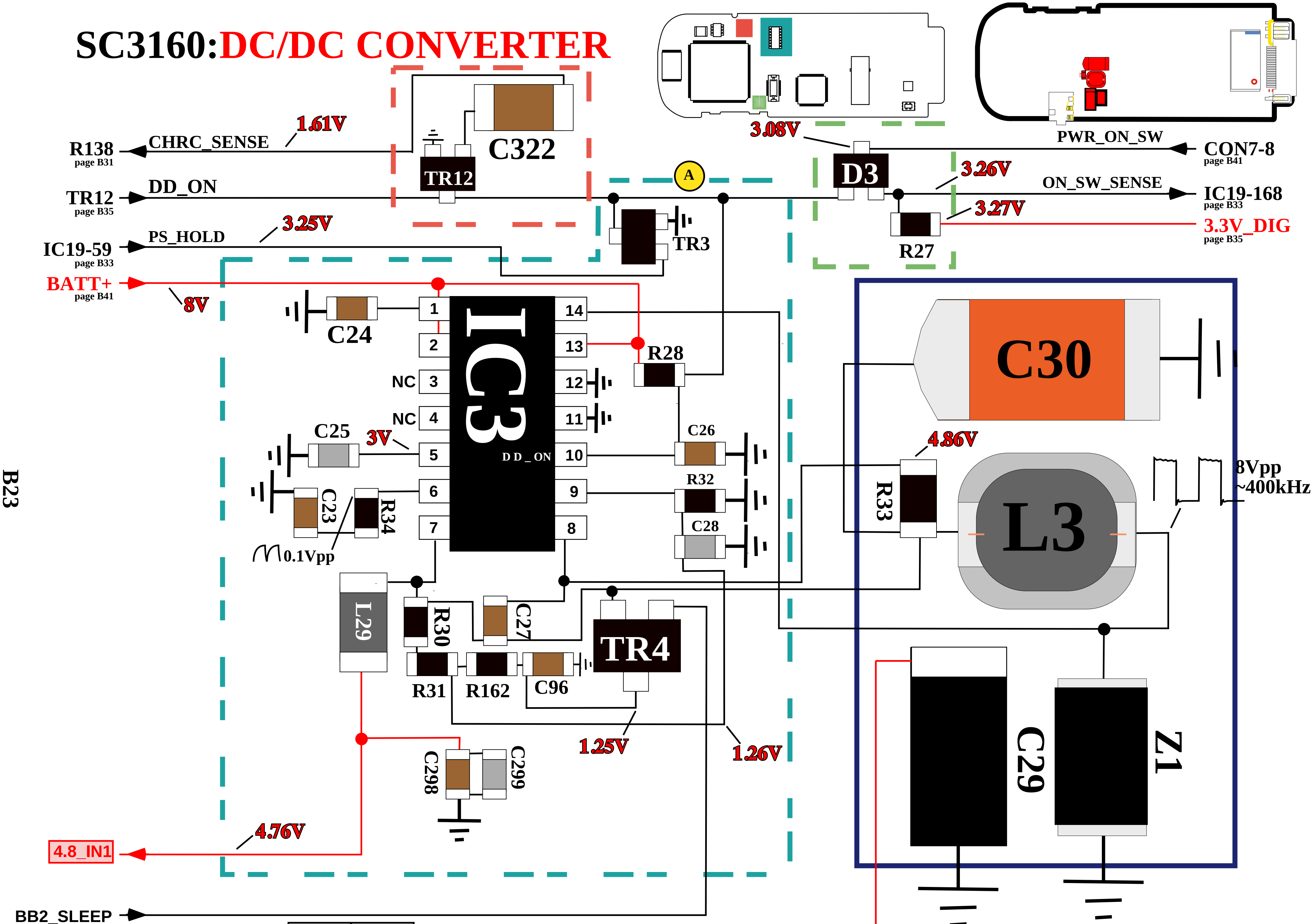
IC3 is a DC-DC converter used to generate the 4.8V_IN1 supply. The 4.8V_IN1 supply can be switch on or off by the power key(PWR_ON_SW). When the PWR_SW_ON is depressed, DD_ON is pulled low. This state will cause IC3 to switch 4.8V_IN1 on. When the power switch is not depressed, DD_ON is pulled high by the battery voltage.

As a power cycle is initiated, the ON_SW_SENSE line will report the on/off state changes to the MSM thru D3. Once the MSM detects the power on cycle, it will turn on TR3 which will maintain DD_ON low after the power button is released. When the power key is depressed to turn off the unit, the ON_SW_SENSE reports the turn off cycle to the MSM. The MSM will then trun TR3 off, allowing DD_ON to be pulled high, thus, switching IC3 off.

IC3 outputs a 400kHz pulsed signal to L3. Since an inductor resists polarity changes, a peak voltage is maintained and the result is filtered by capacitors which will provide a clean dc voltage.

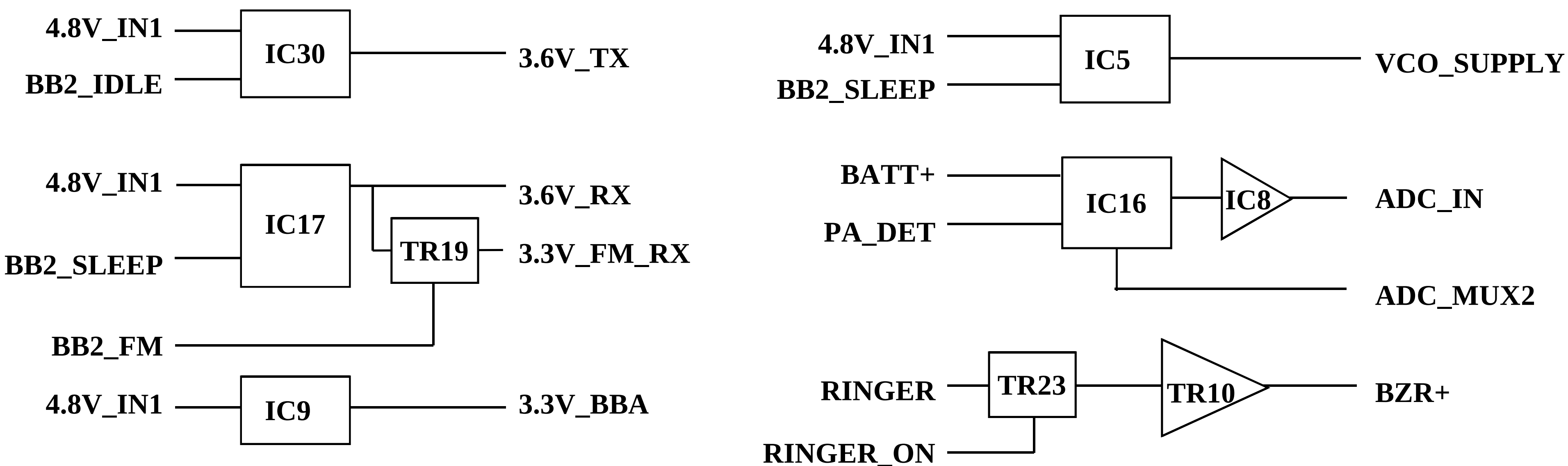
TR4 changes the amount of output voltage will be fed back to IC3 by either including R162 in the feedback network or exclude it. The voltage level of 4.8V)IN1 will change according to how much voltage is fed back to IC3.

SC3160:DC/DC CONVERTER



Transceiver	On	Off
A	0V	8.23V

SC3160: Regulators/Ring Drive/PA Det



Description

IC30 is a voltage regulator used to provide the 3.6V_TX supply. It uses 4.8V_IN1 as a voltage source. 3.6V_TX is active only when the unit is transmitting. BB2_IDLE controls the output of IC30. 3.6V_TX is used to suplpy portions of the transmit circuit.

IC5 is a voltage regulator used to supply the VCO. IC5 uses 4.8V_IN1 as a source. The VCO_SUPPLY is only active whenever the transceiver is not in sleep mode. BB2_SLEEP controls the output of IC5.

IC17 is a voltage regulator used to provide the 3.6V_RX supply. 3.6V_RX is used to supply various receive circuits. IC17 is sourced from 4.8V_IN1 and the out put of IC17 is controlled by BB2_SLEEP. Supply output 3.6V_RX is also used to supply 3.3V_FM_RX. 3.3V_FM_RX is used to supply the FM receive circuit. The output is controlled by BB2_FM which is active only when the transceiver is in analog mode.

IC9 is another voltage regulator used to produce 3.3V_BBA from the source 4.8V_IN1. This supply is mainly used for the BBA supply.

IC16 is a multiplexer used to multiplex signal inputs, BATT+ and PA_DET in a single input to the BBA Analog-digital converter. Before entering the BBA, the signal output from IC16 is buffered by IC8. The signal that is going to be sent to the ADC_IN is determined by ADC_MUX2.

The ringer signal can be controlled by TR23. RINGER_ON will switch TR23 on or off, controlling whether or not the ringer is going to be activated. TR10 amplifies the ring signal before it enters the buzzer.

SC3160: Regulators/Ring Drive/PA Det

VOLTAGE SUPPLIES

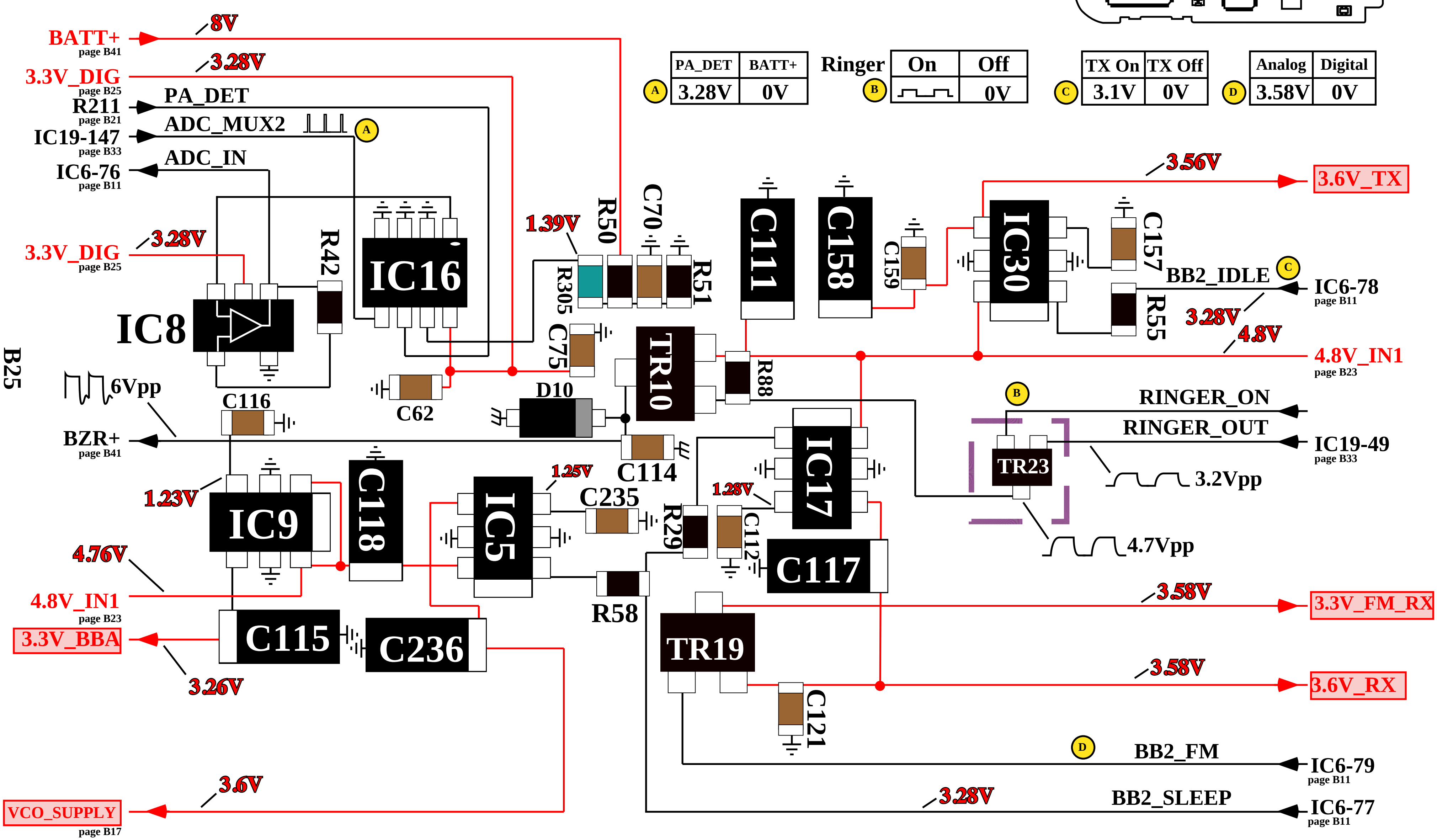
Colored boxes represent the area in which the components are placed.

	PA_DET	BATT+
A	3.28V	0V

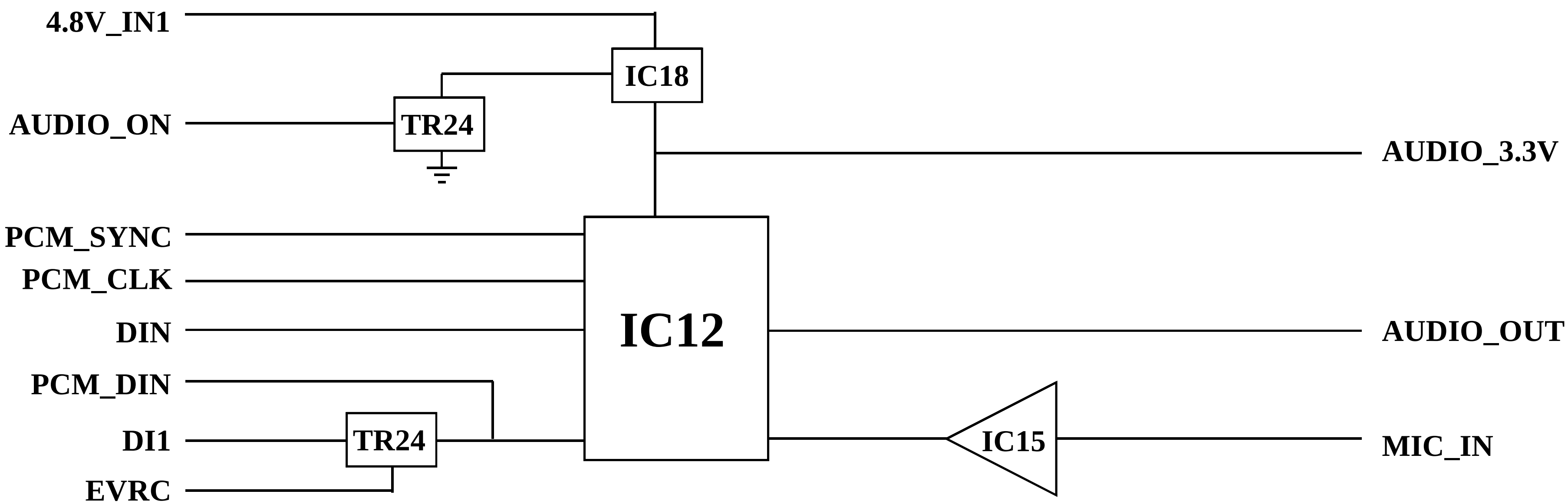
Ringer	On	Off
B		0V

	TX On	TX Off
C	3.1V	0V

	Analog	Digital
D	3.58V	0V



SC3160: CODEC(IC12)



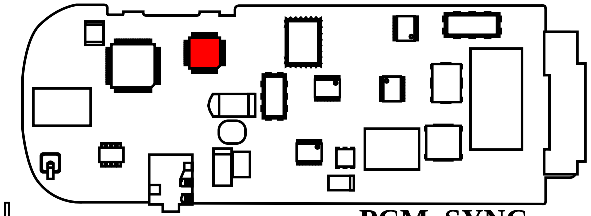
Description

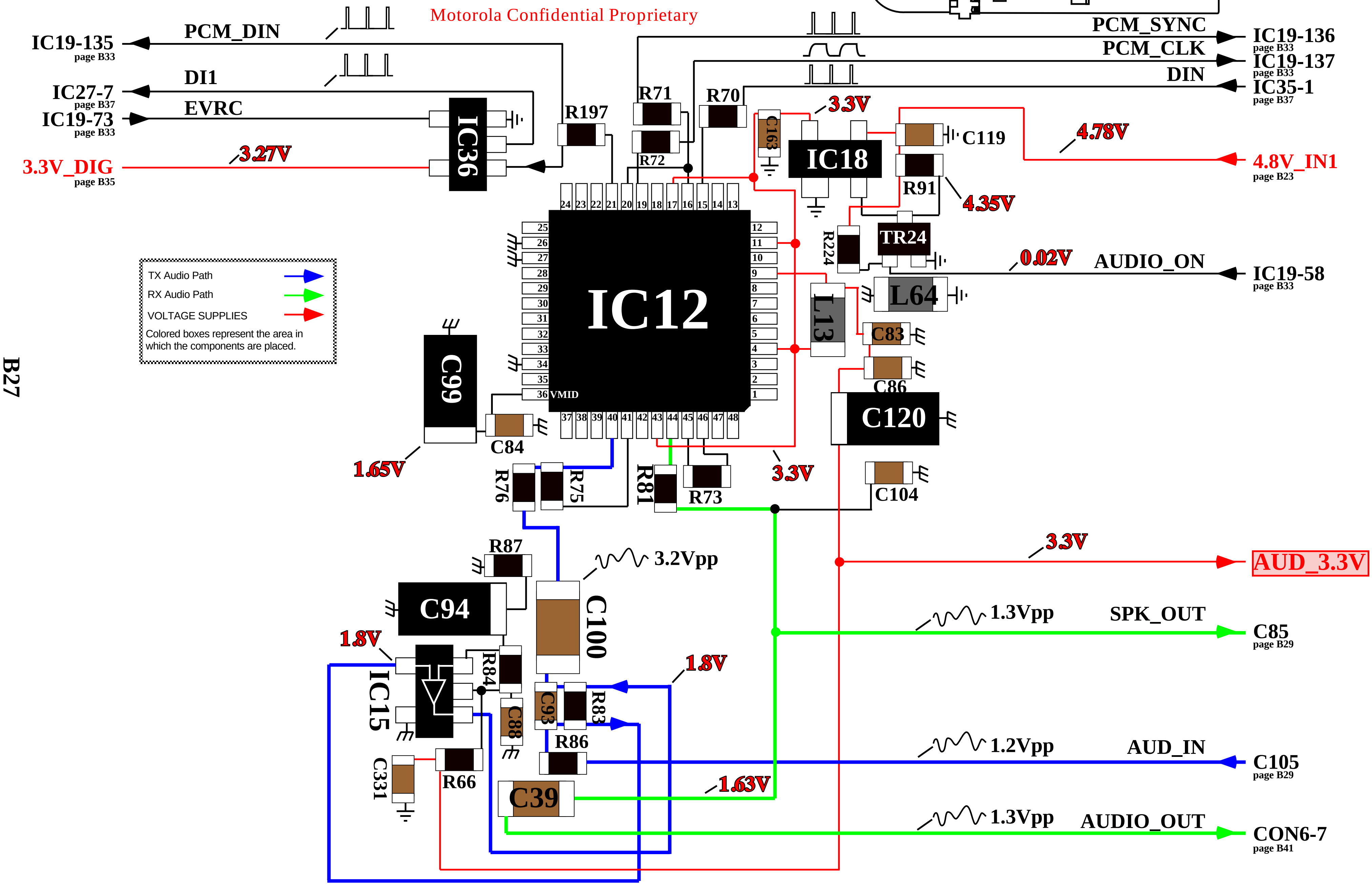
IC12 is an audio CODEC(coder-decoder) used to digitize an audio source for transmission to a logic device and to convert a digital signal to an audio form which is received from a logic device. IC12 can be switched off by disconnecting the supply. AUDIO_OUT is used to supply IC12. IC18 is a voltage regulator used to provide the AUDIO_OUT source. IC18 is sourced from 4.8V_IN1. The output of IC18 is controlled by the AUDIO_ON line which switches TR24 on or off causing IC18 to be switched on or off.

The microphone audio is amplified by IC15 and then sent to IC12 for the digital coding process. The processed signal is then sent on line PCM_DIN or DI1, depending on which VOCODER is being used. If a 8k or 16k vocoder is being used, the digitized signal is sent on line PCM_DIN. If vocoder EVRC is being used, TR24 will be switched on via line EVRC to allow DI1 to be used.

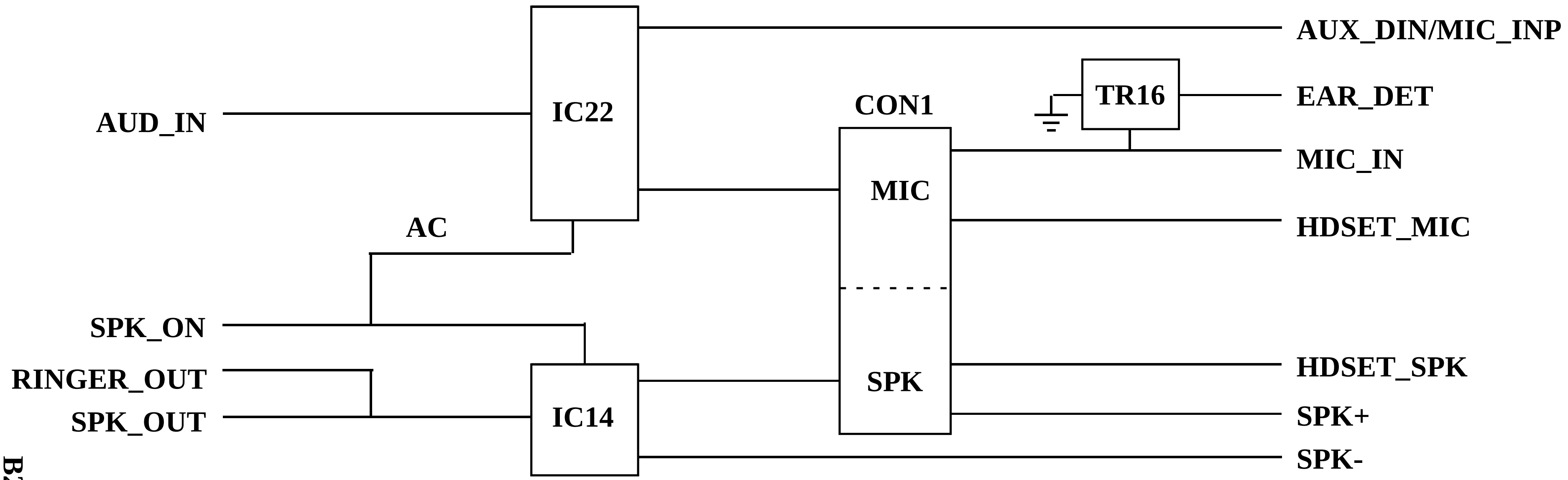
When a signal is sent to IC12 it is sent on line DIN. The signal is then converted to an audio signal and sent out to the speaker.

SC3160: CODEC(IC12)





SC3160: Audio Drivers



Description

IC14 is an audio drier for the speaker path. It can be switched on or off via the SPK_ON line. The output of IC14 is sent to either the internal speaker or the headset speaker. The audio path is determined by CON1. When there is no headset attached to CON1, the output of IC14 is shorted to the SPK+ line allowing internal speaker operation. When a headset is attached, the output of IC14 is no longer shorted to SPK+ but shorted to the HDSET_SPK line allowing headset speaker operation. When the headset is in operation the speaker audio paths are disabled. This is accomplished by disabling the internal speaker path of IC14 via the SPK_ON line.

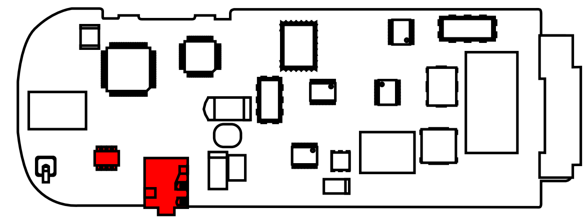
IC22 is a multiplexer used to allow one of the two audio inputs, MIC_IN and HDSET_MIC, to be sent out to the CODEC. IC22 is controlled via the AC line by monitoring the EAR_DET line. When a headset is not attached, the microphone biasing voltage is present on the MIC_IN line. This state will switch TR16 on which as a result will force EAR_DET to ground. EAR_DET is reported to the MSM which as a result will respond by changing the state of SPK_ON, which is the same line as AC. When a headset is attached, the microphone biasing voltage is disconnected causing TR16 to be switched off. This will cause a state change on the AC line, thus, allowing headset microphone operation.

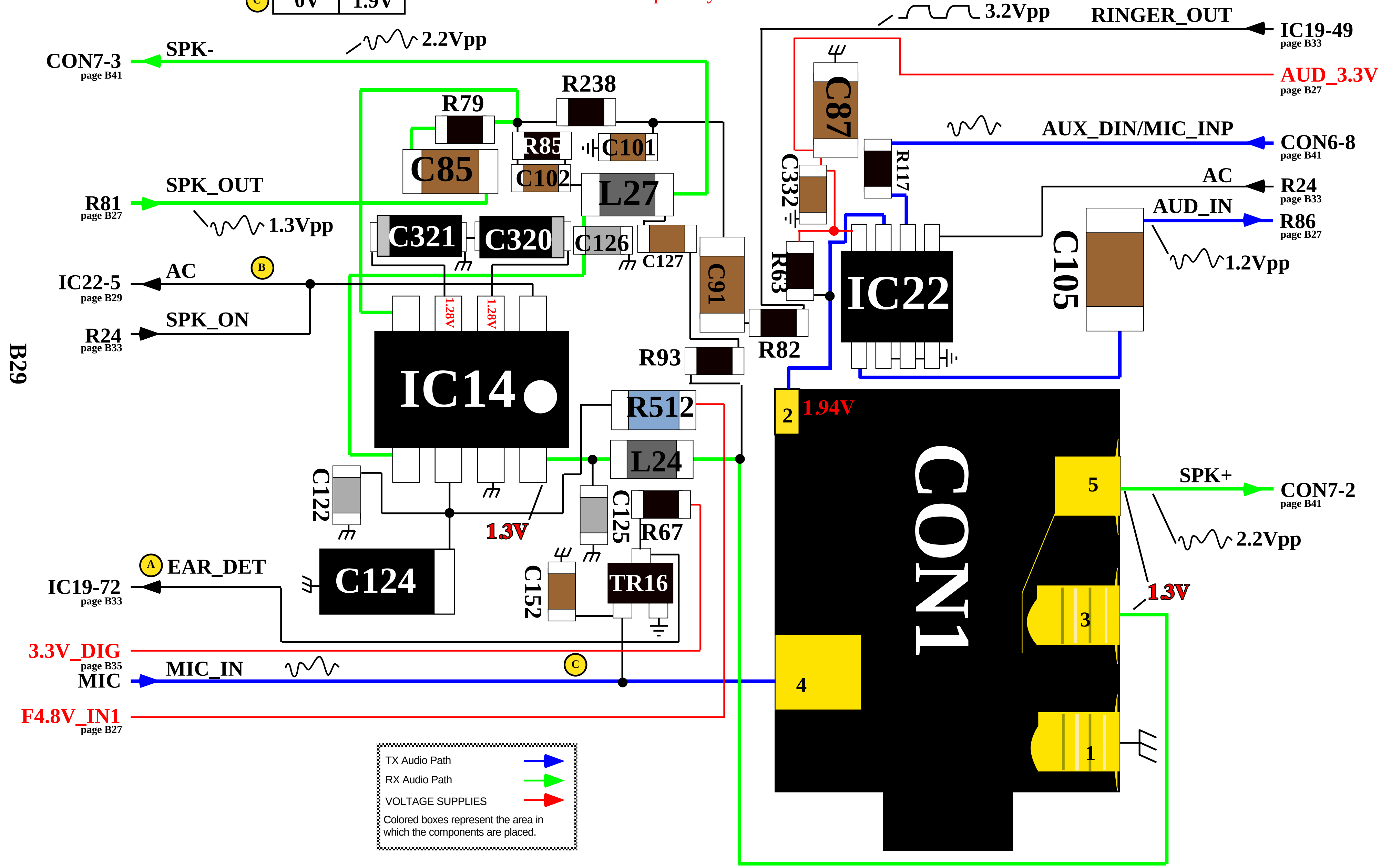
When a headset is attached and the ringer is activated, the ringer signal is sent to the speaker audio path of the headset. If a headset is not atached, the ringer audio will be sent to the buzzer and not the internal speaker.

SC3160: Audio Drivers

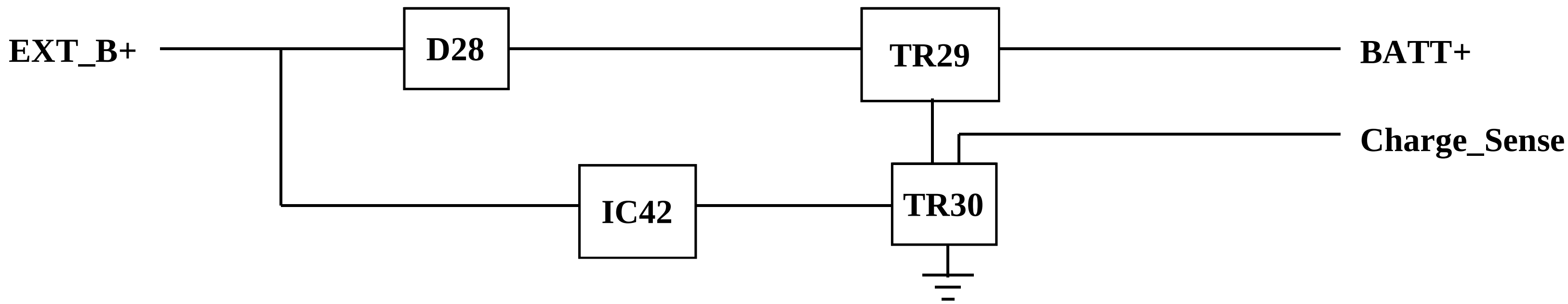
	Internal Audio	External Audio
B	0V	3.26V

	Headset	No Headset
A	3V	0V
C	0V	1.9V





SC3160: Charger/Supply Disconnect



Description

IC42 is a device that restricts high voltage level from damaging the transceiver. IC42 is configured to disconnect the external supply path from the main board supply to prevent high voltage damage. IC42 pulls the output low if the correct operating voltage is present at the input. This state will switch TR30 on allowing the control line of TR29 to be pulled to ground. TR29 will be turned on, allowing EXT_B+ supply BATT+.

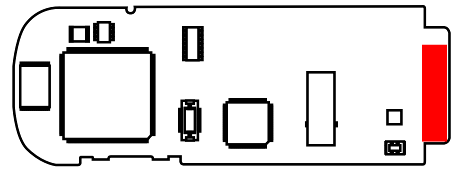
If the voltage level at EXT_B+ is too high, IC42 will no longer pull the output low. This state will switch TR30 off, allowing the control line of TR29 to be pulled high. This will in turn switch TR29 off, not allowing EXT_B+ to supply BATT+.

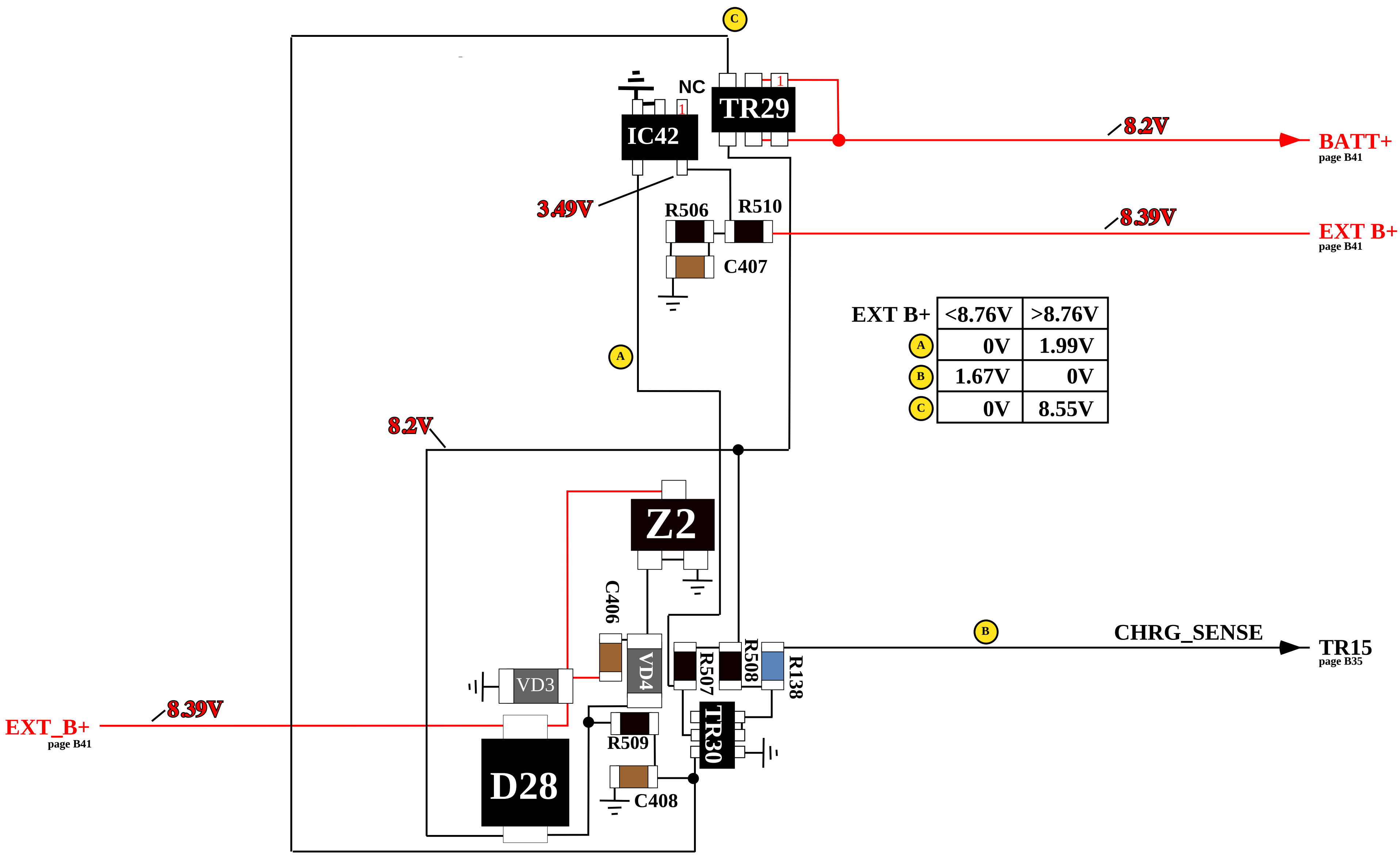
Charge_sense reports the charger state to the MSM.

SC3160: Charger/Supply Disconnect

VOLTAGE SUPPLIES

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





EXT B+	<8.76V	>8.76V
A	0V	1.99V
B	1.67V	0V
C	0V	8.55V

SC3160: IC19-MSM2300

BLOCK DIAGRAM NOT NECESSARY
REFER TO PAGE B33

Description

The MSM performs all the digital processing functions of the CDMA/FM cellular phone. This is composed of integrated CDMA CORE, QCELP algorithm VOCODER, i186 microprocessor CORE and interface of peripheral equipment.

The CDMA core has a RF interface to connect to the external RF circuitry. It contains a data bus interface to transmit and receive I and Q data. This interface also includes PA controls, receiver AGC adjustment, transmitter AGC, and frequency control.

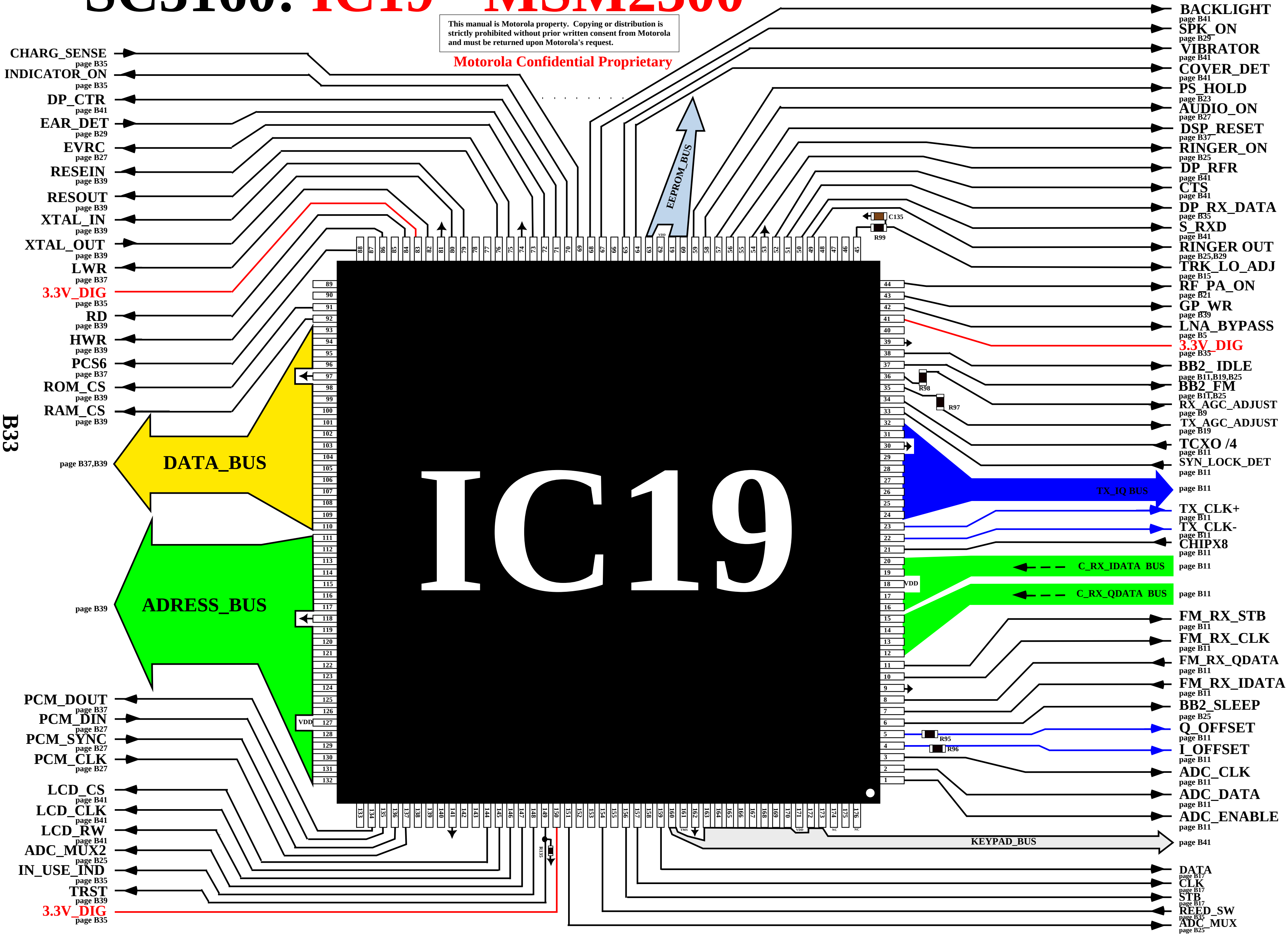
The microprocessor core provides external peripheral control(memory). The processor provides controls for most functions of the transceiver.

The MSM contains a vocoder for processing transmit and receive voice signals at a rate of 8kbits and 16kbits. It provides QCELP encoding/decoding and analog signal processing.

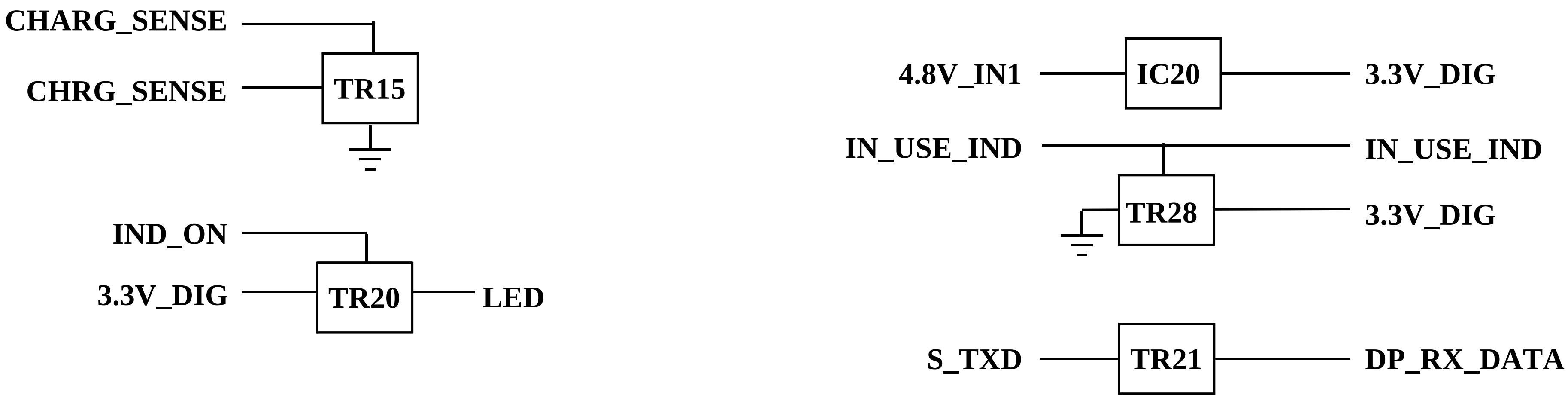
The MSM contains a non-synchronous UART used to connect to external non-synchronous serial devices such as the EEPROM.

In addition the MSM contains several ADC interfaces.

SC3160: IC19 - MSM2300



SC3160: MSM-Miscellaneous



Description

TR15 is used to report the state of charge to the MSM. TR12 is used for the ignition sense of the phone. When a external supply is attached, C322 will charge then discharge to the base of TR12. This will cause TR12 to switch on mometarily, causing the DD_ON to be pulled low.

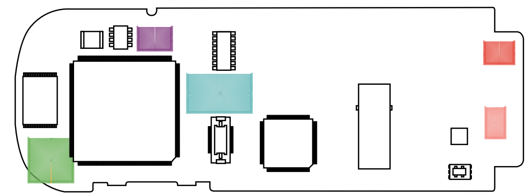
TR20 drives the LED by switching on or off TR20 via the IND_ON line.

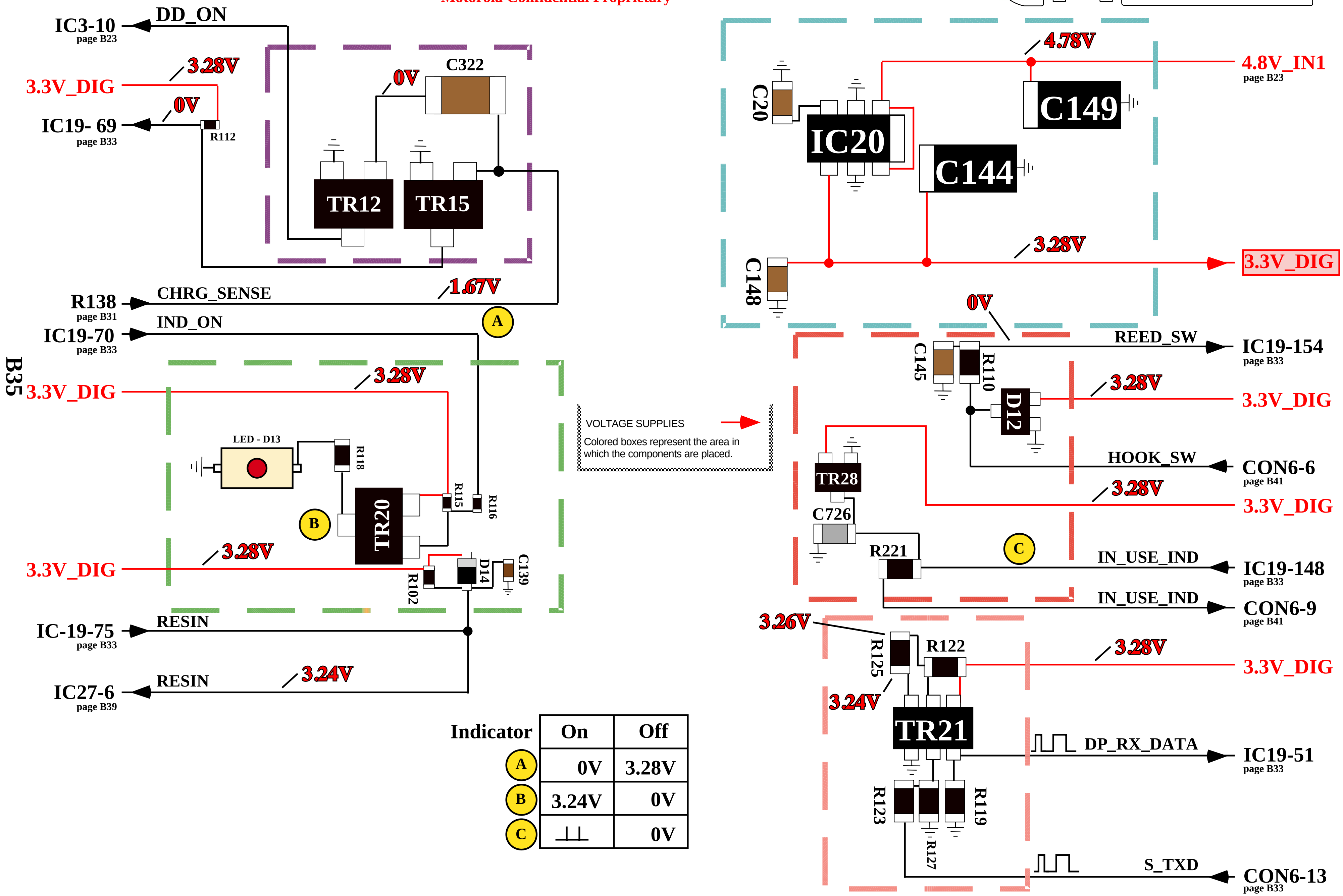
IC20 is a voltage regulator that is sourced from the 4.8V_IN1 supply. It is used to supply most of the logic circuitry.

The IN_USE_IND is a signal that the MSM reports to an external device that is using the system connector J600. Whenever the unit is ringing it turns on the LED indicator. When the red LED indicator is on, a pulsed signal is sent on the IN_USE_IND line.

TR21 is used to buffer the S_TXD signal before it enters the MSM.

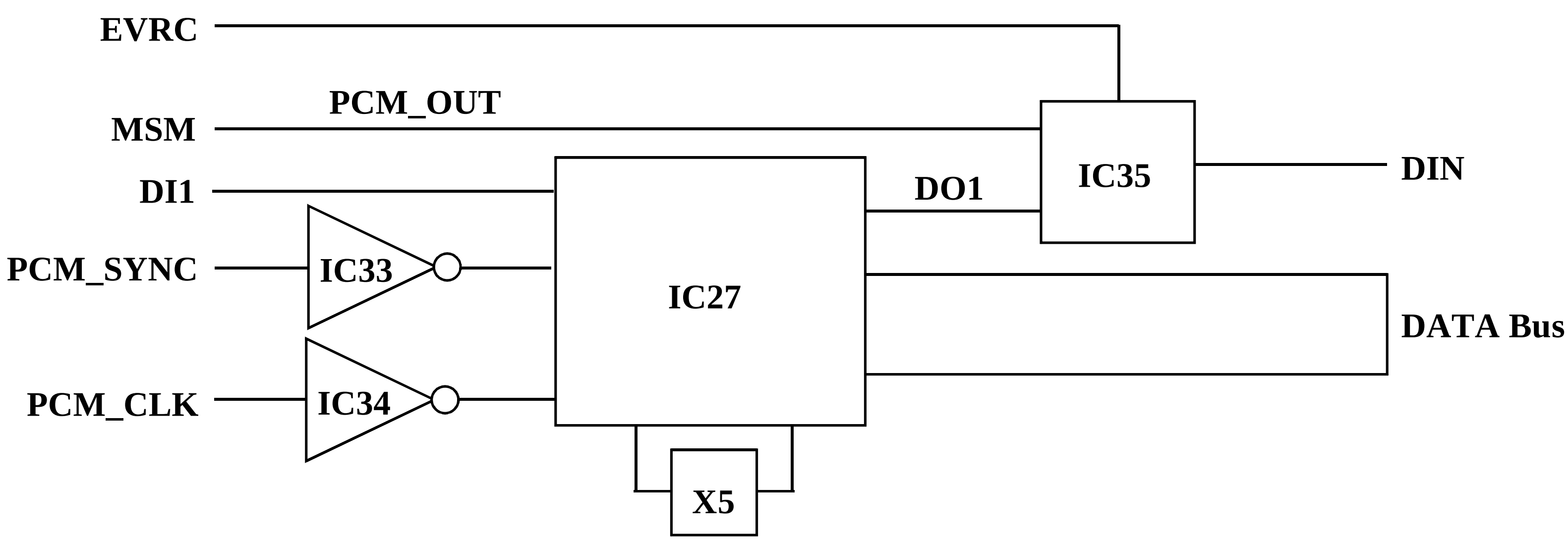
SC3160: MSM- Miscellaneous





Indicator	On	Off
A	0V	3.28V
B	3.24V	0V
C	⊥⊥	0V

SC3160: DSP(IC27)



Description

IC27 is a Digital Signalling Processor(DSP) which provides support for EVRC vocoding. When the phone is in EVRC mode, multiplexer IC35 is controlled to allow the output of IC27 to be sent to the CODEC via the DIN line. The output of IC35 is determined by toggling the EVRC line. When the phone is using a 8k or 16k vocoder, IC35 is controlled to allow the output of the vocoder, internal to the MSM, to be sent to the DIN line . PCM_OUT is the output of the MSM vocoder.

X5 provides the clock signal for IC27.

PMC_SYNC and PCM_CLK are used in conjuction with the digital input output signals(DI1 and DIN).

The data bus is a communication interface to the MSM.

SC3160: DSP(IC27)

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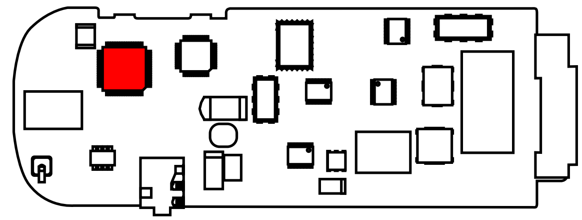
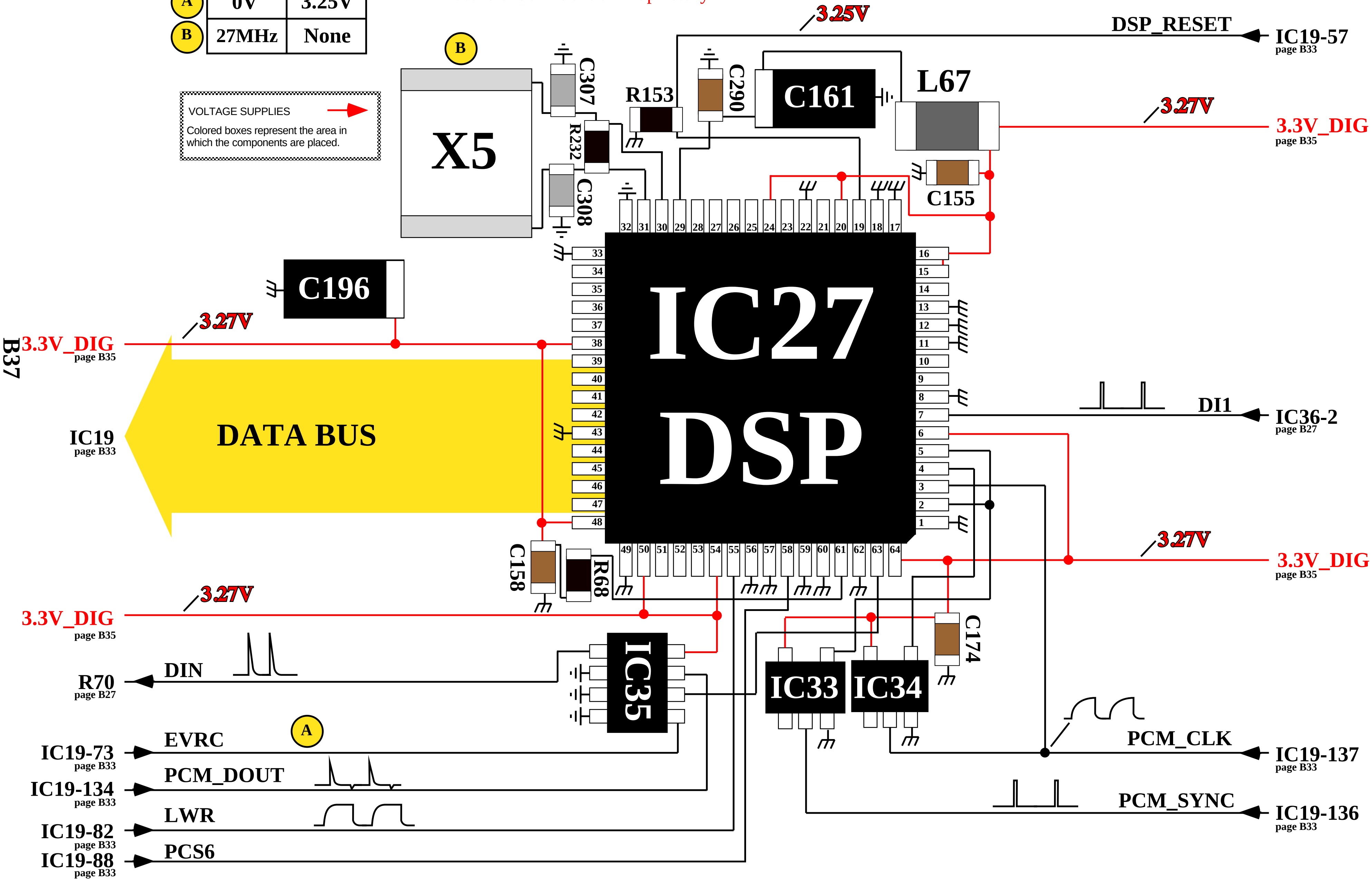


Vocoder	EVRC	8K/13K
A	0V	3.25V
B	27MHz	None

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



SC3160: Memory

BLOCK DIAGRAM NOT NECESSARY
REFER TO PAGE B39

Description

IC21 is a SRAM device which holds 2M bits of information. Internal flag information, call-processing data, and timer data.

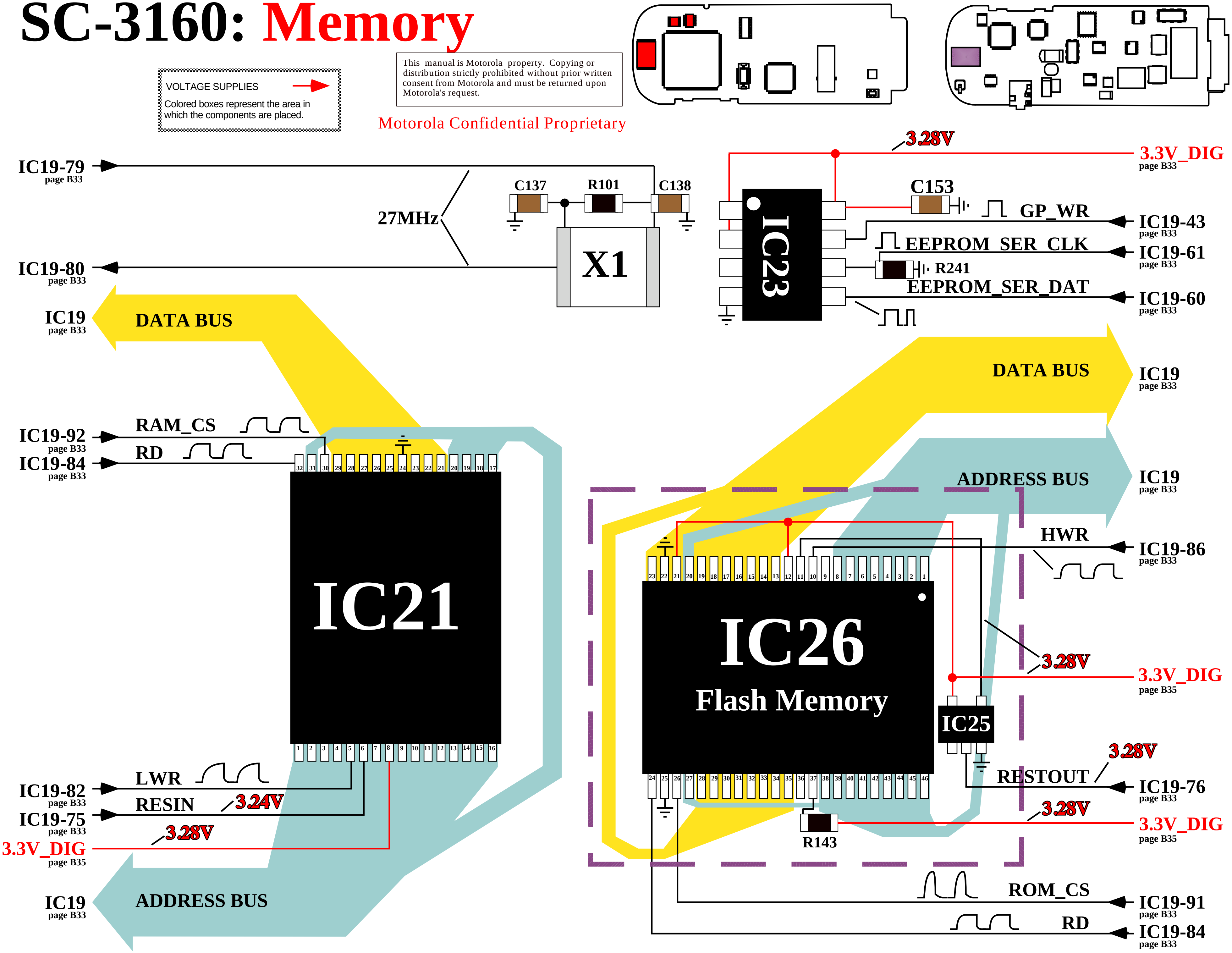
IC26 is a 8M bit memory device which contains the instruction set of the microprocessor. IC26 can be reprogrammed for software upgrades.

IC23 is an EEPROM capable of storing 128k bits of information. This device stores factory calibration data, ESN, NAM, telephone numbers, and SMS.

X1 provides the logic clock pulse for the MSM.

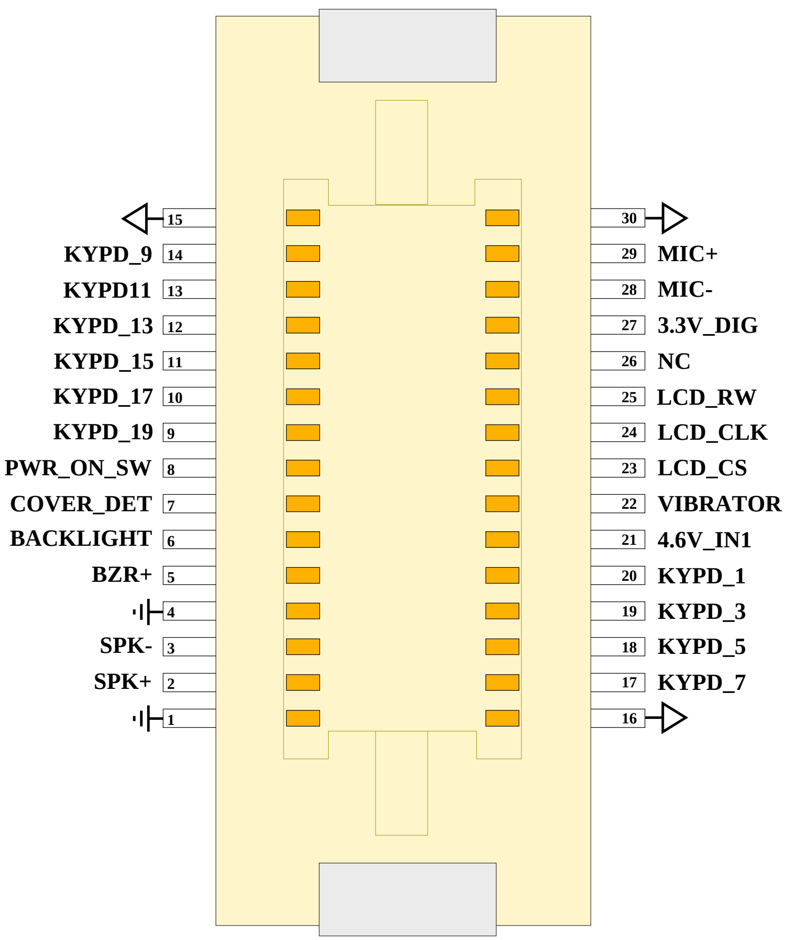
SC-3160: Memory

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

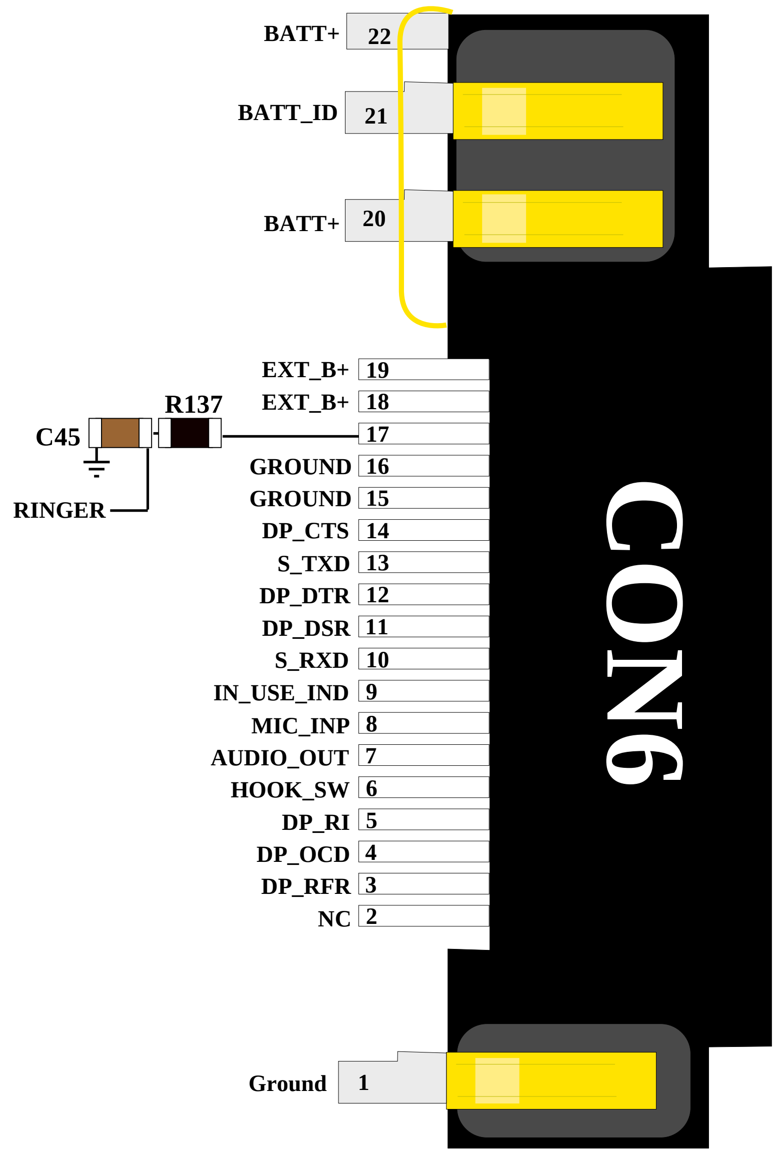


SC3160: Connectors

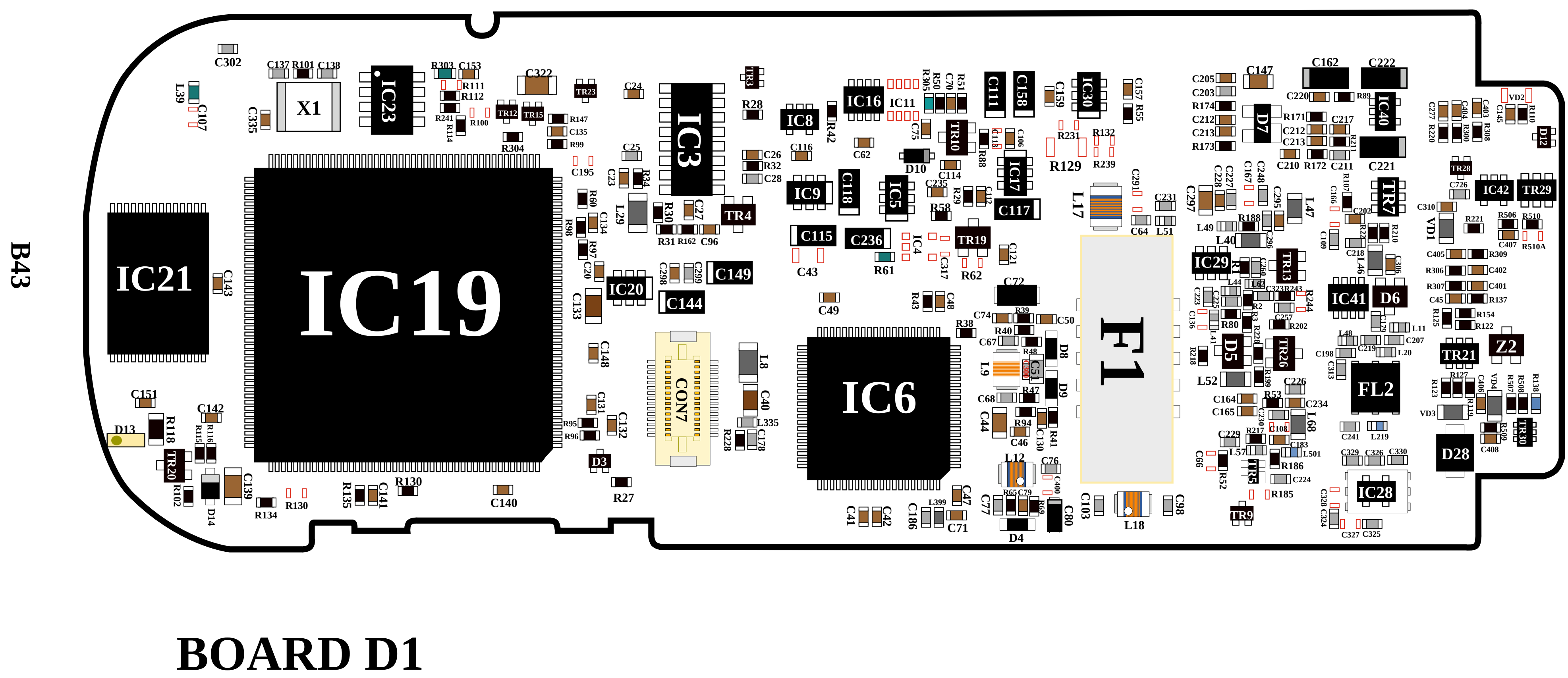
CON7



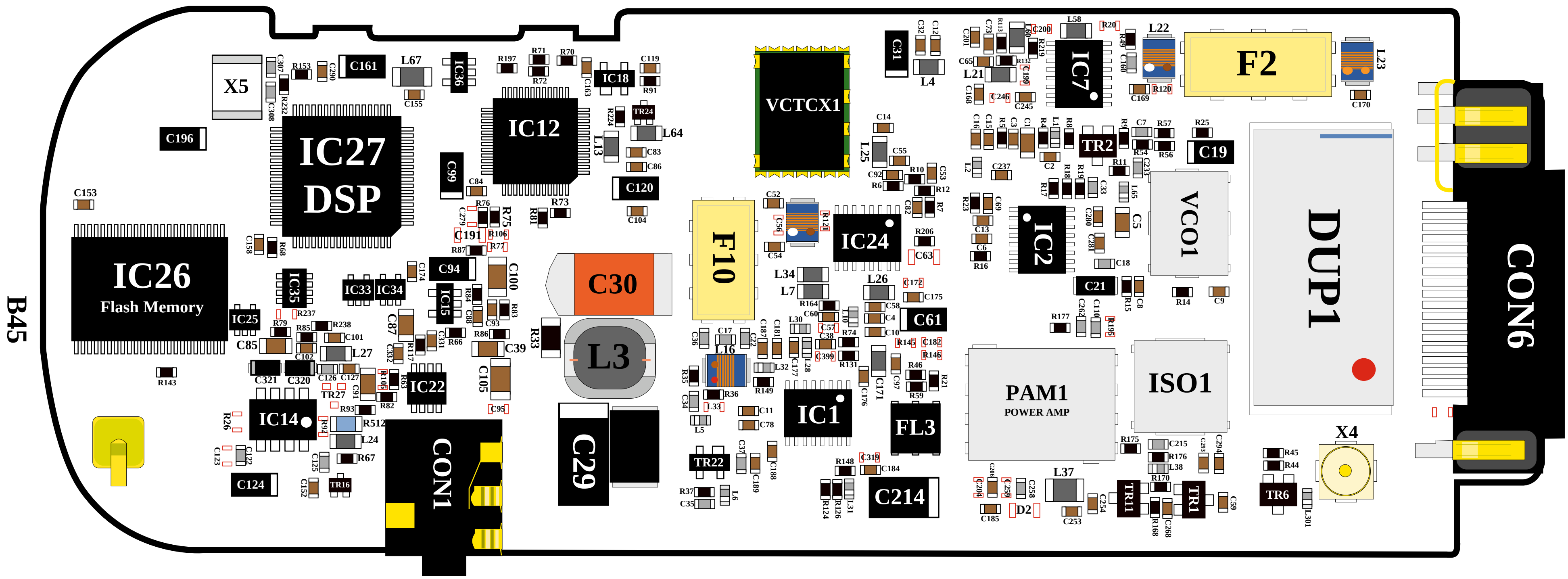
B41



SC3160: Side 1 Layout



SC3160: Side 2 Layout



BOARD D1

SC3160: Block Diagram