MOTOROLA

Service Manual

Level 3

Release 1.0

series™

DIGITAL WIRELESS TELEPHONE

Model 120t

TDMA 1900MHz/TDMA 800MHz/Analog 800MHz

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About This Manual

Scope of Manual

This manual is intended for use by experienced technicians familiar with similar types of equipment. It is intended primarily to support level 3servicing, which consists primarily of component level repair.

Authorized distributors may receive training to become a level 3 service center. Your regional Customer Support Manager will have 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 finest 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 Motorola's repair capabilities and policy for in-warranty and out-of-warranty repairs in your region.

General Safety Information

Portable Operation

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

DO NOT operate the telephone in an airplane.

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

Mobile Operation (Vehicle Adaptor)

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

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

cally 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

Table 1.Overall System

Function	*Specification*
Frequency Range	**TX (800MHz)** : 824.04 - 848.97 MHz Channels 1 to 799, f_{TX} = 0.03 * N+ 825MHz Channels 991 to 1023, f_{TX} = 0.03 * (N-1023) + 825MHz **RX(800MHz)**: 869.04 – 893.97 MHz Channels 1 to 799, f_{RX} = 0.03 * N+ 870MHz Channels 991 to 1023, f_{RX} = 0.03 * (N-1023) + 870MHz **TX (1.9 GHz)** : 1850.080 to 1909.960 MHZ Channels 2 to 1998 f_{TX} = 0.03 * N + 1850 (MHz) Channels 1 and 1998 are not used **RX (1.9 GHz)** : 1930.080 to 1989.860 MHZ Channels 2 to 1998 f_{RX} = 0.03 * N + 1930 (MHz) Channels 1 and 1998 are not used
Channel Spacing	30 kHz
Channels	832 (800MHz), 1999 (1.9 GHz)
Duplex Spacing	45 MHz (800MHz), 80.04 MHz (1.9GHz)
Input/Output Impedance	50 ohms (nominal)
Operating Voltage	2.9 to 4.4 volts DC at battery terminals, 4.2 to 6.63 volts DC at CE Bus
Dimensions (Volume)	126x43x28 (105cc)
Weight	128gm
Display	LCD Full Matrix (96 x 64 pixel), LED Backlighting, 5 row x 15 character: SMS & Phonebook
Analog 800MHz RF Power Output	0.427 Watts (26.3 dBm)
Digital 800MHz RF Power Output	0.428 Watts (26.8 dBm)
Digital 1.9GHz RF Power Output	0.407 Watts (26.1 dBm)
Automatic Power Control	9, 4 dBm steps

Table 2. EAMPS System

Function	*Specification*
Modulation Type	FM
Frequency Stability	± 200 Hz
Duty Cycle	Continuous
Audio Distortion (transmit and receive)	Less than 5% at 1 kHz tone with 8 kHz deviation
FM Hum and Noise (C-MSG weighted)	-60 dB to –40 dB at 1 kHz tone with 8 kHz deviation
Voice Modulation	8 kHz to 12 kHz deviation
Receive Sensitivity	-116 dBm for 12 dB SINAD (C-MSG weighted)

Table 3. TDMA System

Function	*Specification*
Modulation Type	Pi/4DQPSK
Frequency Stability	± 200 Hz
Duty Cycle	32.3%
Error Vector Magnitude (?/4DQPSK mode)	Error Vector Magnitude [Digital] 12.5%
Transmit Audio Sensitivity	TOLR of –46 dB nominal
Receive Sensitivity	-110 dBm for 3% static BER
Adjacent and Alternate Channel Desensitization	-110 dBm for 3% static BER
IM	Less than or equal to 3% static BER
Vocoder	ACELP

Table 4. Environment

Function	*Specification*
Temperature	-30ºC to +60ºC
Humidity	80% RH at 50ºC
Vibration	EIA PN1376
Shock	EIA PN1376

TDMA Extended 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: Easy NAM Programming and Extended NAM Programming.

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 Extended NAM Programming.

Extended NAM Programming

The TDMA (Time Division Multiple Access) digital cellular telephones can be programmed to work in a private 800 MHz cellular or 1900 MHz PCS (Personal Communications System) environment. The telephone will prefer to go into service in any of three types of cellular or PCS systems. The three systems are *public, private, or residential***.** The *public* system is a metropolitan-wide system provided by a carrier licensed by the Federal Communications Commission. A *private* system is one operated by a business or other commercial or institutional entity, typically within a large building or campus. A *residential* system, is for a home based system. System priorities are determined by extended NAM programming.

There are four levels of programming. Levels 1 and 2 contain essentially User Mode Programming Levels 3 is for prioritizing and editing private or residential SID's (System ID's). Level 4 allows the programmer to enter up to three emergency numbers.

Extended NAM Programming Steps

The user must enter "<MENU>0SETUP*"or "#PROGRAM#SND" from idle to invoke the Programming Menu feature. The user will be prompted with the Enter Security Code screen. When security code is entered (default 6 zeroes), press the identified OK button. This will take you to the initial Programming Menu. Select NAM Setup by using the scroll key to highlight the NAM Setup option and by pressing the identified SELECT key. This will take you to the initial NAM Setup screen.

The following pages describe the Extended NAM menu options. Note that the **>** Symbol indicates that you have selected an option from the NAM program menu and that you are one step into that option. Increments of that symbol indicate that you are that many steps into that option.

Extended NAM Programming Menu

Table 5. TDMA Level 1 Programming Menu

Level 1	Menu Item	Description	Values
	ESN (Hex) ABCDEF10	ESN is an abbreviation for Electronic Serial Number. It consists of eight digits displayed in hexadecimal code using the numbers 0 through 9 and the letters A through F to represent the numbers 0 through 15 with a single digit. The ESN is merely displayed.It cannot be changed by the programmer.	ESN
	ESN (Dec) 123.45678901	ESN displayed in decimal code eleven digits long. As with the hexadecimal display, the decimal ESN is merely displayed. It cannot be changed by the programmer.	ESN
	MIN XXXYYYYYYY	MIN is an abbreviation for Mobile Identification Number. This is the equivalent of the telephone number: the three digit area code (XXX) and the seven digit directory number (YYYYYYY).	Ten digit Number
	IMSI	International Mobile Station Identify, a fifteen digit number similar to a MIN (in other words, the telephone number).	1-15 digit number
	MDN	Displays and allows the user to edit the phone's Mobile Directory Number	10 digit number
	Home SID	SID is an abbreviation for System ID, a five digit number uniquely identifying the PUBLIC carrier within a metropolitan area. Note that any leading zeroes are not displayed. *When this field is modified, the values of the Primary Paging Channel, Primary Scan, Secondary Paging Channel, and Secondary Scan will be defaulted for the cellular a or b system depending on the value of the SID.*	1-5 digit number 1-32767
	Home SOC	System Operator Code, a four digit number, similar to the SID, used to identify a national operator, useful for roaming purposes and also used with IRDB. For certain operators this entry will not be present. *Only editable if SOC locking is flexed off. If SOC locking is flexed on, Home SOC will not appear in the menu and it may not be changed via any available method.*	1-4 digit number 0-4095
	MCC	The MCC is a three digit abbreviation for Mobile Country Code allowing for easier international roaming.	0-3 digit number 0-999 or no value
	Home Tag	The programmer may here enter the home carrier's alphanumeric default display identifying the particular SID/SOC combination being entered.	15 character alphanumeric
	Partner Tag	The programmer may here enter the carrier's partner alphanumeric display identifying SIDs that have negotiated superior roaming rates.	15 character alphanumeric

Table 5. TDMA Level 1 Programming Menu - Continued

Level 1 Continued	Menu Item	Description	Values
	Favored Tag	The programmer may here enter the carrier's favored alphanumeric display identifying SIDs that have overlapping coverage with a Partner SP.	15 character alphanumeric
	Neutral Tag	The programmer may here enter the carrier's neutral alphanumeric display identifying SIDs that are not listed in the database.	15 character alphanumeric
	Unlock Code	The four digit code to unlock the telephone when it is locked. The factory default is 1234, but it may be changed at this point. NOTE: *The Unlock Code is the same value for each NAM.*	4 digit number
	Security Code	The six digit security code that was entered earlier is now displayed. The factory default is 000000, but it may be changed at this point. NOTE: *The Security Code is the same value for each NAM.*	6 digit number
	Email Gateway MIN	MIN format, no more than 10 digits	
	Server Addrs	Title for Teleservice Server Addresses Programming Form. Allows the user to enter the form for setting teleservice server addresses.	
		The following entries are transition points between Level 1 into Levels 2, 3, and 4. To select Level 2, 3, or 4, press the identified select key.	
	Level 2	To move to Level 2 press the identified select key. To skip past Level 2 to Level 3, press the up/down scroll key.	
	Level 3	To move to Level 3 press the identified select key. To skip past Level 3 to Level 4, press the up/down scroll key.	

Table 6. TDMA Level 2 Programming Menu

Level 2	Menu Item	Description	Values
	Primary Pag Ch	This is not an automatic entry. It should show 333 if the carrier operates on the A side with an odd numbered System ID, or 334 if the carrier operates on the B side with an even numbered System ID.	4 digit number
	Sec Pag Ch	This is not an automatic entry. If the SID is even, the Secondary Paging channel should be 737, but for odd SIDs the Secondary Paging Channel should be 708.	4 digit number
	Access Method	The default setting for this bit is ON, allowing the telephone to SEND the three digit area code when it transmits its identity (Electronic Serial Number and Mobile Identification	On, Off
	Overload Class	This two digit number, which should begin with zero for consumers, specifies the level of priority assigned to the mobile for accessing the system. Assigned by the system operator for roaming, the default is zero followed by the last digit of the MIN.	2 digit number
	To Level 1	Pressing the identified cancel key will cause the program to back-step to Level 2 entry. Pressing the identified cancel key again, will cause the program to back-step to Level 1.	

Table 7. TDMA Level 3 Programming Menu

Level 3	Menu Item	Description	Values
	PSID/RSIDs	Pressing the identified select key at this point allows editing of the specific PSID or RSID selected. Pressing the up/down scroll key moves the entry to the next PSID/RSID to a maximum of 5. Pressing the identified BACK key will cause the program to back	
	> PSID/RSID1 1 through 5 available for editing.	There is a maximum of 5 PSID/RSID you can select for editing. The following Menu Items apply only to PSID/RSID1. To edit another PSID/RSID, the programmer must return to the previous (first) entry in level 3.	
	>> PSID/RSID	This is the Private SID. Any five digit numerical SID may be entered. Leading zeroes will be ignored. Press the scroll key to advance to the next step.	1-5 digit number 1-32767
	>> SID	This is the Public SID with Private SID associated. Any five digit numerical SID may be entered. Leading zeroes will be ignored. Press the scroll key to advance to the next step.	1-5 digit number 1-32767
	>> SOC	The SOC is a four digit abbreviation for System Operator Code. It serves a function quite similar to the SID except it identifies the carrier's entire operating footprint. Press the scroll key to advance to the next step.	1-4 digit number 0-4095

Table 7. TDMA Level 3 Programming Menu - Continued

Level 3 Continued	Menu Item	Description	Values
	>> MCC	The MCC is a three digit abbreviation for Mobile Country Code allowing for easier international roaming. Leading zeroes are ignored. Press the scroll key to advance to the next step.	0-3 digit number 0-999 or no value
	>> Alpha Tag	The programmer may enter an alphabetic mnemonic for the PSID/RSID being programmed. This may be overwritten by the network. Press the scroll key to advance to the next step.	15 alphanumeric characters.
	>> Type	The programmer may select between Private or Residential. Press the identified SELECT key to select between Private or Residential option. After option is selected the program will automatically advance to the next step.	Private, Residen-tial
	>> PSP1 1 through 8 available for editing.	Pressing the identified select key at this point allows editing of the specific Public Service Profile (PSP) selected. Pressing the up/down scroll key moves the entry to the next PSP to a maximum of 8. Pressing the identified CANCEL key will cause the program to back-step.	
	>>> Type	Here the programmer may select between Digital or Analog system type. Press the identified SELECT key to select between Digital or Analog option. After option is selected the program will automatically advance to the next step.	Digital, Analog
	>>> Hyperband	This indicates the band where the selected channel is located. If analog is selected in the previous Type menu, then 800 MHz will be your only selection. Digital has 800 MHz and 1900 MHz option. After option is selected the program will automatically advance to the next step.	800 MHz, 1900 MHz
	>>> Channel	The programmer may enter the private channel for the system being used. After option is selected the program will automatically advance to the next step.	1-1099 for digital 1-1023 for analog
	>>> DVCC/DCC	Digital Verification Color Code (DVCC) / Digital Color Code (DCC) are used when going into service and during handoffs, and to prevent co-channel interference. You have an option to select from 0 to 3. After option is selected the program will automatically advance back to the first step (Type).	DVCC - 0-255 DCC - 0-3
	>> POF1	Pressing the identified select key at this point allows editing of the specific Private Operating Frequency (POF) selected. Pressing the up/down scroll key moves the entry to the next POF to a maximum of 8. Pressing the identified CANCEL key will cause the program to back-step.	
	>>> Hyperband	This indicates the band where the selected channel is located. 800 MHz for Cellular and 1900 MHz for PCS.	800 MHz, 1900 MHz

Table 7. TDMA Level 3 Programming Menu - Continued

Level 3 Continued	Menu Item	Description	Values
	>>> Channel	The programmer may enter the private channel for the system being used. After option is selected the program will automatically advance to the next step.	1-1099 for 1900 MHz 1-1023 for 800 MHz
	>>> DVCC	Digital Verification Color Code (DVCC) is used when going into service and during handoffs, and to prevent co-channel interference. You have an option to select from 0 to 255. After option is selected the program will automatically advance to the next step.	0-255
	>>> Celltype	The programmer may select between Regular or Preferred Celltypes. Press the identified SELECT key to select between Regular or Preferred option. After option is selected the program will automatically advance to the next step.	Regular, Preferred
	>>> MS_ACC_PWR	Displays and allows the user to change the MS_ACC_PWR parameter for the POF. You have an option to select from 0 to 10. After option is selected the program will automatically advance to the next step.	0-10
	>>> RSS_ACC_MIN	Displays and allows the user to change the RSS_ACC_MIN parameter for the POF. You have an option to select from 0 to 31. After option is selected the program will automatically advance to the next step.	0-31
	>>> SS_SUFF	Displays and allows the user to change the SS_SUFF parameter for the POF. You have an option to select from 0 to 31. After option is selected the program will automatically advance to the next step.	0-31
	>>> Delay	Displays and allows the user to change the Delay parameter for the POF. You have an option to select from 0 to 14. After option is selected the program will automatically advance to the next step.	0-14
	Test P/RSID	Pressing the identified SELECT key at this point allows for viewing of the specific PSID or RSID selected. Pressing the up/down scroll key moves the entry to the next PSID/RSID to a maximum of 5. Pressing the identified BACK key will cause the program to back-step to Level 3.	
	Accept P/RSID	Pressing the identified SELECT key at this point allows for viewing of the specific PSID or RSID selected. Pressing the up/down scroll key moves the entry to the next PSID/RSID to a maximum of 5. Pressing the identified BACK key will cause the program to back-step to Level 3.	
	Allow Public	The default is YES. This will allow accessing public systems. Press the identified CHANGE key and then use the scroll key to change from YES to NO. After option is selected the program will automatically advance to the next step.	Yes, No

Table 7. TDMA Level 3 Programming Menu - Continued

Level 3 Continued	Menu Item	Description	Values
	Allow Private	The default is YES. This will allow accessing private systems. Press the identified CHANGE key and then use the scroll key to change from YES to NO. After option is selected the program will automatically advance to the next step.	Yes, No
	Residential	The default is YES. This will allow accessing residential systems. Press the identified CHANGE key and then use the scroll key to change from YES to NO. After option is selected the program will automatically advance to the next step.	Yes, No
	Priorities	The programmer has the option of choosing which system (RESIDENTIAL, PUBLIC, NONE, OR PRIVATE) has priority over the other. Press the identified SELECT key to enter priorities menu. Press the identified DONE key to exit Level 3 menu options.	
	> 1st Priority	The default setting for this entry is Residential. Press the identified CHANGE key and use the scroll key to scroll through the options: RESIDENTIAL, PUBLIC, NONE, OR PRIVATE. After option is selected the program will automatically advance to the next step.	Private, Residential, Public, None
	> 2nd Priority	The default setting for this entry is Private. Press the identified CHANGE key and use the scroll key to scroll through the options: RESIDENTIAL, PUBLIC, NONE, OR PRIVATE. After option is selected the program will automatically advance to the next step.	Private, Residential, Public, None
	> 3rd Priority	The default setting for this entry is Public. Press the identified CHANGE key and use the scroll key to scroll through the options: RESIDENTIAL, PUBLIC, NONE, OR PRIVATE. After option is selected the program will automatically advance back to the top of the priorities list (1st Priority)	Private, Residential, Public, None

Table 8. TDMA Level 4 Programming Menu

Level 4	Menu Item	Description	Values
	Emergency 1	The default setting for Emergency 1 is 911. You can enter the desired emergency number (up to 32 digits) by pressing the identified CHANGE key. After desired emergency number is changed, press the identified OK key. The program will automatically advance to the next step (Emergency 2).	1-32 digit number
	Emergency 2	The default setting for Emergency 2 is 911. You can enter the desired emergency number (up to 32 digits) by pressing the identified CHANGE key. After desired emergency number is changed, press the identified OK key. The program will automatically advance to the next step (Emergency 3).	1-32 digit number
	Emergency 3	The default setting for Emergency 3 is 911. You can enter the desired emergency number (up to 32 digits) by pressing the identified CHANGE key. After desired emergency number is changed, press the identified OK key. The program will automatically advance to the top of list (Emergency 1).	1-32 digit number
	To Level 1	Pressing the identified cancel key will cause the program to back-step to Level 4 entry. Pressing the identified cancel key again, will cause the program to back-step to Level 1.	

Handset Test Commands

Introduction

The Handset Test Command mode of the phone is provided primarily for service personnel without access to equipment capable of exercising Test Commands over a computer connection. This mode collects inputfrom the user and packages it in the format required by the Test Command component within the phone.

User Interface

Three screens are used, as described below, for command data entry and command response display: the opcode entry screen, the field entry screen, and the command results screen. The following screen flow diagrams do not depict an actual test command, but instead demonstrate the general behavior of the mode.

As the phone does not provide an easy method of hexidecimal entry, all input and output will be in decimal format, with the exception of output fields considered to be data streams. This requires careful consideration as a significant portion of this document is described using hexadecimal format. As an aid in the decimal entry of opcodes, Table - 1. is provided which indicates the decimal equivalent number for supported opcodes.

The END key exits handset test command mode or restarts the phone (if suspended). However, pressing the END key in the waiting for results screen (a “frozen” version of the final entry screen) has no effect, though the power key still allows the phone to be powered down.

Entry

The mode is entered using a key shortcut, “<MENU> 0 HTCMD *”, as depicted in Figure - 1. The mode may only be entered from the idle screen. Entry is not allowed while an active computer test command session exists (ie RS232 or USB); an error will be displayed if a computer session is active.

Handset Test Command mode entry

The user must enter "<MENU>0HTCMD*" from idle to invoke the handset test command feature. The user will be taken to the initialscreen (the opcode entry screen).

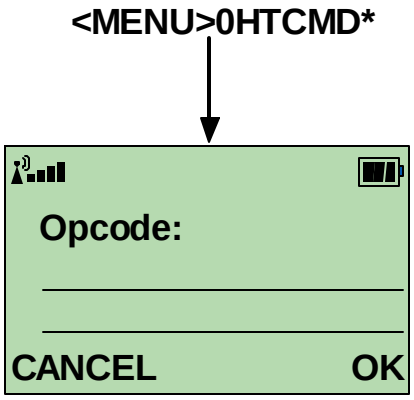
When the handset test commands feature isinvoked, the handset is not suspended by default. The handset can only be suspended by executing the SUSPEND test command. The user can exit the feature and return to idle if the handset has not yet been suspended. Otherwise, exiting the feature will cause a restart.

Command entry

Once the mode is entered, two screens are used to collect command request information from the user. The opcode entry screen (Figure - 2) allows the entry of either an entire command as described in this section, or entry of a partial command. If a partial command is entered, the user will be prompted to enter the remaining required information via an appropriate number of field entry screens (Figure - 3). Pressing OK with no data entered in the opcode or field entry screen will cause a parse error (unless the field is optional).

The asterisk is used to delimit fields on the opcode entry screen and is not allowed on the field entry screen. On the opcode entry screen, it is not legal to have an asterisk immediately follow another asterisk.

Figure 1. Test Command mode entry



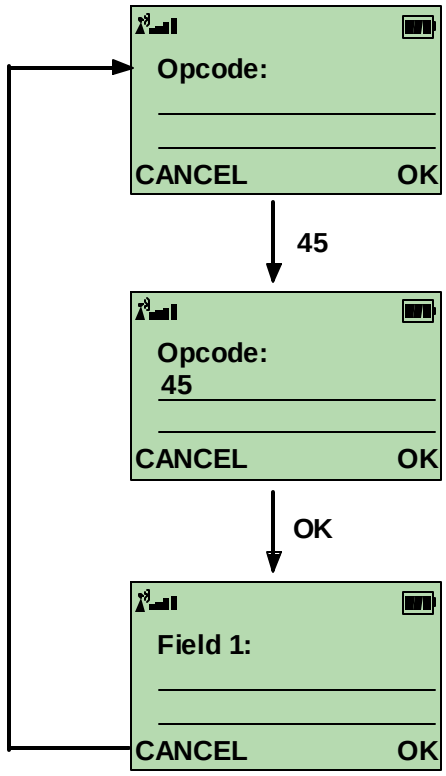
Opcode entry

The opcode entry screen allows the user to enter the opcode for the test command, or the opcode plus additional parameters delimited by the * character.

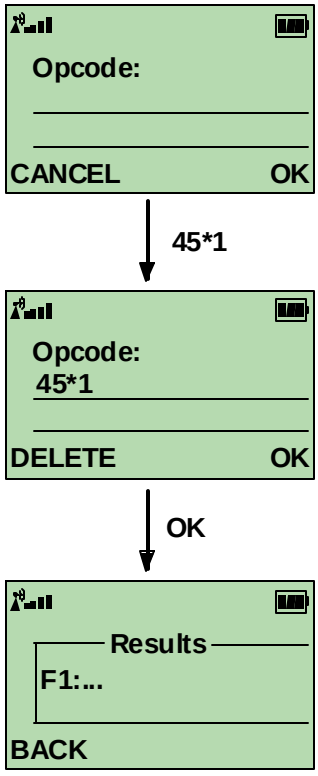
Opcode Entry Screen Keymap:

0-9: command data
*: field delimiter
OK: process value, move to next screen
DELETE (short): delete single char
DELETE (long): delete all chars
CANCEL: return to idle or restart if suspended
End: return to idle or restart if suspended

Figure 2. Opcode Entry Screen



Example of entering multiple parameter command in a single command line in the opcode entry screen.



Field entry

The field entry screen allows the user to enter fields for the test command separately from the opcode. Each field entry screen allows only one field to be entered. The user will be led through the remaining parametersone by one until the command is completed.

Field Entry Screen Keymap:

0-9: command data
OK: process value, move to next screen
DELETE (short): delete single char
DELETE (long): delete all chars
CANCEL: return to opcode entry screen
End: return to idle or restart if suspended

Numeric Field Entry:

Fields are numeric by default. The digits entered for the field will be evaluated as a single decimal number.

Data Field Entry:

The user must enter 3 digits for each byte of a data field (variable or non-variable length). Zero padding is required if all 3 digits are not required to represent the value. Any data field which is not a multiple of 3 digits will generate a parse error. The field title of any data field will be tagged with a (D). Figure 4. is an example of a 5 byte data field.

Figure 3. Field Entry Screen

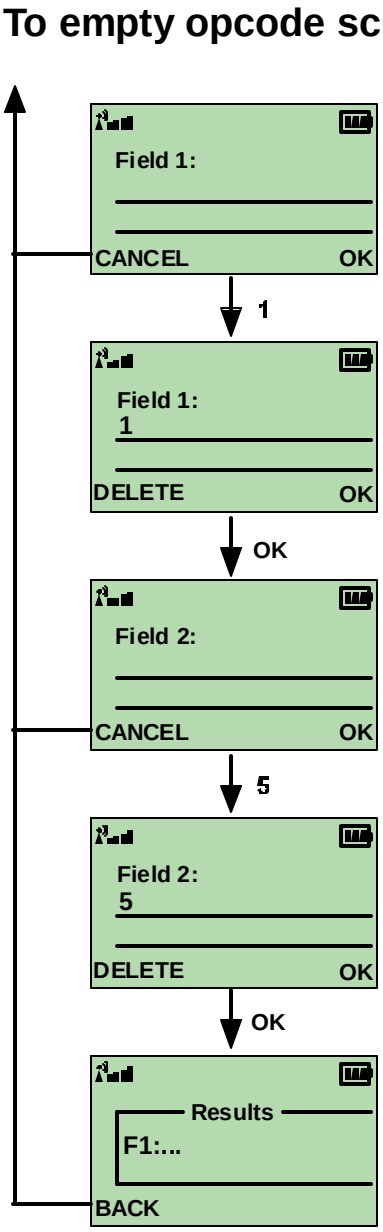
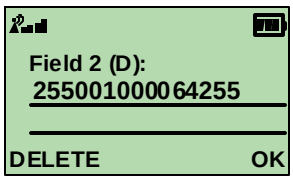


Figure 4. Five byte data field



Command Results

If a command completes successfully with returned data, the data is displayed in a results screen as depicted in Figure 5. If a command is successfully completed but does not produce any output data, the user will be returned to the opcode entry screen. In the case of a command error, the standard response code (Table 2) is displayed on the results screen.

There is no way to abort or power down from the waiting for results screen. The waiting for results screen is simply a "frozen" version of the final entry screen as opposed to having a dedicated screen.

The command result screen allows the user to view and scroll through all of the result data for the test command.

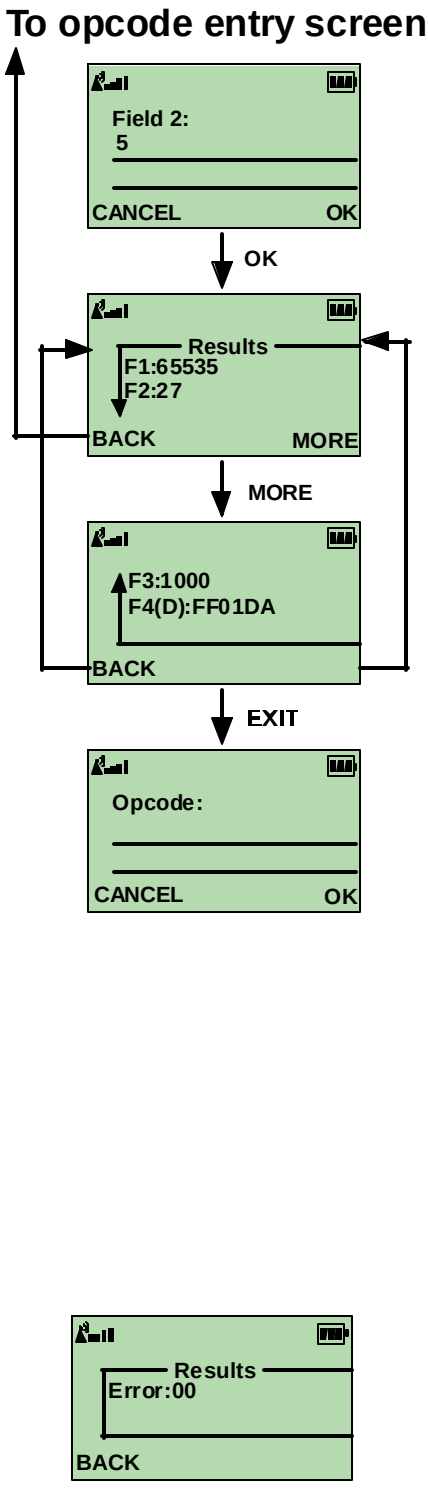
Command Result Screen Keymap:

MORE: scroll to next result screen
BACK: scroll to previous result screen if not on first page of output, return to opcode entry screen if on initial page of output
End: return to idle or restart if suspended

All result screens will be titled "**Result**". Each result field will be tagged with "**F#**:". Each field will start on a new line in the result screen. Data fields, as in the field entry screen, will be tagged with (**D**), but will be displayed in hexadecimal format.

Error Reporting:
If the command fails for any reason the userwill be notified of the error with the response code (decimal format) from the test command protocol (Table 2).

Figure 5. Command Results Screen



Supported Handset Commands

Table 9. Supported Handset Test Commands

Opcode Hexadecimal	Opcode Decimal	Opcode Mnemonic	Legacy Handset Commands	Key Entry Format	Op Code Description
000	0	AUD_TN_LST	33X#	0 *<Action> * <Tone Identifier>**OK**	Generate/disable predefined tone
003	3	AUD_CTRL	48#	3 *<Device/Process> * <Action>**OK**	Control various audio functions; enable/disable vibrator
004	4	AUD_LPB	57#	4 *<Loopback Type> * <Action>**OK**	Enable audio loopback
005	5	AUD_LVL	47X#	5 *<Get/Set>*<Volume>**OK**	Set audio level
006	6	AUD_PATH	35X#	6 *<Input Path>*<Output Path>*<RX Mute>*<TX Mute>**OK**	Change audio path
007	7	CARRIER	05#, 06#	7 *<Option>*<Action>**OK**	Enable/disable carrier
009	9	COMPD	58#	9 *<Action>**OK**	Enable/disable compander
00C	12	ERS_PANIC	52#	12 **OK**	Erase panic information on flash memory
011	17	INIT	04#	17 **OK**	Initialize radio to known states to be determined
012	18	INVM	32#	18 *<Level>**OK**	Initialize the non-volatile memory parameters
014	20	LOAD_SYN	11XXX#	20 *<Channel>*<Band Selection>**OK**	Load channel into synthesizer
022	34	RESTART	01#	34 * **OK**	Generate a software restart
027	39	RSSI	45#	39 *<Type>**OK**	Return compensated RSSI (in dBm) for current channel
02B	43	SAT	25#	43 *<Action>*<Color Code>**OK**	Enable /disable SAT transponding
02D	45	SET_RF_PWR	12X#	45 *<Power Level>**OK**	Set RF power attenuation
02E	46	SIGTONE	14#,15#	46 *<Action>**OK**	Enable/disable signaling tone
036	54	SUSPEND	#	54 **OK**	terminate normal mode and enter test mode
037	55	TST_DISP	NONE	55 *<Parameter>*<Parameter Data>**OK**	Place a test pattern in the display
B04	2820	DIGTS	NONE	2820 *<Slot>**OK**	Switch to DTC mode
B06	2822	TDMA_ON	57#	2822 * <DVCC> * <PRIV_KEY> * <VP> * <Echo> * <Type>**OK**	Synchronize to forward traffic channel

Response Codes

Table 10. Standard Response Codes

Opcode (Hexadecimal)	Opcode (Decimal)	Response Field Definition
0000b (0x00)	0	parse error (no data follows): invalid data length for command
0001b (0x01)	1	parse error (no data follows): inadequate security level for command/parameter
0010b (0x02)	2	parser error (no data follows): command/parameter not supported for current protocol (CDMA, GSM, TDMA)
0011b (0x03)	3	parse error (no data follows): command/parameter not supported for current mode (normal, test mode, handset test mode)
0100b (0x04)	4	parse error (no data follows): unsupported/invalid opcode
0101b (0x05)	5	parse error (no data follows): unsupported/invalid parameter for opcode
0110b (0x06)	6	command response: generic success (no data follows)
0111b (0x07)	7	command response: generic failure (no data follows)
1000b (0x08)	8	command response: data follows
1001b (0x09)	9	unsolicited/multiple response: data follows (sequence tag is 0)
1010b (0x0A)	10	error: couldn't allocate memory
1011b (0x0B)	11	error: internal task error
1100b (0x0C)	12	error: Test Command task timed out waiting for response from another SW compon
1101b (0x0D)	13	CDMA: parse error (no data follows): command/parameter not supported for current sub-mode TDMA: command not supported in current Call Stack Test Mode
1110b (0x0E)	14	error: length specified in command header greater than length received by transport l
1111b (0x0F)	15	error: irrecoverable error; phone state has been lost. Phone is being powered down

Field Data

Table 11. Field and Parameter descriptions

Opcode (Decimal)	Opcode Mnemonic	Field	Description
0	AUD_TN_LST	Field 1	0 = start atone 1 = stop a tone
		Field 2	0-9 = DTMF tones
3	AUD_CTRL	Field 1	0 = Vibrator 1 = Sidetone 2 = Echo canceling 3 = Noise suppressor
		Field 2	0 = Disable 1 = Enable
4	AUD_LPB	Field 1	0 = CODEC loopback. (0 timeout)
		Field 2	0 = Disable Audio loopback 1 = Enable Audio loopback
5	AUD_LVL	Field 1	0 = Set the volume specified
		Field 2	0 = lowest, 15 = loudest
6	AUD_PATH	Field 1	0 = As is. 1 = Mute input path 2 = Internal (handset) mic 3 = Ext audio input (CE Bus) 4 = Boom (headset) mic
		Field 2	0 = As is 1 = Mute output path 2 = Internal (handset) Speaker 3 = Alert 4 = Ext audio output (CE Bus) 5 = Speakerphone 6 = Boom (headset) speaker
		Field 3	0 = RX audio unmuted 1 = RX audio muted
		Field 4	0 = TX audio unmuted 1 = TX audio muted
7	CARRIER	Field 1	0 = As is
		Field 2	0 = Disable 1 = Enable

Field Data (Continued)

Table 11. Field and Parameter descriptions (continued)

Opcode (Decimal)	Opcode Mnemonic	Field	Description
9	COMPD	Field 1	0 = Turn compander on 1 = Turn compander off
12	ERS_PANIC	Field 1	As is
17	INIT	Field 1	As is
18	INVM	Field 1	0 = Master Reset 1 = Master Clear
20	LOAD_SYN	Field 1	Channel number in decimal. Valid channel numbers are: 1-799, 990-1023 (TDMA 800 MHz, Analog) 1-1998 (TDMA 1900 MHz)
		Field 2	Select band 0 = 800 MHz (TDMA and Analog) 3 = 1900 MHz (TDMA only)
34	RESTART	Field 1	As is
39	RSSI	Field 1	3 = RSSI reading (If reading [rdg] is > 32767 then take rdg minus 65536 and /by 10. If reading is < 32767 then take 65535 minus rdg and /by 10.) Result will be in dbm.
43	SAT	Field 1	0 = Disable 1 = Enable
		Field 2	SAT Color Code: 0 = 5970 Hz 1 = 6000 Hz 2 = 6030 Hz
45	SET_RF_PWR	Field 1	TDMA protocol: 0-10 = RF power level (0-10)
46	SIGTONE	Field 1	0 = Disable 1 = Enable
54	SUSPEND	Field 1	As is
55	TST_DISP	Field 1	Step 1: 1 = Select display
		Field 2	Step 1: 000 = Main Display, 001 = CLI display
		Field 1	Step 2: 2 = Display predifined pattern on selected display
		Field 2	Step 2: 000 = All pixels off 001 = All pixels on

Field Data (Continued)

Table11. Field and Parameter descriptions (continued)

Opcode (Decimal)	Opcode Mnemonic	Field	Description
2820	DIGTS	Field 1	1 = Slot 1 2 = Slot 2 3 = Slot 3
2822	TDMA_ON	Field 1	1 = 8 bit word
		Field 2	Determines the Voice Privacy Mask following the values below: 0 = Tx Key = 1s / Rx key = 0s 1 = Tx Key = 0s / Rx key = 1s 2 = Tx Key = 101010... / Rx key = 0s 3 = Tx Key = 010101... / Rx key = 0s 4 = Tx Key = 0s / Rx key = 101010... 5 = Tx Key = 0s / Rx key = 010101... 6 = Tx Key = Rx key = 1s 7 = Tx Key = Rx key = 101010...
		Field 3	0 = Do not apply Voice Privacy Mask. 1 = Apply Voice Privacy Mask based on PRIV_KEY
		Field 4	0 = Echo the DATA field[6] before convolutional decoding. 1 = If the DATA field contains Speech Data echo the Class I bits after convolutional decoding and echo the Class II bits. if the DATA field contains FACCH word echo the FACCH word after convolutional decoding. In all cases the CRC bits are not recomputed before they are echoed.
		Field 5	0 = DATA field contains Speech DATA. 1 = DATA field contains FACCH word.

Test Procedures

Introduction

The phone allows keypad controlled testing of various analog and digital operating parameters.

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

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, such as, 991 (lowest frequency), 333 (middle frequency), and 799 (highest frequency). In digital mode slots 1 & 4, 2 & 5, and 3 & 6 should be verified.

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

- MAHO Measurements
- Digital RX Sensitivity (BER)
- Digital Power Out
- TX Frequency Error
- Digital Modulation Stability (EVM)

The analog and digital parameters are stored in EPROM 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.

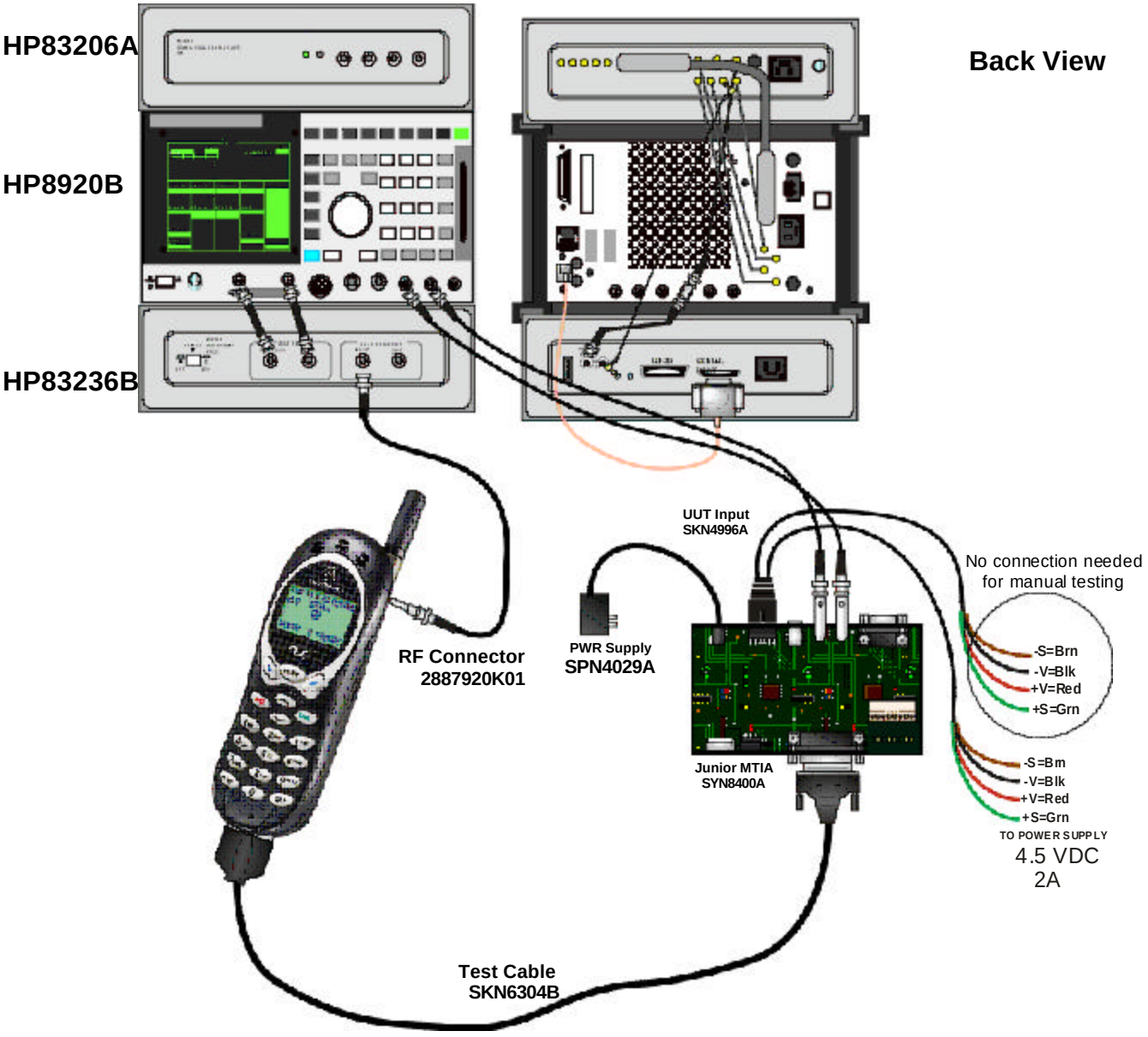
Test Connections

The diagram below shows the recommended connections for PCS testing when using the HP83236B PCS Interface with the HP8920B via Serial Port. Make sure to set the **HP-IB/ Ser** switch of the HP-IB Address Selector on the rear panel of the PCS Interface to "**Ser**."

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

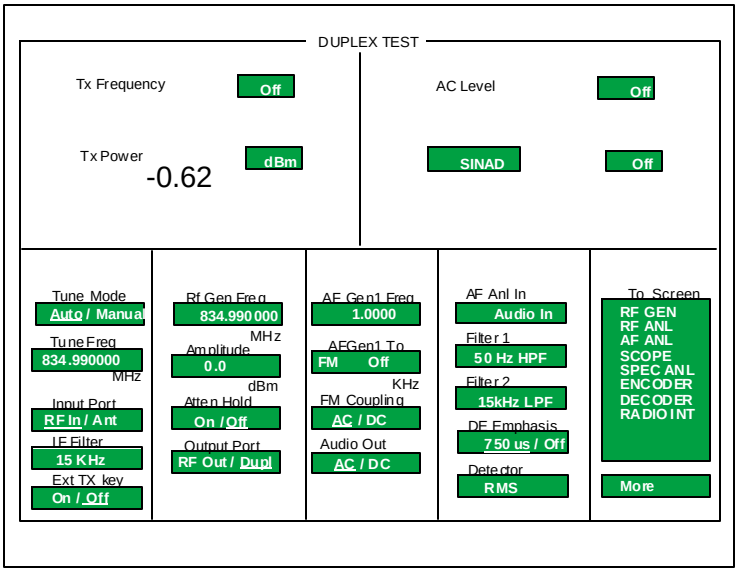
A variety of communications analyzers may be used. Refer to the analyzer manufacturer's user manual for proper setup before starting tests.

Figure 6. Connections for PCS Testing



RF Cable Test

Figure 7. Duplex Test Screen



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

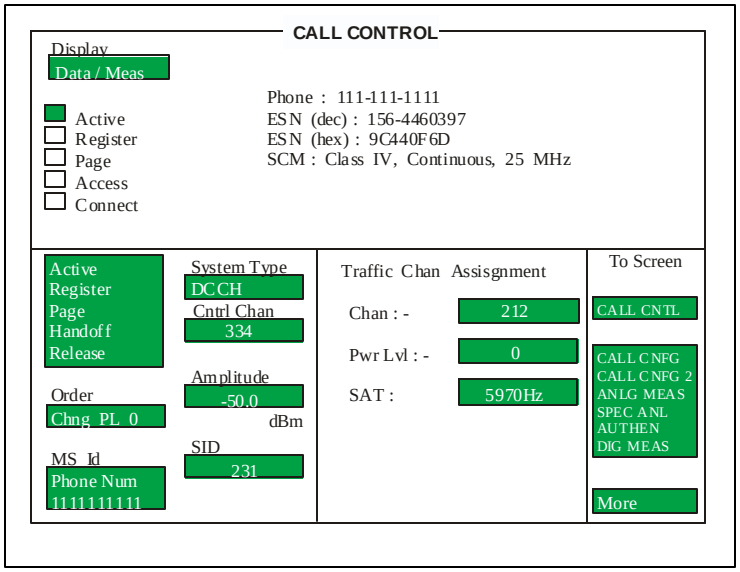
Bad cable: More than -.8 dBm

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

Figure 8. Call Control Screen



Select CALL CNTL from the To Screen

- 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 **Data** 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 light turns on. This is the Connect state.

Origination

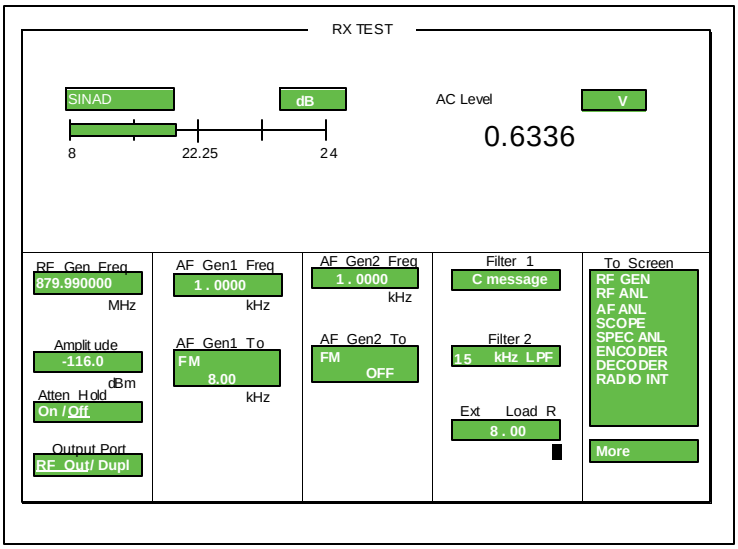
1 Dial the desired phone number on the mobile station and press SEND.

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)

Figure 9. RX Test Screen



Communications Analyzer Setup:

- Select **RX** button from the 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**

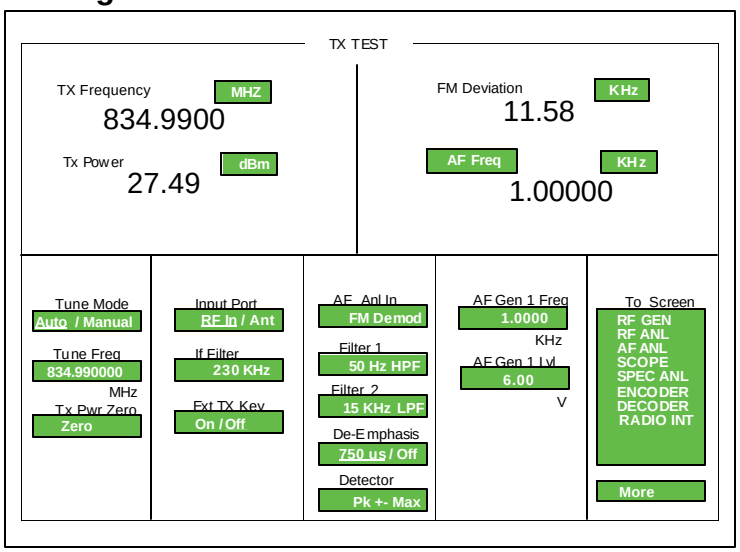
Test Mode Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2.
7*0*1	Turns on transmit carrier
9*0	Turn on Compandor
3*1*0	Disable Sidetone
5*0*4	Volume level 4
6*3*4*0*1	Mute TX Audio path, Unmute RX, Select External TX Audio path

Sinad measured on the communications analyzer must be more than 12dB.

Analog TX Power Out Test

Figure 10. TX Test Screen



Communications Analyzer Setup:

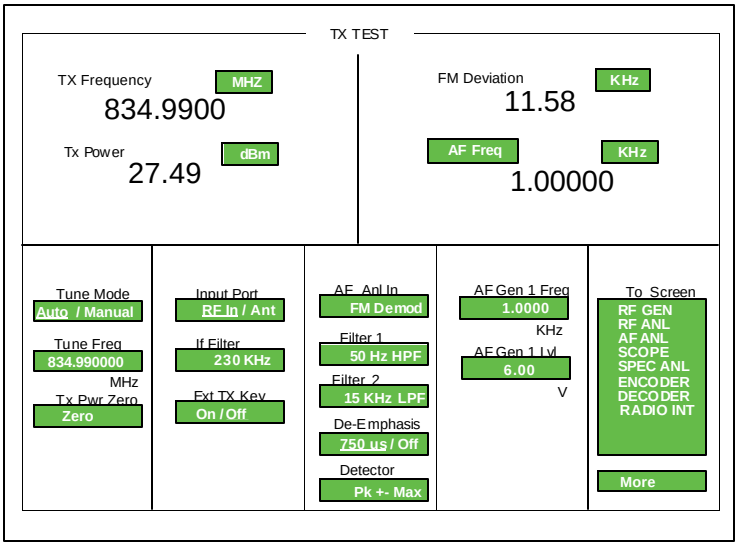
- **Select** TX **button from the Screen Control panel**
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **TX frequency** to **834.990 MHz**
- Set **IF filter** to **230 kHz**
- Set **AF Filter 1** to **50 Hz**
- Set **AF 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:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2, where 2 is a power level from 1 to 7.
7*0*1	Turns on transmit carrier

TX Frequency Error Test

Figure 11. TX Test Screen



Test Mode Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2, where 2 is a power level from 1 to 7.
7*0*1	Turns on transmit carrier

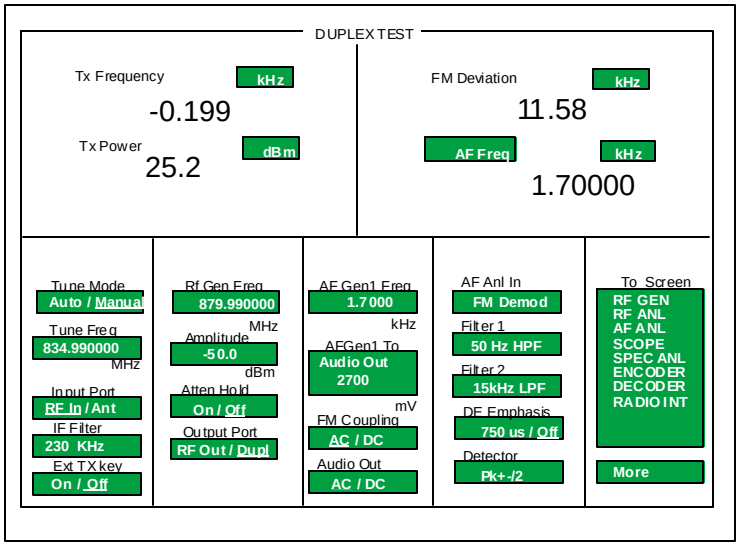
The frequency error measured on the communications analyzer must be less than ±1 kHz.

Communications Analyzer Setup:

- **Select** TX **button from the 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)

TX Maximum Deviation Test

Figure 12. TX Test Screen



Test Mode Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2, where 2 is a power level from 1 to 7.
7*0*1	Turns on transmit carrier
9*0	Turn on Compandor
6*3*4*1*0	Unmute TX Audio path, Mute RX, Select External TX Audio path

View FM Deviation for reading.

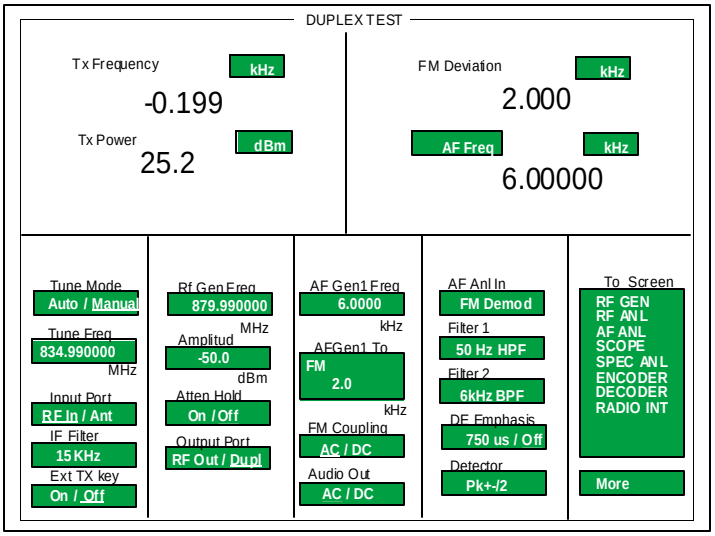
TX Maximum Deviation Pass Specifications: 9.8 kHz - 12 kHz.

Communications Analyzer Setup:

- Select **DUPLEX** button from the Screen Control panel
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **Tune freq** to **834.990000 MHz**
- Set **Input Port** to **RF In**
- Set **IF filter** to **230 kHz**
- Set **Ext TX Key** to **Off**
- Set **RF Gen Freq** to **879.990000 MHz**
- Set **Amplitude** to **-50 dBm**
- Set **Atten Hold** to **Off**
- Set **Output Port** to **Dupl**
- Set **AF Gen1 Freq** to **1.7000 kHz**
- Set **AF Gen1 To** to **Audio Out** and **2700 mV**
- Set **FM Coupling** to **AC**
- Set **Audio Out** to **AC**
- Set **AF Anl In** to **FM Demod**
- Set **Filter 1** to **50 Hz HPF**
- Set **Filter 2** to **15 kHz LPF**
- Set **DE Emphasis** to **Off**
- Set **Detector** to **Pk+-/2**

TX SAT Deviation Test

Figure 13. Call Control Screen



Test Mode Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2, where 2 is a power level from 1 to 7.
7*0*1	Turns on transmit carrier
9*0	Turn on Compandor
43*1*1	Enable 6000 Hz SAT tone
6*3*4*1*0	Unmute TX Audio path, Mute RX, Select External TX Audio path

View FM Deviation for the reading. The transponded peak SAT FM deviation should be 2 kHz ±200 Hz.

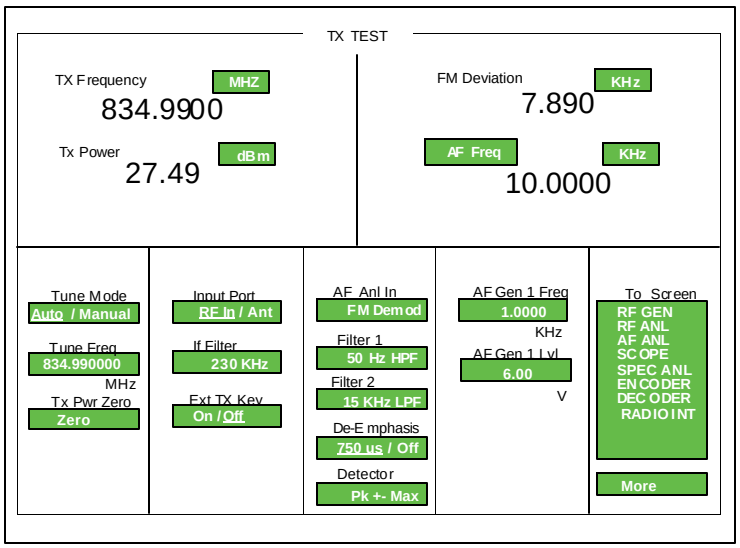
The demodulated signal on the communications analyzer should have an audio frequency of 6000 Hz.

Communications Analyzer Setup:

- Select **DUPLEX** button from the Screen Control panel
- **PWR** is measured in **dBm**
- Set **Frequency Measurement** to **auto or manual** (display will show TX Freq. Error)
- Set **Tune freq** to **834.990000 MHz**
- Set **Input Port** to **RF In**
- Set **IF filter** to **15 kHz**
- Set **Ext TX Key** to **Off**
- Set **RF Gen Freq** to **879.990000 MHz**
- Set **Amplitude** to **-50 dBm**
- Set **Atten Hold** to **Off**
- Set **Output Port** to **Dupl**
- Set **AF Gen1 Freq** to **6.0000 kHz**
- Set **AF Gen1 To** to **FM** and **2.0 kHz**
- Set **FM Coupling** to **AC**
- Set **Audio Out** to **AC**
- Set **AF Anl In** to **FM Demod**
- Set **Filter 1** to **50 Hz HPF**
- Set **Filter 2** to **6 kHz BPF**
- Set **DE Emphasis** to **Off**
- Set **Detector** to **Pk+-/2**

TX ST Deviation Test

Figure 14. TX Test Screen



Test Mode Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, set transmit frequency to 800 MHz.
45*2	Set power level to step 2, where 2 is a power level from 1 to 7.
7*0*1	Turns on transmit carrier
9*0	Turn on Compandor
3*1*0	Disables Sidetone
46*1	Enable signaling tone
6*3*4*1*0	Unmute TX Audio path, Mute RX, Select External TX Audio path

Communications Analyzer Setup:

- Select **TX** button from the 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)

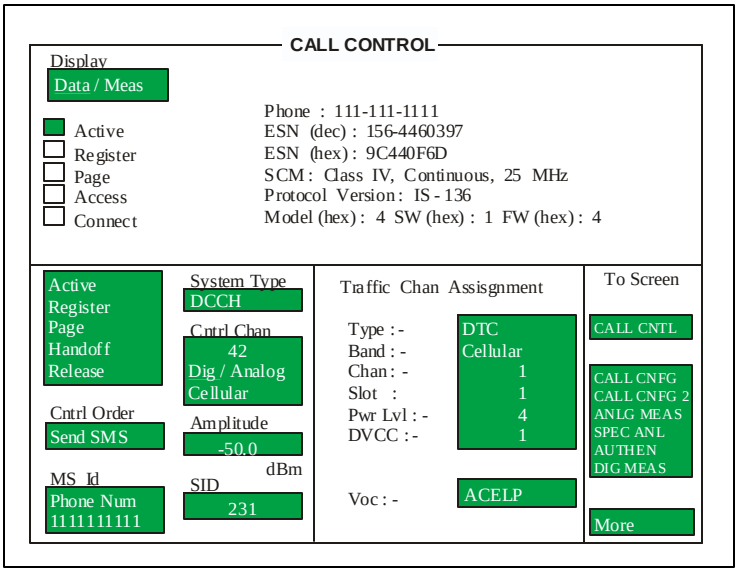
View FM Deviation for reading.

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.

Set up for TDMA Cellular call

Figure 15. Call Control Screen



Call Process

Registration

1. Put the Test Set in Active state by selecting **Active** from the list on the left side of the screen.
2. Select **Data** 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.

Select CALL CNTL from the To Screen

- Select System type: **DCCH**
- Zero the RF Power meter in the: **Call Config Screen**
- Set Amplitude to: **-50 dBm**
- Set SID: **Your phone's System ID**
- Select: **Active**
- **Traffic Channel Assignment Type:**
- Choose **DTC** to set up a Digital Traffic channel
- Type: **DTC**
- Chan: **1**
- Slot: **1**
- Pwr Lvl: **4**
- DVCC: **1**

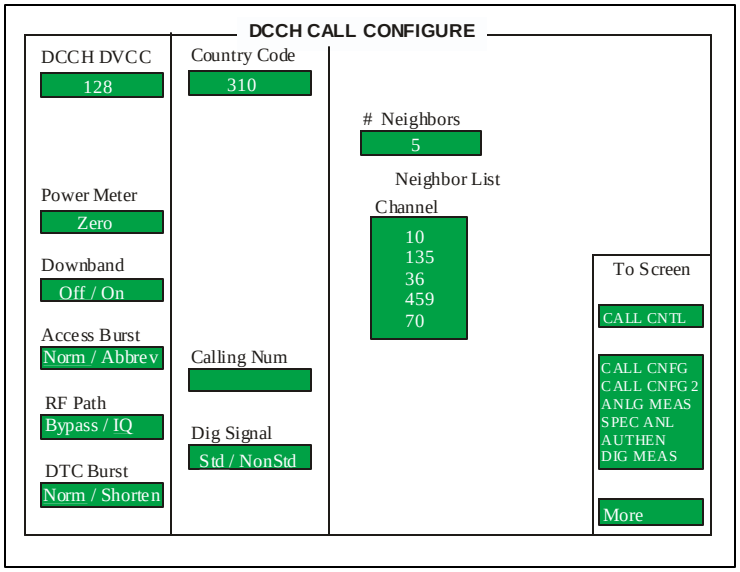
3 Answer the call by raising the flip or press SEND on the mobile to start the conversation.
4 The Connect annunciator lights. This is the Connect state. Data to be displayed is shown above.

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.

TDMA Cellular MAHO Measurements

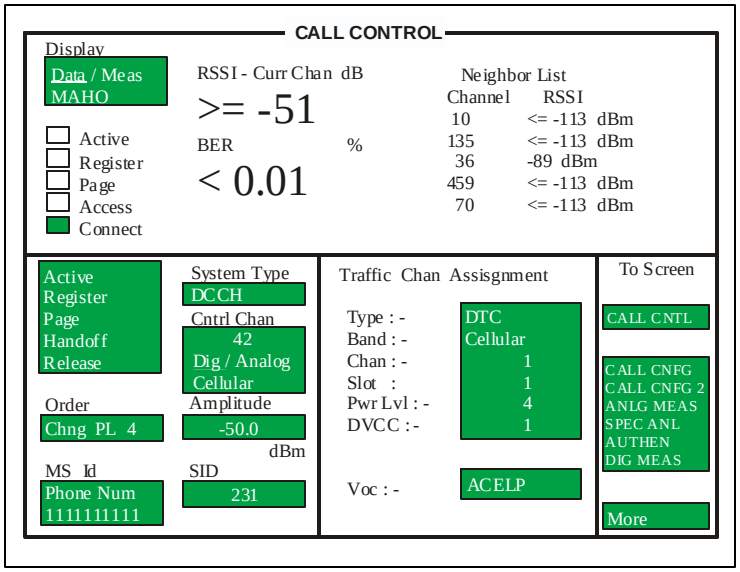
Figure 16. DCCH Call Configure Screen



Setting up the MAHO measurement

1 Select **CALL CNFG** from the CALL CONTROL's **To Screen.**
2 Set the number of neighbors (up to 6) with the field # Neighbors.
3 **Neighbor List Channel** fields ap pear below the **# Neighbors** field.
4 Set the channel number of each neigh bor channel.

Figure 17. Call Control Screen



Measuring MAHO

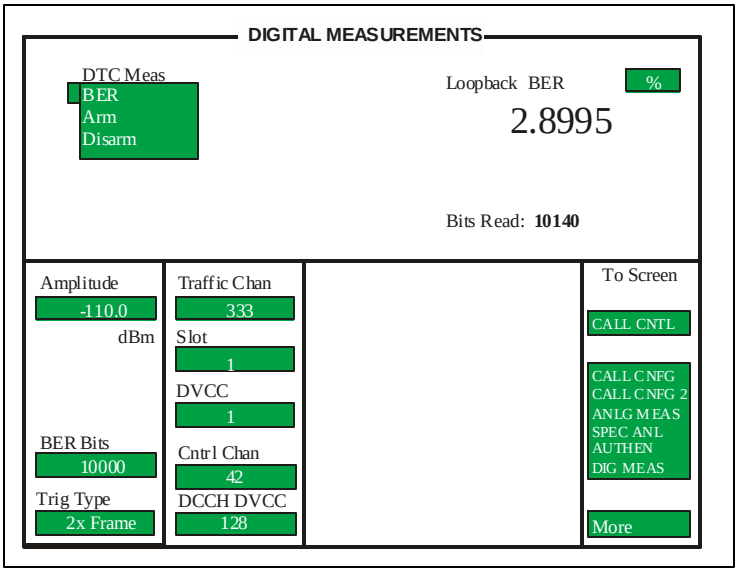
1 From **CALL CONTROL** screen, set up a call (Test Set must be in Connect mode).
2 Select **Meas** from the **Data / Meas** field.
3 Select the field that has appeared be low **Data / Meas.**
4 Select **MAHO** from the list of choices.
5 The **RSSI** and **BER** of the current channel are reported, as well as the **RSSI** of the designated neighbor chan nels.

MAHO (Mobile Assisted HandOff) is actually a measurement, not a handoff. The reported results are used by a base station to select the channel for the handoff.

The mobile performs the measurements, and then reports the results back to the base station. The mobile measures the **RSSI** of neighboring channels, as instructed by the base station. It also measures and reports the **RSSI** and **BER** of the current channel.

TDMA Cellular BER Measurements

Figure 18. Digital Measurements Screen



TDMA Cellular Mode Handset Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, sets transmit frequency to 800MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1
2822*1*0*0*0*1	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

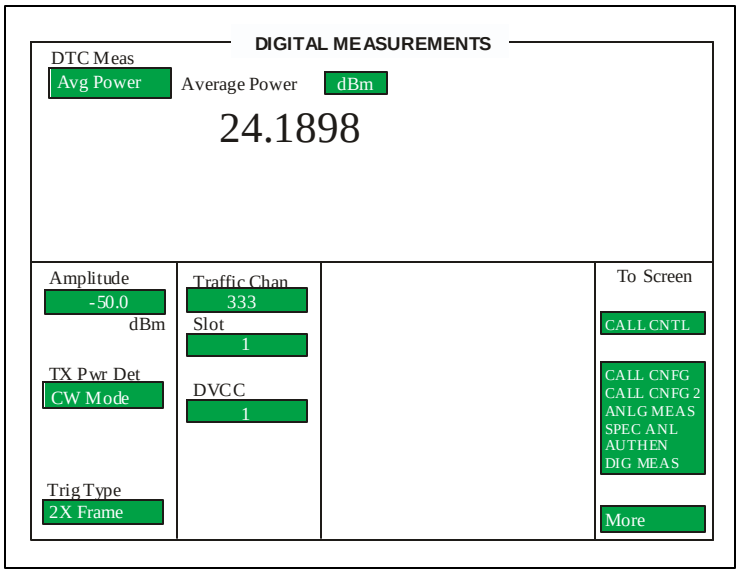
The BER measured on the communications analyzer must be less than or equal to **3%.**

BER Measurement Procedure

1. Make sure the Test Set is in Active mode.
2. Select **DIG MEAS** from the **To Screen** menu.
3. Select the **DTC Meas** field to display a list of available tests.
4. Select **BER** from the list.
5. Enter the number of bits to be measured in the **BER Bits** field. (Note: the number of bits actually read will be calculated in whole frames.)
6. **Amplitude** should be set to -110 dBm.
7. **Traffic Chan** to 333.
8. **Slot** to 1.
9. **DVCC** to 1.
10. **Cntrl Chan** to 42.
11. **DCCH DVCC** to 128.
12. Put the mobile into test mode and enter the proper test commands for **BER** reading.
13. Select **ARM**.
14. After the actual number of bits has been transmitted and received, the **BER** should be displayed.

TDMA Cellular TX Power Measurements

Figure 19. Digital Measurements Screen



Digital TX Power Out Test Procedure

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **AVG Power.**
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 Make Digital TX Power Out measure ments.

TDMA Cellular Mode Handset Commands:

54	Suspends phone
20*333*0	Loads synthesizer to chan- nel 333, sets transmit fre- quency to 800MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1

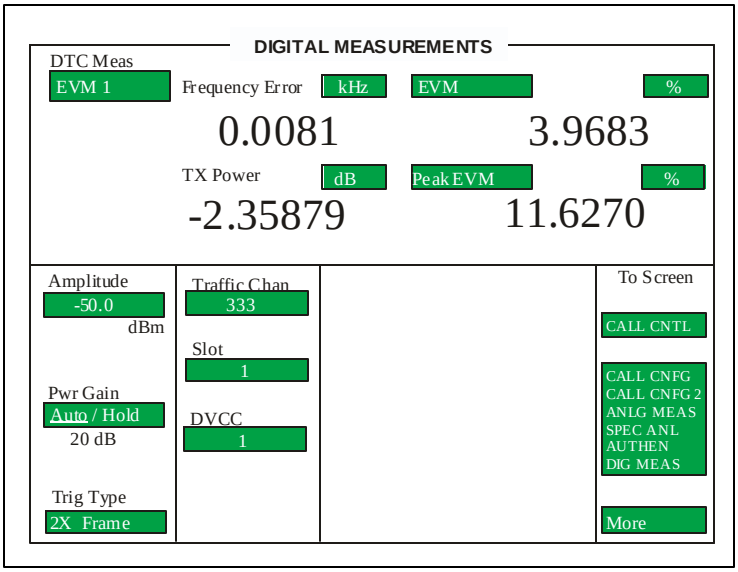
2822*1*0*0*0*0	Turns on TDMA trans- mit carrier. Note: In or- der for this command to work properly, RF con- nector must be plugged in to unit.

Max Digital TX power out should be around **26 dB** minus cable loss.

You can also use Digital Call processing to make these measurements.

TX Frequency Error Measurements

Figure 20. Digital Measurements Screen



TX Frequency Error Measurement Test

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **EVM 1**.
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 Frequency error is displayed.

TDMA Cellular Mode Handset Commands:

54	Suspends phone
20*333*0	Loads synthesizer to channel 333, sets transmit frequency to 800MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1

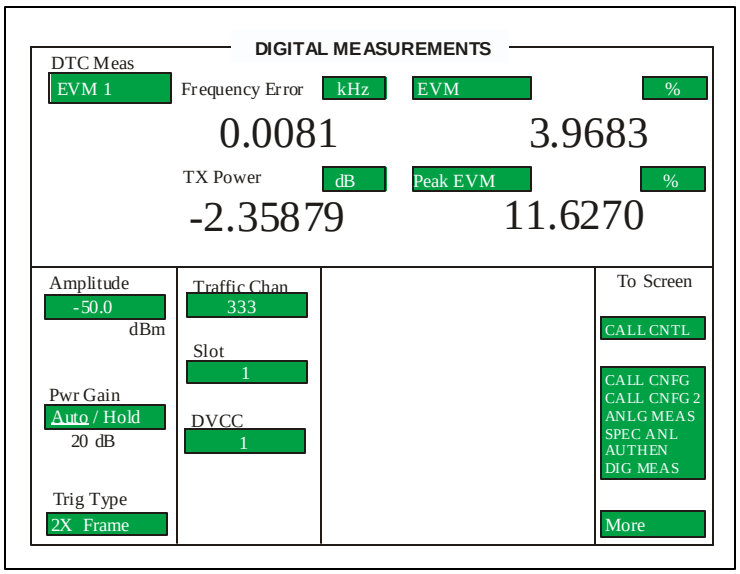
2822*1*0*0*0*0	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

The frequency error measured on the communications analyzer must be **<200Hz**.

You can also use Digital Call processing to make these measurements.

TDMA Cellular EVM Measurements

Figure 21. Digital Measurements Screen



EVM Measurement Test

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **EVM 1**. **EVM 10** can also be selected, it measures a 10 burst aver age.
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 EVM is displayed.

TDMA Cellular Mode Handset Commands:

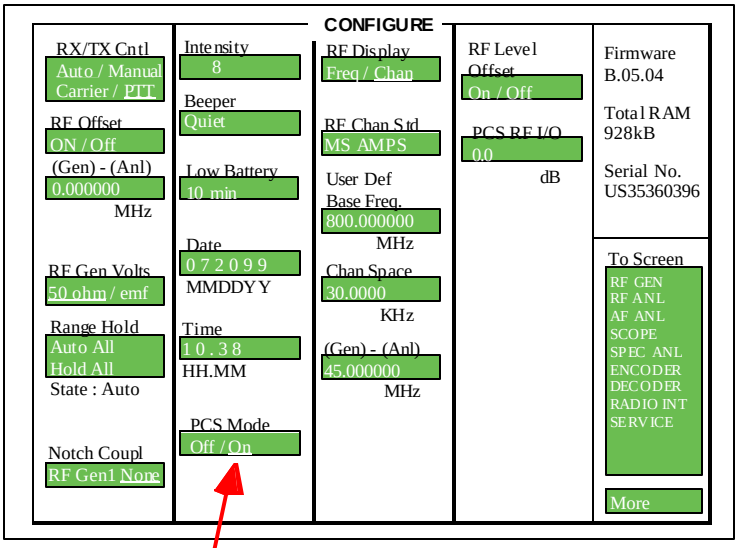
54	Suspends phone
20*333*0	Loads synthesizer to channel 333, sets transmit frequency to 800MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1
2822*1*0*0*0*0	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

The 10 burst average EVM measured should be less than or equal to **12.5%**.

You can also use Digital Call processing to make these measurements.

Setting up for TDMA PCS Measurements

Figure 22. Configure Screen

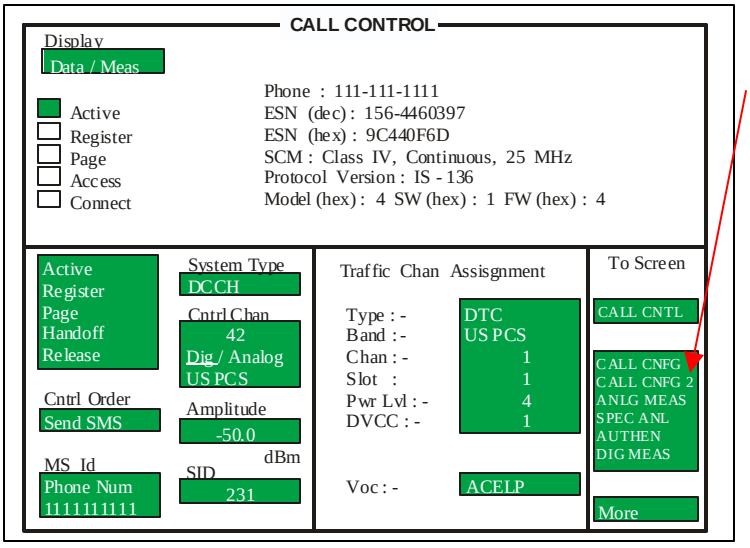


Set PC Mode to “On”

Power up the PCS Adapter, after two beeps are heard power up the 8920B

1 Go to the Configure screen on the 8920B (press blue shift key and then the Config/Duplex key).
2 Turn PCS mode to On.
3 Go to the Call Cntrl Screen by selecting More and then Call Cntrl from list.

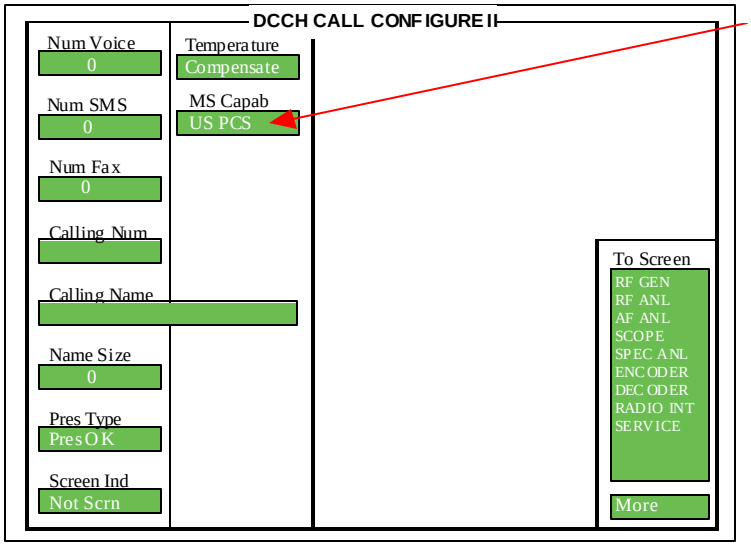
Figure 23. Call Control Screen



4 Select Call Config 2 Screen.
5 In the MS Capab field select select US PCS

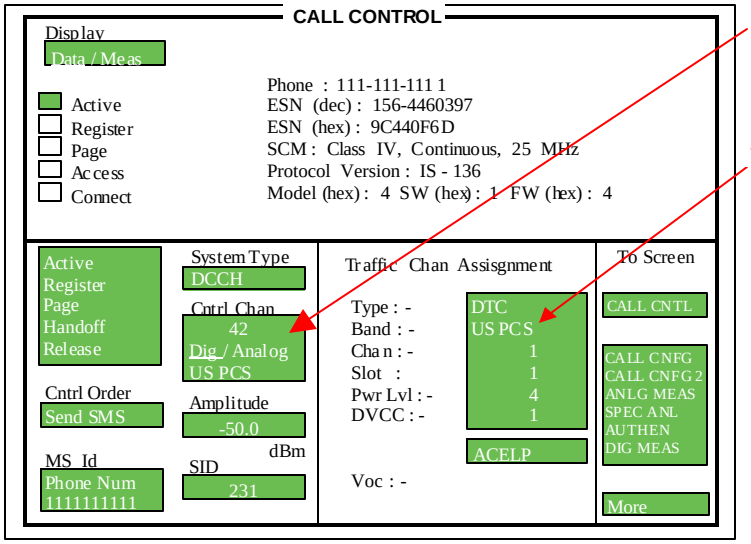
Setting up for TDMA PCS Measurements

Figure 24. DCCH Call Configure II Screen



5 In the MS Capab field select select US PCS

Figure 25. Call Control Screen

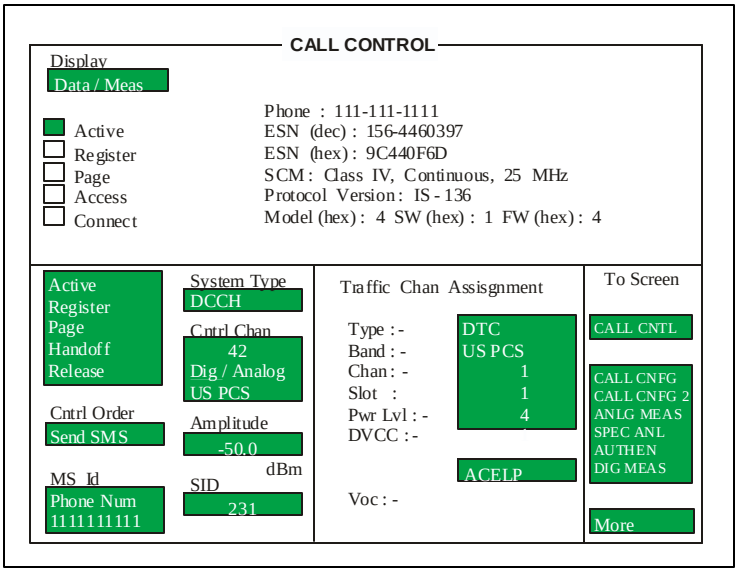


6 On the **Call Cntrl** Screen under the **Cntrl Chan** section select a digital control channel and select **US PCS** in the **Cellular / PCS** field.

7 On the **Call Cntrl** Screen under the **Traffic Channel Assignment** section in the **Band** field select US PCS.

Set up for TDMA PCS call

Figure 26. Call Control Screen



Call Process

Registration

1. Put the Test Set in Active state by selecting **Active** from the list on the left side of the screen.
2. Select **Data** 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.

Select CALL CNTL from the To Screen

- Select System type: **DCCH**
- Zero the RF Power meter in the: **Call Config Screen**
- Set Amplitude to: **-50 dBm**
- Set SID: **Your phone's System ID**
- Select: **Active**
- **Traffic Channel Assignment Type:**
- Choose **DTC** to set up a Digital Traffic channel
- Type: **DTC**
- Chan: **1**
- Slot: **1**
- Pwr Lvl: **4**
- DVCC: **1**

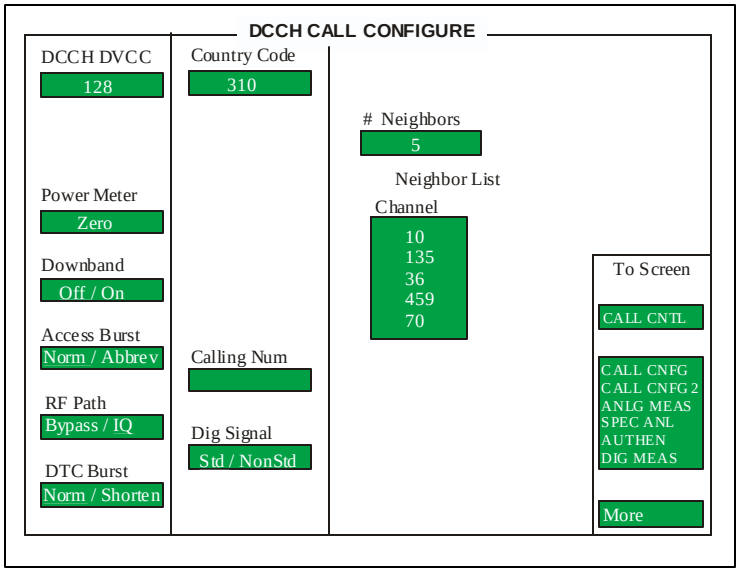
3 Answer the call by raising the flip or press SEND on the mobile to start the conversation.
4 The Connect annunciator lights. This is the Connect state. Data to be displayed is shown above.

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.

TDMA PCS MAHO Measurements

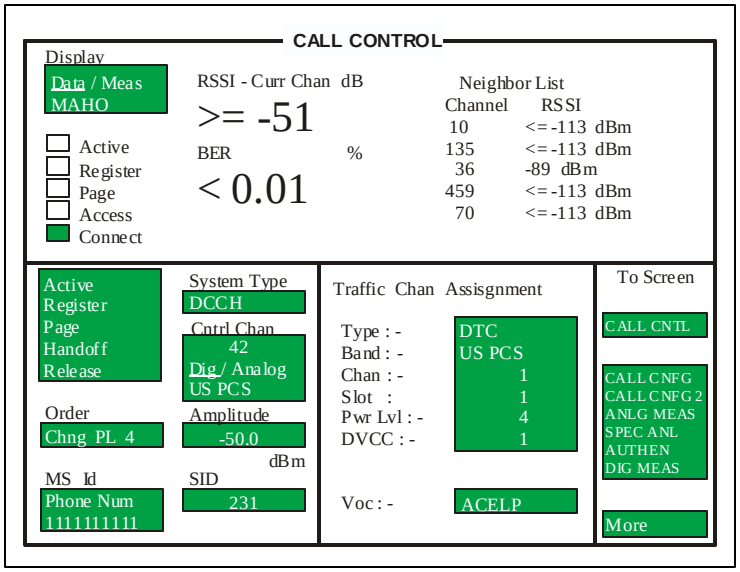
Figure 27. DCCH Call Configure Screen



Setting up the MAHO measurement

1 Select **CALL CNFG** from the CALL CONTROL's **To Screen.**
2 Set the number of neighbors (up to 6) with the field # Neighbors.
3 **Neighbor List Channel** fields ap pear below the **# Neighbors** field.
4 Set the channel number of each neigh bor channel.

Figure 28. Call Control Screen



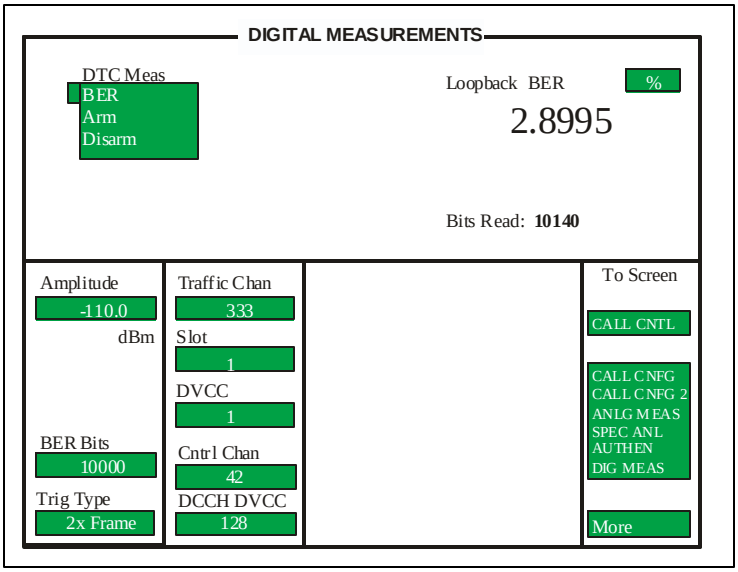
Measuring MAHO

1 From **CALL CONTROL** screen, set up a call (Test Set must be in Connect mode).
2 Select **Meas** from the **Data / Meas** field.
3 Select the field that has appeared be low **Data / Meas.**
4 Select **MAHO** from the list of choices.
5 The **RSSI** and **BER** of the current channel are reported, as well as the **RSSI** of the designated neighbor chan nels.

MAHO (Mobile Assisted Hand Off) is actually a measurement, not a handoff. The reported results are used by a base station to select the channel for the handoff. The mobile performs the measurements, and then reports the results back to the base station. The mobile measures the **RSSI** of neighboring channels, as instructed by the base station. It also measures and reports the **RSSI** and **BER** of the current channel.

TDMA PCS BER Measurements

Figure 29. Digital Measurements Screen



TDMA PCS Mode Handset Commands:

54	Suspends phone
20*333*3	Loads synthesizer to channel 333, sets transmit frequency to 1900MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1
2822*1*0*0*0*1	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

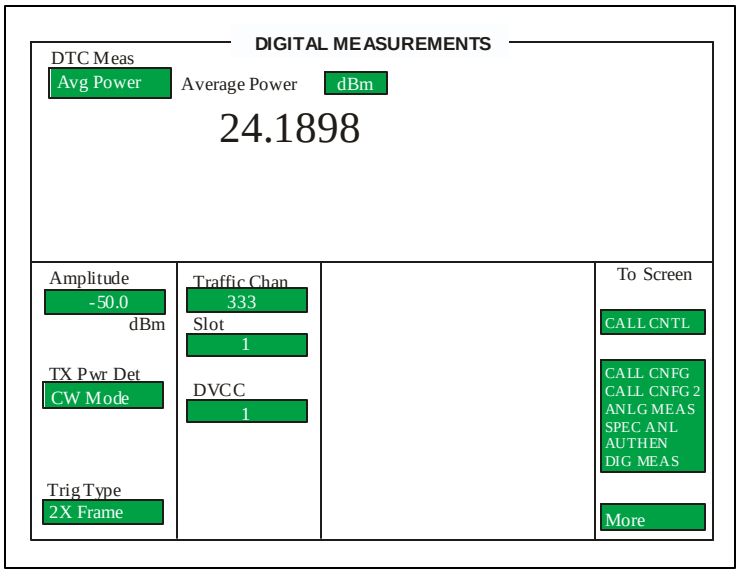
The BER measured on the communications analyzer must be less than or equal to **3%**.

BER Measurement Procedure

1. Make sure the Test Set is in Active mode.
2. Select **DIG MEAS** from the **To Screen** menu.
3. Select the **DTC Meas** field to display a list of available tests.
4. Select **BER** from the list.
5. Enter the number of bits to be measured in the **BER Bits** field. (Note: the number of bits actually read will be calculated in whole frames.)
6. **Amplitude** should be set to -110 dBm.
7. **Traffic Chan** to 333.
8. **Slot** to 1.
9. **DVCC** to 1.
10. **Cntrl Chan** to 42.
11. **DCCH DVCC** to 128.
12. Put the mobile into test mode and enter the proper test commands for **BER** reading.
13. Select **ARM**.
14. After the actual number of bits has been transmitted and received, the **BER** should be displayed.

TDMA PCS TX Power Measurements

Figure 30. Digital Measurements Screen



Digital TX Power Out Test Procedure

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **AVG Power.**
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 Make Digital TX Power Out measure ments.

TDMA PCS Mode Handset Commands:

54	Suspends phone
20*333*3	Loads synthesizer to channel 333, sets transmit frequency to 1900MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1

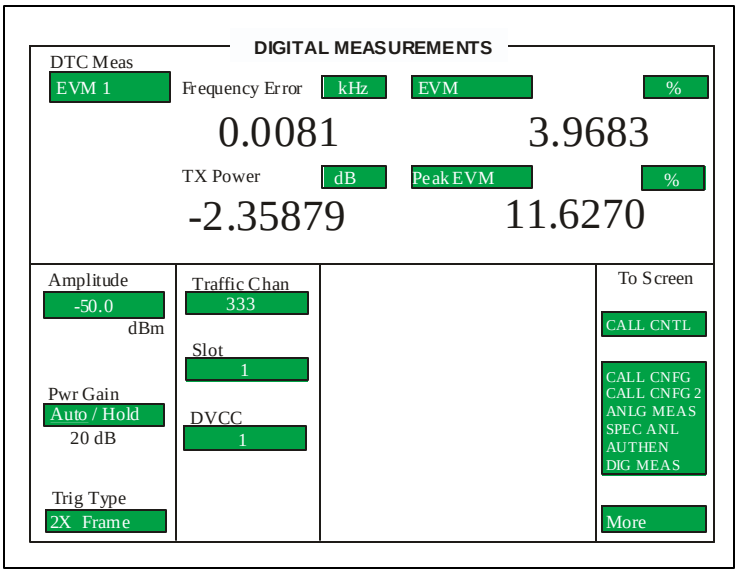
2822*1*0*0*0*0	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

Max Digital TX power out should be around **26 dB** minus cable loss.

You can also use Digital Call processing to make these measurements.

TX Frequency Error Measurements

Figure 31. Digital Measurements Screen



TX Frequency Error Measurement Test

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **EVM 1**.
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 Frequency error is displayed.

TDMA PCS Mode Handset Commands:

54	Suspends phone
20*333*3	Loads synthesizer to channel 333, sets transmit frequency to 1900MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1

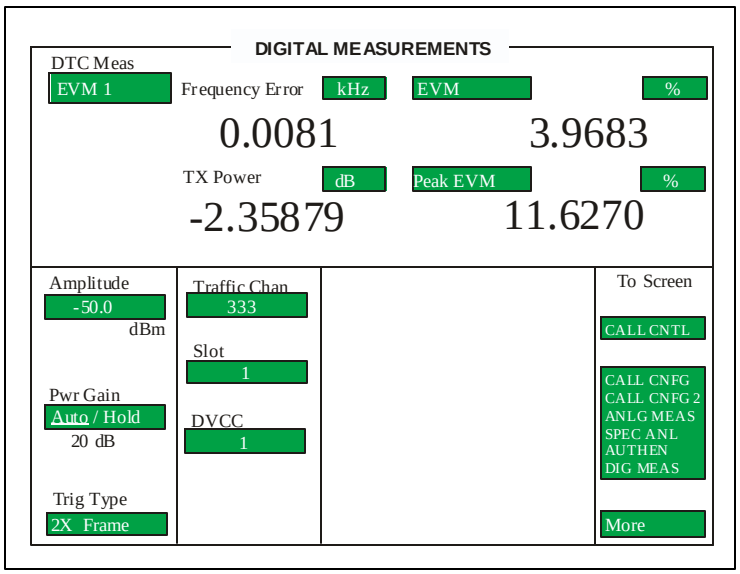
2822*1*0*0*0*0	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

The frequency error measured on the communications analyzer must be **<200Hz**.

You can also use Digital Call processing to make these measurements.

TDMA PCS EVM Measurements

Figure 32. Digital Measurements Screen



EVM Measurement Test

1 Make sure the Test Set is in Active mode.
2 Select **DIG MEAS** from the **To Screen**.
3 Select the **DTC Meas** field. This shows the **To Screen** with a list of available tests.
4 Select **EVM 1**. **EVM 10** can also be selected, it measures a 10 burst aver age.
5 **Traffic Chan** should be set to 333.
6 Put the mobile into test mode.
7 EVM is displayed.

TDMA PCS Mode Handset Commands:

54	Suspends phone
20*333*3	Loads synthesizer to channel 333, sets transmit frequency to 1900MHz.
45*2	Set power level to step 2.
2820*1	Digital mode, time slot 1

2822*1*0*0*0*0	Turns on TDMA transmit carrier. Note: In order for this command to work properly, RF connector must be plugged in to unit.

The 10 burst average EVM measured should be less than or equal to **12.5%**.

You can also use Digital Call processing to make these measurements.

Service Diagrams

Introduction

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

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

Test Point Measurements

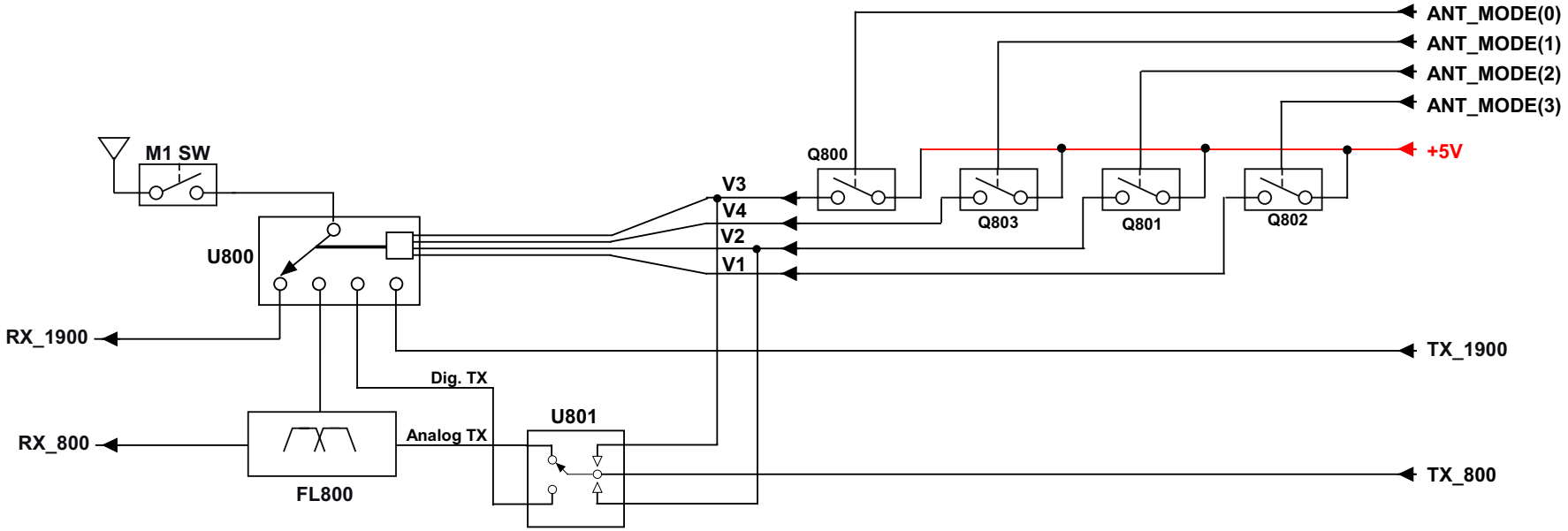
The measurements labeled on the service diagrams are approximate values and may vary slightly. These measurements are dependent on the accuracy of the test equipment.

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.

V120t: Antenna Circuit



Description

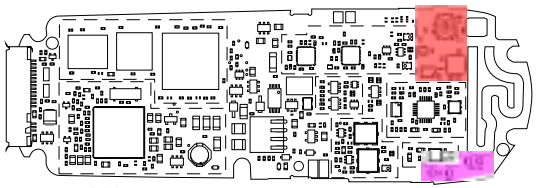
The received signal from the antenna is fed to a SP4T switch IC (U800) through antenna matching components. For 800 MHz (Cellular) band operation, the received signal is switched to the antenna port of the duplexer (FL800) in both analog and digital mode. FL800 provides a minimum of 35db attenuation at image frequencies. For 1900 MHz (PCS - Personal Communications Service) operation, the received signal is switched to the pre-selector band pass filter (FL801).

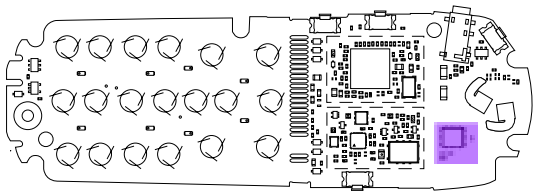
The transmitter signal in analog mode is routed to SPDT switch IC (U801) and to the SAW duplexer TX port (FL800). At the ANT port of the duplexer the signal is routed to pin 12 of SP4T switch IC (U800). In digital mode the transmitter signal is routed to SPDT switch IC (801) and then connected to pin 4 of SP4T switch IC (U800), thus bypassing the duplexer to minimize insertion loss. FL800 is used to suppress spurius emissions when transmitting in analog mode. Digital transmission doesn't require as much spurius emission suppression since it is transmitted and a higher power level.

Since U800 needs a 5V supply for the 4 port control functions, Q800 through Q803 are used to boost the control logic from 2.75V to 5V.

M1 SW is a RF tap used as an alternative antenna path which is normally used to connect RF test equipment.

V120t: Antenna Circuit





800 MHz

Analog	Digital
RX	RX
D -35.6dBm	-36.17dBm
E -34.8dBm	-24.6dBm

1.9 GHz

RX	TX
C -36.86dBm	13.23dBm

Troubleshooting Configuration	Page
Analog RX	6-3
Analog TX	6-5
Digital RX(800/1900)	6-2
Digital TX(800/1900)	6-4

	Analog 800 MHz		Digital 800 MHz		PCS 1.9 GHz	
	RX	TX	RX	TX	RX	TX
A	-35.03dBm	15.69dBm	-25.3dBm	16.4dBm	-26.11dBm	8.46dBm

800 MHz

Analog	Digital
TX	TX
B 15.1dBm	18.44dBm

	Dig TX 800MHz	Dig TX 1900MHz
ANT_MODE(0)	0Vdc	1.1Vdc
ANT_MODE(1)	2.67Vdc	0Vdc
ANT_MODE(2)	0Vdc	0Vdc
ANT_MODE(3)	0Vdc	1.53Vdc
F	0.63Vdc	2.68Vdc
G	5.5Vdc	0.56Vdc
H	0.75Vdc	0.52Vdc
I	0.6Vdc	3.36Vdc

RX_800 page 5-5

FL800

C800

C810

C813

TX Analog

L801

L901

C902

L900

C500

C807

M1

C803

TX_800 page 5-27

U801

C811

TX Digital

C802

C808

V1 V4 V2 V3

U800

TX_1900 page 5-27

C801

FL801

RX_1900 page 5-5

C805

C806

C804

Q802

R800

Q801

R801

Q800

Q803

R803

R802

5.51Vdc

+5V page 5-33

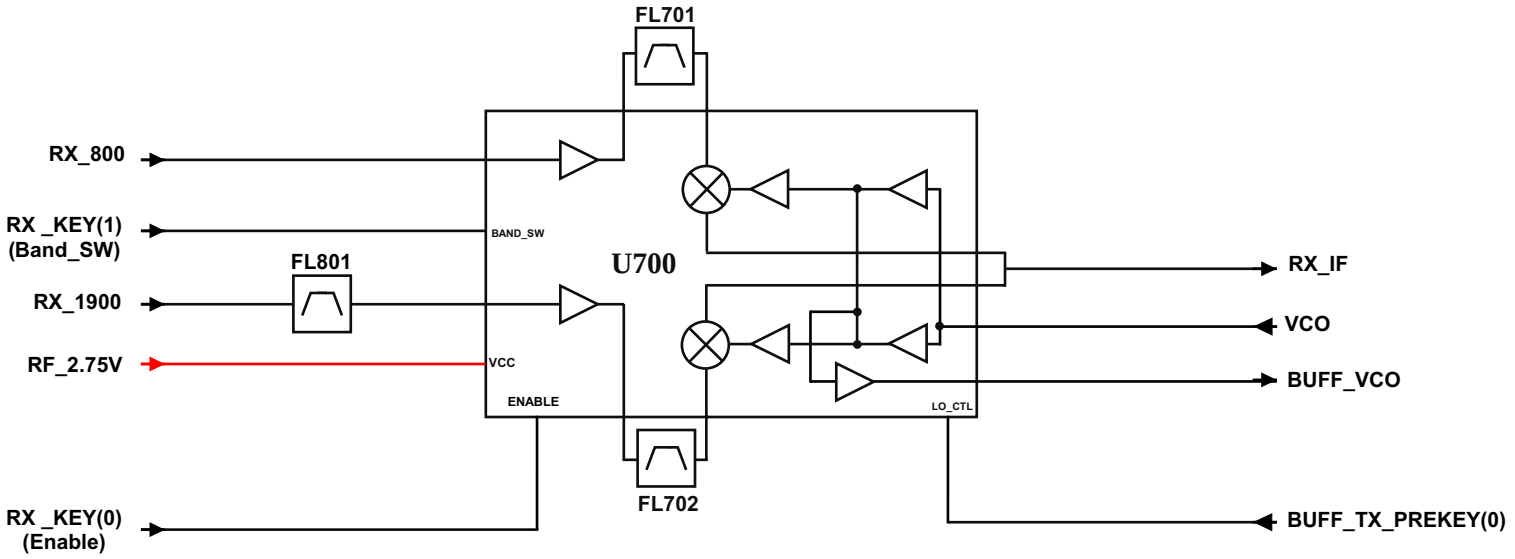
ANT_MODE(3) page 5-11

ANT_MODE(2) page 5-11

ANT_MODE(0) page 5-11

ANT_MODE(1) page 5-11

V120t: Front End IC



Description

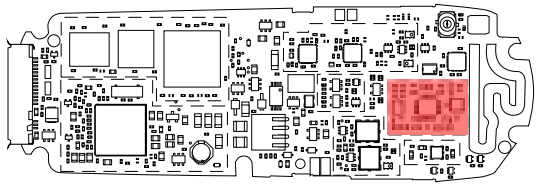
The received signal in PCS mode is switched to the pre-selector band pass filter (FL801). It is then fed to the 1900 MHz LNA (U700). FL801 provides minimum of 35 dB attenuation at image frequencies. The U700 is a front end IC that contains two sets of LNA and mixer, and VCO buffer amplifiers for dual band operation.

The 800 MHz receive signal is further filtered through the SAW band pass filter (FL701) for image rejection and LO leakage attenuation. The 1900 MHz receive signal similarly is filtered through FL702 before being fed to the mixer.

The 800 MHz and 1900 MHz mixers down-convert the receive signal to the IF frequency of 112.32 MHz. Both mixers are of single-ended Gilbert cell design, and typically require a LO input level of -10 dBm for 800 MHz and -3 dBm for 1900 MHz at the LO input of U700 respectively. The LO signals for the mixers are 112.32 MHz above the receiver channel frequencies, and mixer outputs are combined to a single output at pin 3 of U700 to be fed to a 112.32 MHz two-pole fundamental crystal filter (FL700) through the matching components. Primary function of FL700 is to improve IIP3 of the IF preamplifier and direct conversion mixer of the backend IC, U400, for the two-frequency offset combination of 60 & 120 kHz and 120 & 240 kHz.

RX_KEY(1) selects the band operating mode of U700. RX_KEY(0) enables or disables U700 during digital slot mode operation. BUFF_TX_PREKEY(0) controls the BUFF_VCO signal output which is used for frequency upconversion in the transmitter circuits.

V120t: Front End IC



RX Analog: 2.76Vdc
RX Digital: 3Vpp square-wave
RX PCS: 3Vpp square-wave

RX_KEY(0)
(Enable)
page 5-43

RX_800
page 5-3

RX_1900
page 5-3

RF_2.75V
page 5-33

2.68V

RX PCS
-22dBm

RX Analog: -34.7dBm
RX Digital: -35.79dBm

RX Analog: -11dBm
RX Digital: -13.99dBm

RF_2.75V
page 5-33

C726
C724
C723
R703
C722
C721
C715
C718
C716
L703
L706
C725
L705
L704
C720
C717
C729
C730
C727

Digital TX(800) on:
2.8Vpp
Setup:1V@10mS
Analog TX on: 2.65Vdc
Analog TX off: 0Vdc

BUFF_TX_PREKEY(0)
page 5-29

RX PCS
-18.56dBm

FL702

U700

C719

FL701

RX Analog: -12dBm
RX Digital: -16.53dBm

RX PCS
-26.3dBm

RX_KEY(1)
Band_SW
page 5-43

800: 0V
1900: 2.77V

C713
C714
C711
C710
C704
R705
C702

RX_KEY(0)
(Enable)
page 5-43

Analog: -14.3dBm
Digital: -20.7dBm
PCS: -25.5 dBm

VCO
page 5-9

C712
R701
C706
C707
L702
C708
L701
C701
C703

Analog: -14.29 dBm
Digital: -15.5dBm
PCS: -19.32dBm

TX_LO
page 5-7

RF_2.75V
page 5-33

2.68V

-7.96dBm
112.32MHz

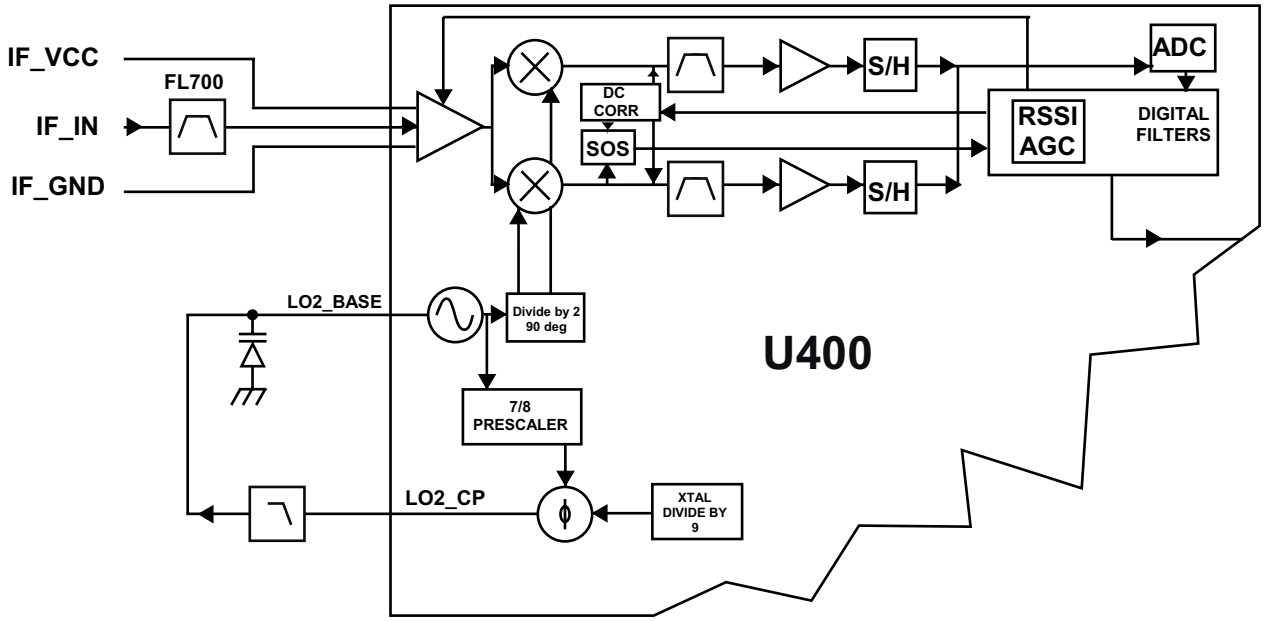
2.68V

RF_2.75V
page 5-33

RX_IF
page 5-7

Troubleshooting Configuration	Page
Analog RX	6-3
Analog TX	6-5
Digital RX(800/1900)	6-2
Digital TX(800/1900)	6-4

V120t: RX Back End Circuit



Description

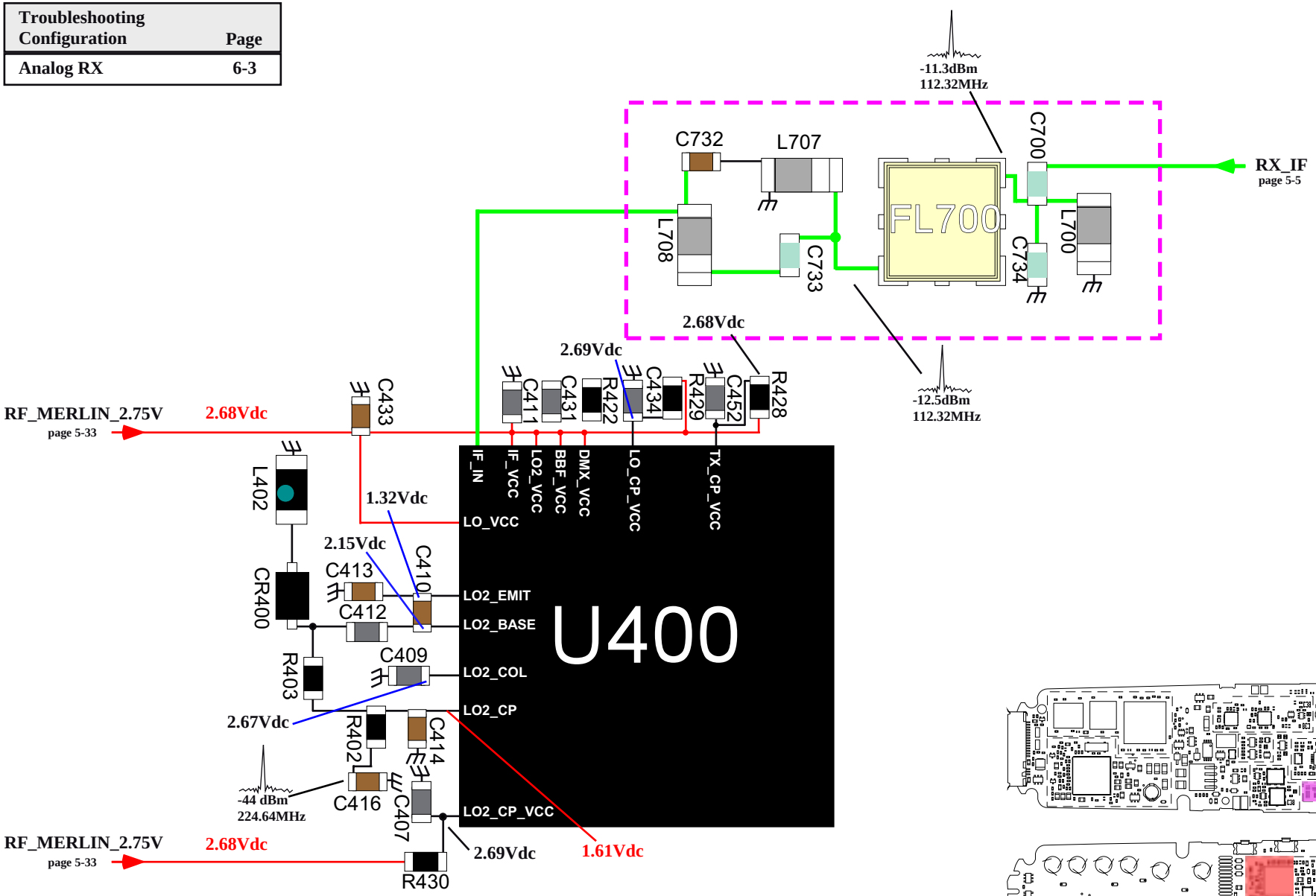
The custom IC (U400) contains the receiver back end. The back end section contains IF step attenuator, preamp with AGC, quadrature down mixers, square-root-raised-cosine, programmable bandwidth IF filter and ADC on I and Q at 4x the symbol rate (24.3 kHz). The receive signal is first amplified/attenuated by the AGC preamp, followed by a down-conversion in quadrature to approximately 0 Hz for IS-136 and 100 Hz for AMPS. Quadrature LO generation is accomplished by means of operating the VCO at twice the desired frequency and division by 2 on chip. The quadrature signals are then filtered with 5-pole active baseband filters to provide channel selectivity. Information from a sum of squares detector at the input to the filter is combined with input from a peak detector at the digitized output to form a composite AGC signal. The filtered AGC signal controls preamp gain and ensures all desired and undesired signals stay within the dynamic range of the baseband filters. DC correction of the baseband output is accomplished by digital filtering of I/Q samples and applying a correction signal to the baseband input. The peak detected output and AGC output are used to generate a digital RSSI signal which is transferred to the Dual Core Processor (U1002) on a serial bus as a 10-bit word.

The baseband filter shape and bandwidth is maintained through the means of an integrated PLL (Phase Lock Loop) with feedback to the filter components. Dual sample and hold circuits clocked at 97.2 kHz capture the I and Q baseband state at the same instant in time for quantization by a single multiplexed 10 bit ADC. These samples are then digitally highpass filtered and transferred to the Dual Core Processor by means of a serial interface for decoding or FM demodulation.

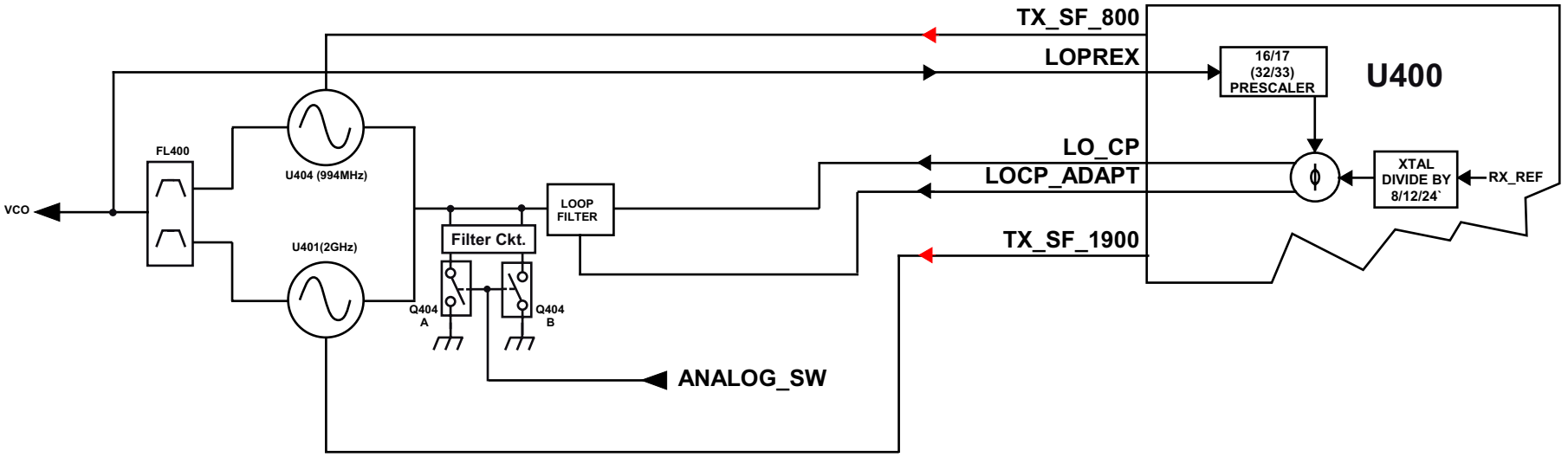
The RX second LO synthesizer is also internal to U400 except for the VCO tank and the loop filter. The synthesizer is a fractional-N type with digital modulation capability. Digital modulation is used to provide AFC (Automatic Frequency Control) for the receiver.

V120t: RX Back End Circuit

Troubleshooting Configuration	Page
Analog RX	6-3



V120t: Main Local Oscillators (VCO)



Description

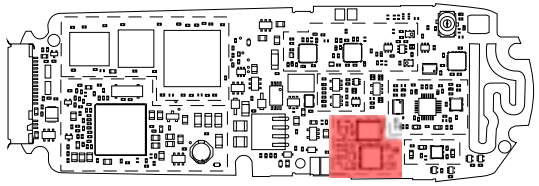
The main synthesizer is part of U400 and is programmable via the SPI interface. U404 is a VCO module that covers the frequency range of 981 MHz to 1007 MHz for the 800 MHz mode, and another VCO module, U401, covers the frequency range of 2007 MHz to 2102 MHz. Both VCOs are powered by a Super Filter DC supply. The VCO control voltage range is 0.39 volts to 2.3 volts.

A 6 dB pad is added at the output of U404. This pad is to equalize both receiver downconverter and transmitter upconverter LO input level with PCS band due to trace loss and lower gain in VCO buffer circuits in U700. Both outputs from U401 and U404 are combined through a diplexer, FL400 and fed to pin 7 of U700. Typical output level out of both VCOs is 0 dBm. The tapped signal is returned to the prescaler of U400.

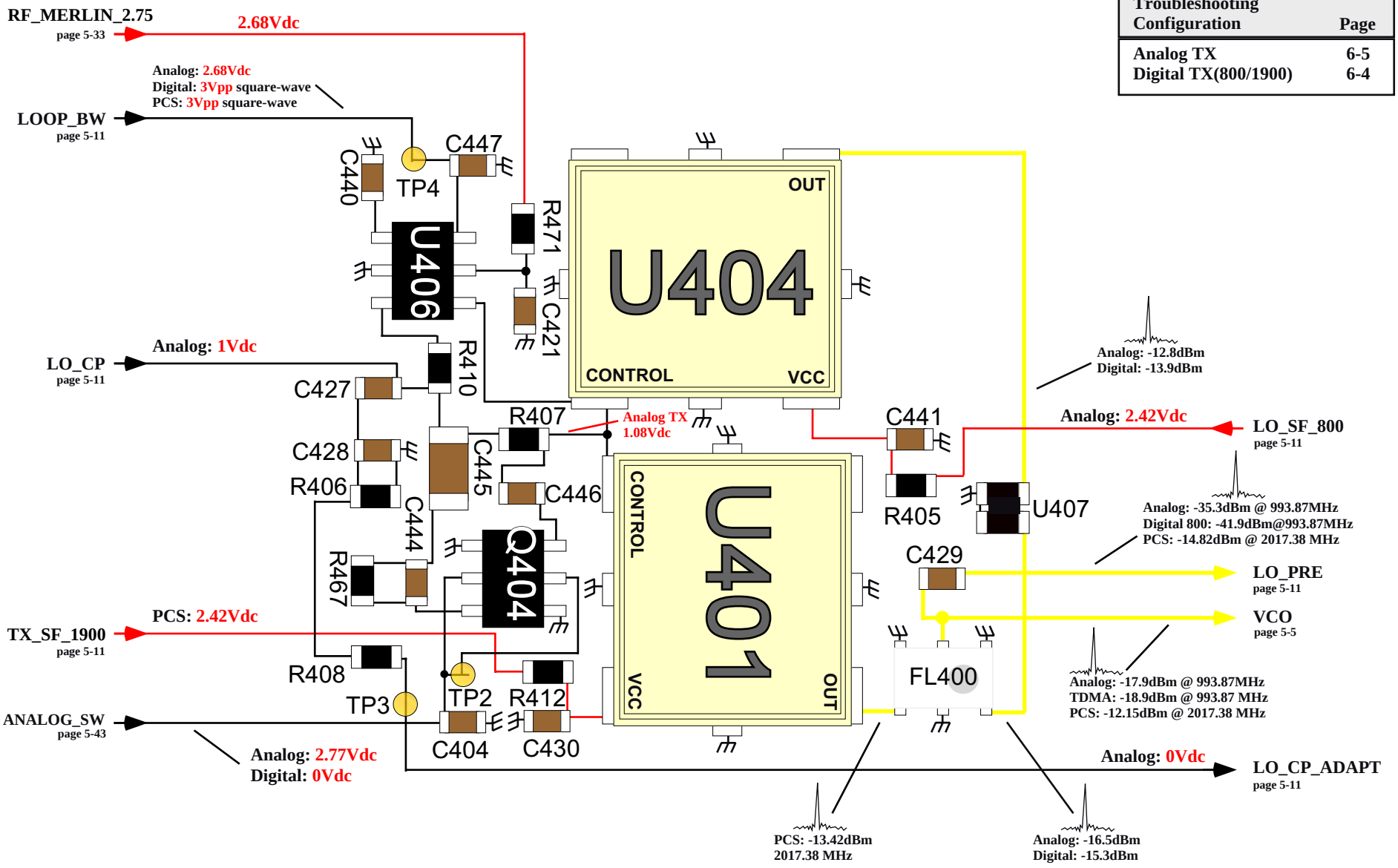
The loop filter consist of C427, C428, C444, C445, C446, C440, R406, R407, R408, R410, R467, U406 and Q404. In analog mode where lock time is not as demanding as digital mode, Q404 switches in additional poles by activating C444, C445, C446 and R467 to improve phase noise and spurious levels. In digital mode where lock time is very critical, Q404 disables those 4 components. The synthesizer IC, U400, allows dual bandwidth for each operating mode by providing two charge pump gain settings.

In analog mode, a fast VCO lock time is not required, therefore ANALOG_SW is used to suppress spurius emissions while in Analog mode.

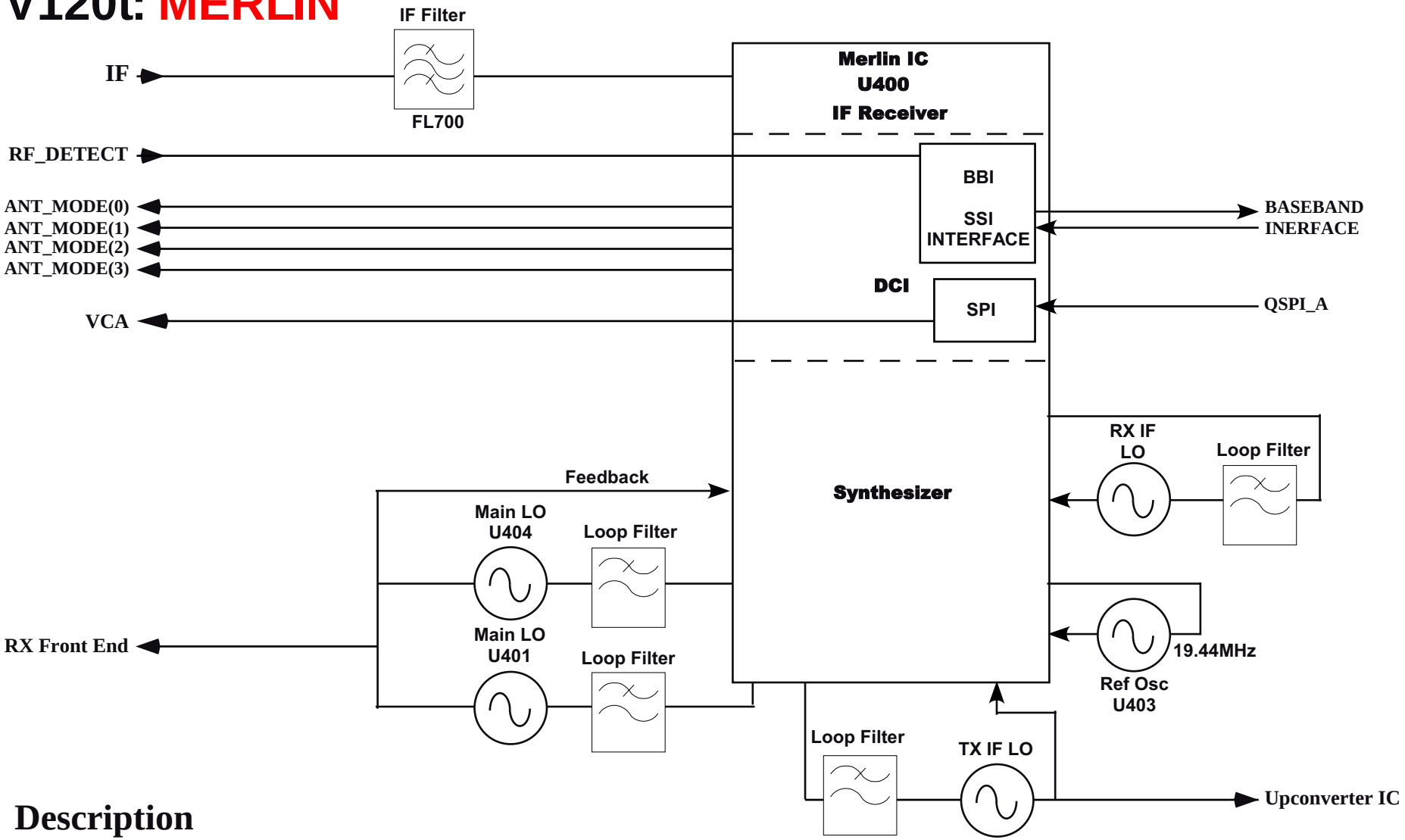
V120t: Main Local Oscillators (VCO)



Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4



V120t: MERLIN



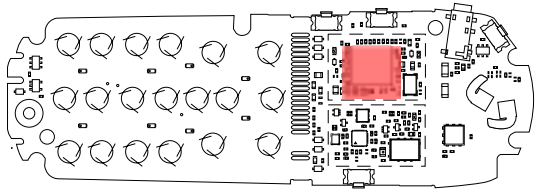
Description

The Merlin IC(U400) combines the functions of an IF receiver, three fractional division PLL synthesizers, a crystal based reference oscillator, two supply superfilters, AOC ADC and DAC, and a linear modulator including a I/Q DACs. All functions are controllable through an addressable SPI interface.

The Merlin QSPI Interface is a synchronous write-only serial interface that is used to configure and control Merlin. The Merlin SSI Interface is a bi-directional synchronous serial interface that is used to pass I/Q/RSSI/AOC data between Patriot and Merlin.

The ADCs consist of the ANT_MODE lines,TX_KEY, TX_PREKEY, and TX_PREKEY(0). The Automatic Output Control(AOC) loop consists of RF_DETECT.

V120t: Merlin



ANT_MODE(0) page 5-3
ANT_MODE(1) page 5-3
ANT_MODE(2) page 5-3
ANT_MODE(3) page 5-3
RF_MRLN_2.75V page 5-33
RF_DETECT page 5-27
WP_DAC page 5-29
MRLN_TX_KEY page 5-15,5-27
PA_MODE page 5-XX
TX_PREKEY(0) page 5-29
LOOP_BW page 5-9
RESET page 5-39
V3 page 5-33
TX_IQ_EN page 5-43

C451
R441
C436
C442
R419
C408
R420
C415
C406
L401
C457
R409
C454
L406
C402
2.39Vdc
2.70V
2.70V

ADC_VCC
TX_STEP
CELL_EN
ACP_EN
CELL_RX_EN
VAG_REF
TX_KEY
TX_PREKEY
ANALOG_EN
PCS_RX_EN
RESETX
DIG_LO_VDD
DIG_HI_VDD
REF_VCC
SF_SUPPLY
SF_BYPASS
LOGIC_CLK

U400

•BBP_CLK
•BBP_MERLIN_RD
•BBP_MERLIN_TD
•BBP_FS
BASEBAND INTERFACE page 5-43

TX_SF_1900 page 5-9
LO_SF_800 page 5-9
MERLIN_19.44MHz page 5-43
XOSC_BASE page 5-29

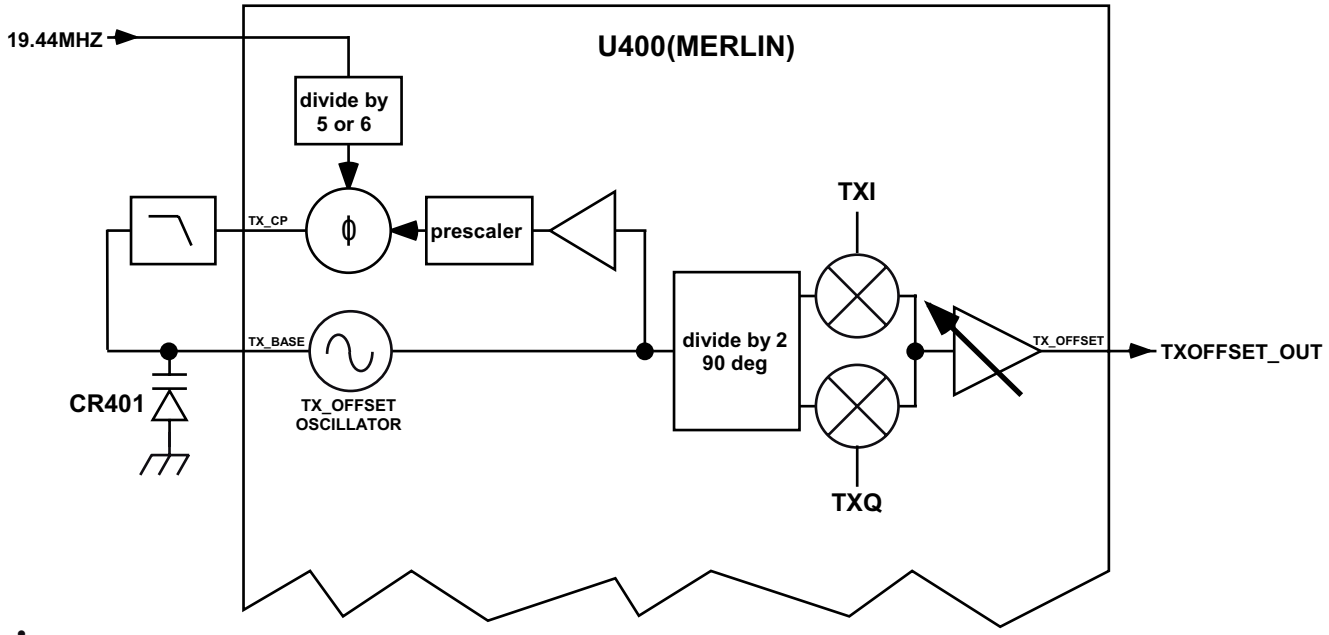
•MERLIN_SPI_DATA
•MERLIN_SPI_CLK
•MERLIN_SPI_CS
QSPI_A page 5-43

RF_MRLN_2.75V page 5-33

2.88Vpp
Setup:1V@10mS

Troubleshooting Configuration	Page
Digital TX(800/1900)	6-4

V120t: TX Offset Oscillator

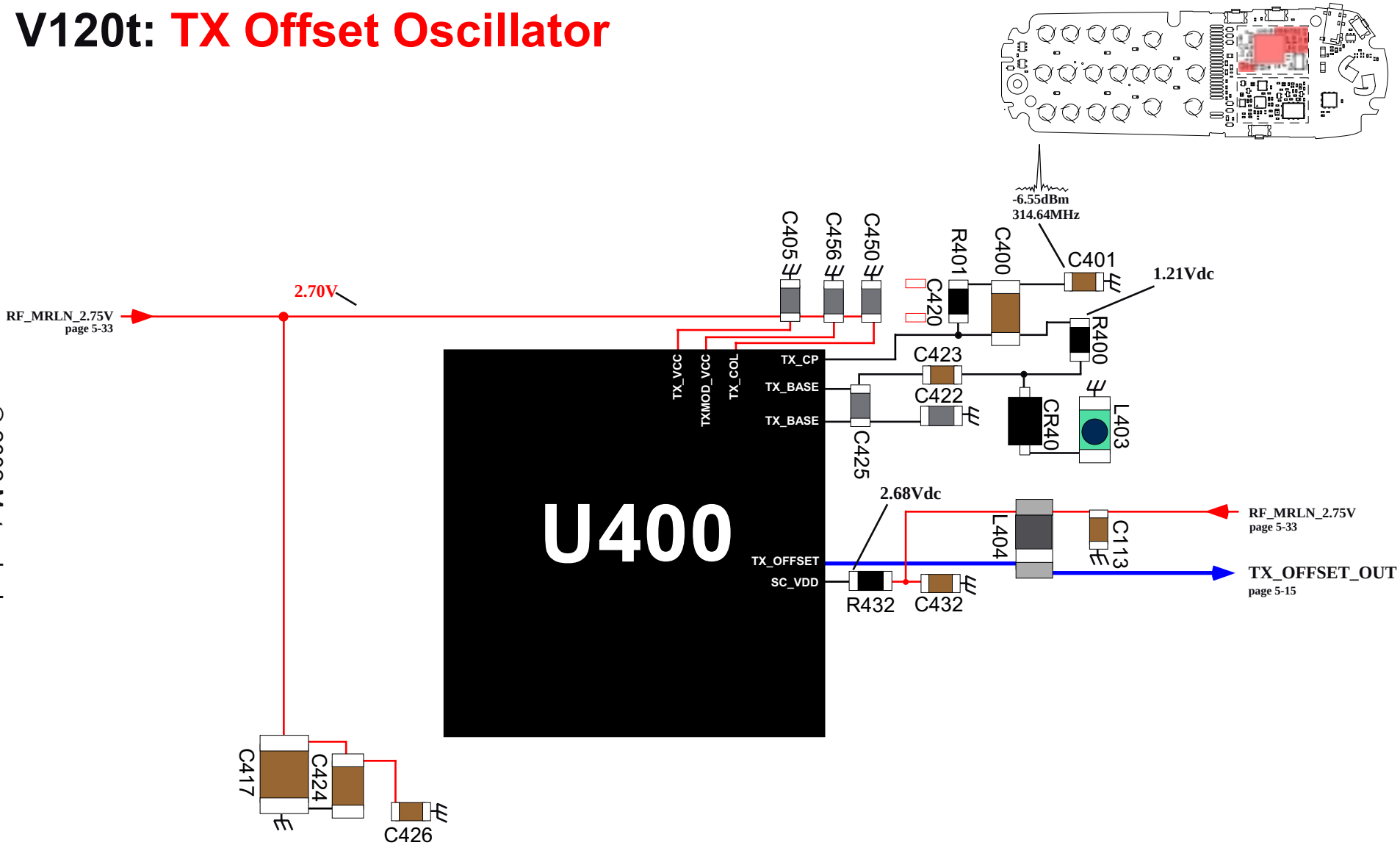


Description

The TX IF synthesizer is totally internal to U400 except for the VCO tank and the loop filter. The synthesizer is a fractional-N type with digital modulation. The quadrature outputs of the TX LO serve as the LO for the I/Q modulator. When the outputs of the mixers are summed, the resulting carrier is linearly modulated both with respect to phase and amplitude. Modulation sensitivity is controlled by an SPI bit to enable the use of a divided-by-two quadrature generator.

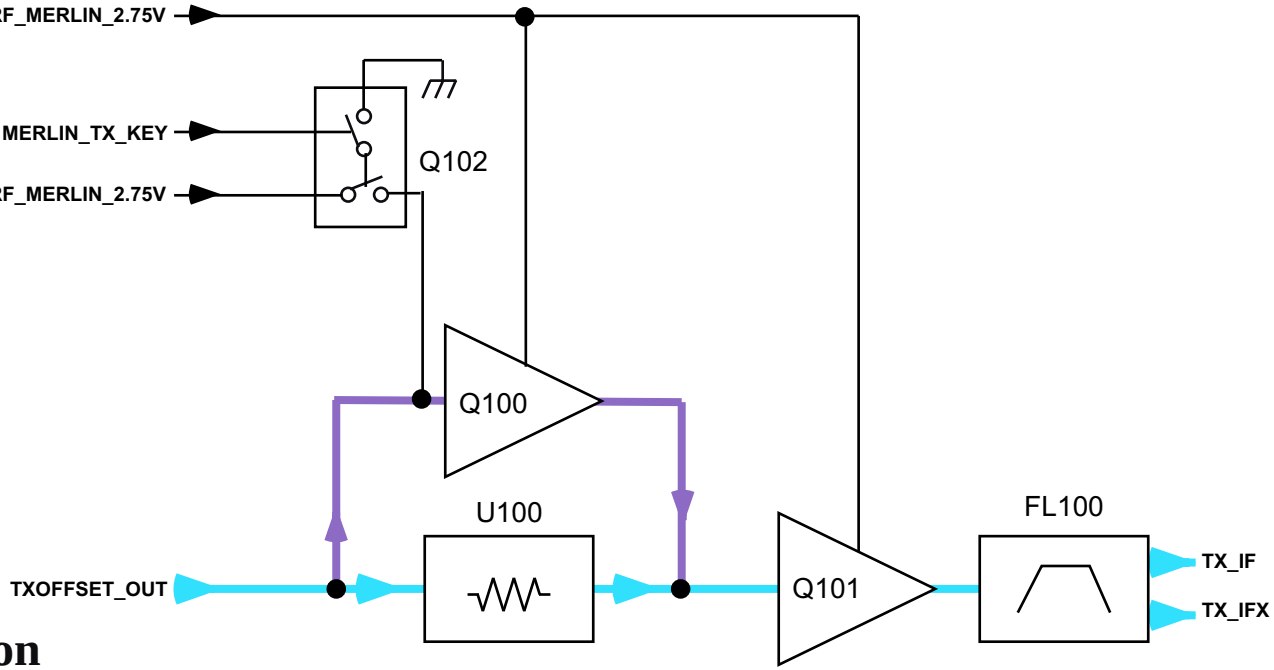
For the 800 MHz band, the transmitter carrier frequency is generated by mixing the main LO signal with the offset VCO signal (TX IF) that is tuned to 157.32 MHz. In analog mode, I/Q signals are used to generate frequency modulation in the custom IC, U400. In digital mode, the I/Q signals are fed to I/Q modulator to provide p/4DQPSK. After passing through a variable attenuator(used for power step control) and a buffer amplifier in U400, the TX IF signal is fed to an external one-bit discrete attenuator. The TX IF output signal out of U400 ranges 0 dBm (-3 dBm for digital mode) to -45 dBm for analog mode (-48 dBm for digital mode). However, the usable linear range is typically less than 30 dB.

V120t: TX Offset Oscillator



Troubleshooting Configuration	Page
Digital TX(800)	6-4

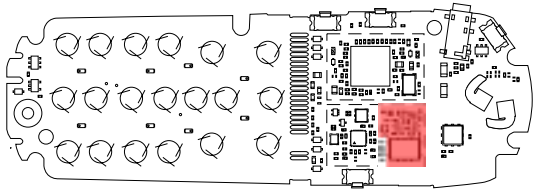
V120t: Attenuator/Amplifier



Description

The external 16 dB attenuator (Q100) improves linear dynamic ranges to nearly 45 dB. The loss through the attenuator is made up through the IF amp, Q101. The typical power output out of U400 for Power Level 0 through 2 is -7 dBm. The attenuator is switched in between Power Level 7 and 10 to re-use the linear range of TX IF signal. The switching mechanism consists of Q102 and the MERLIN_TX_KEY. The TX IF signal after Q101 is filtered by the 157.32 MHz SAW filter (FL100) to attenuate noise at 20 MHz to 60 MHz away from the signal and spurious signals.

V120t: Attenuator / Amplifier



TXOFFSET_OUT
page 5-13

MERLIN_TX_KEY
page 5-11

RF_MERLIN_2.75V
page 5-33

TX_IFX
page 5-17

TX_IF
page 5-17

RF_MERLIN_2.75V
page 5-33

BUFF_TX_PREKEY(0)
page 5-29

C403 U100 C105 R107 C110 L100 C109 C106 C101 C104 R111 R110 R108 Q100 Q101 Q102 R109 C102 R102 R101 L101 C111

FL100

A

PS2:.788Vdc
PS7: 0Vdc

B

PS2: 1.6Vdc
PS7: 0Vdc

PS2: 2.66Vdc
PS7: 0Vdc

2.68Vdc

.6Vdc

.137Vdc

2.66Vdc

Analog: -4.95dBm @ 157.32MHz
TDMA: -6.76dBm @ 157.32MHz
PCS: -2.06dBm @ 157.32MHz

Digital TX(800) on:
2.8Vpp
Setup:1V@10mS

Analog TX on: 2.65Vdc
Analog TX off: 0Vdc

PS2: 0.885Vdc
PS7: 0Vdc

Analog: -10.1dBm @ 157.32MHz
TDMA: -22.61dBm @ 157.32MHz
PCS: -11.24dBm @ 157.32MHz

A

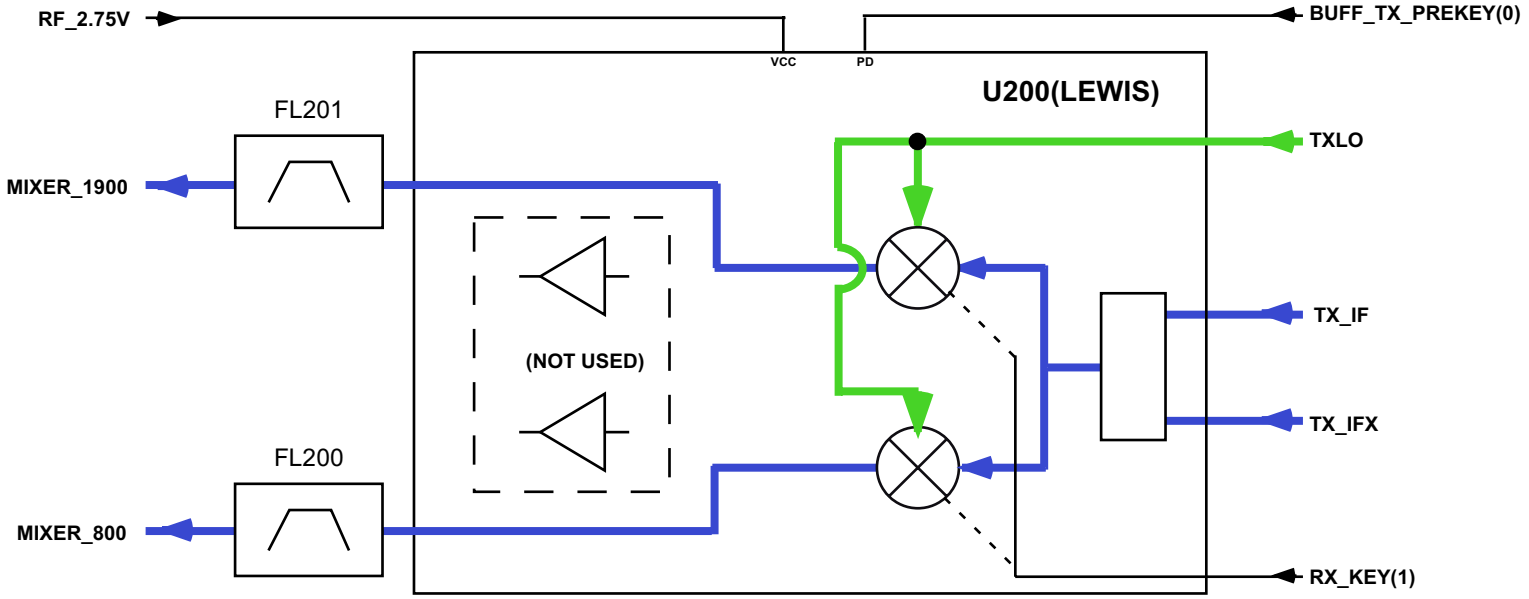
Analog PS2: -16.99dBm @ 157.32MHz
Analog PS7: -37.81dBm @157.32MHz
TDMA PS2: -19.81dBm @ 157.32MHz
TDMA PS7: -41.87dBm @ 157.32MHz
PCS PS2: -15.35dBm @ 157.32MHz
PCS PS7: -33.1dBm @ 157.32MHz

Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4

B

Analog PS2: -16.75dBm @ 157.32MHz
Analog PS7: -22.93dBm @ 157.32MHz
TDMA PS2: -18.06dBm @ 157.32MHz
TDMA PS7: -25.82dBm @ 157.32MHz
PCS PS2: -12.73dBm @ 157.32MHz
PCS PS7: -19.36dBm @ 157.32MHz

V120t: Upconverter (LEWIS)



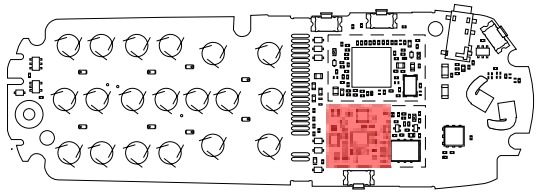
Description

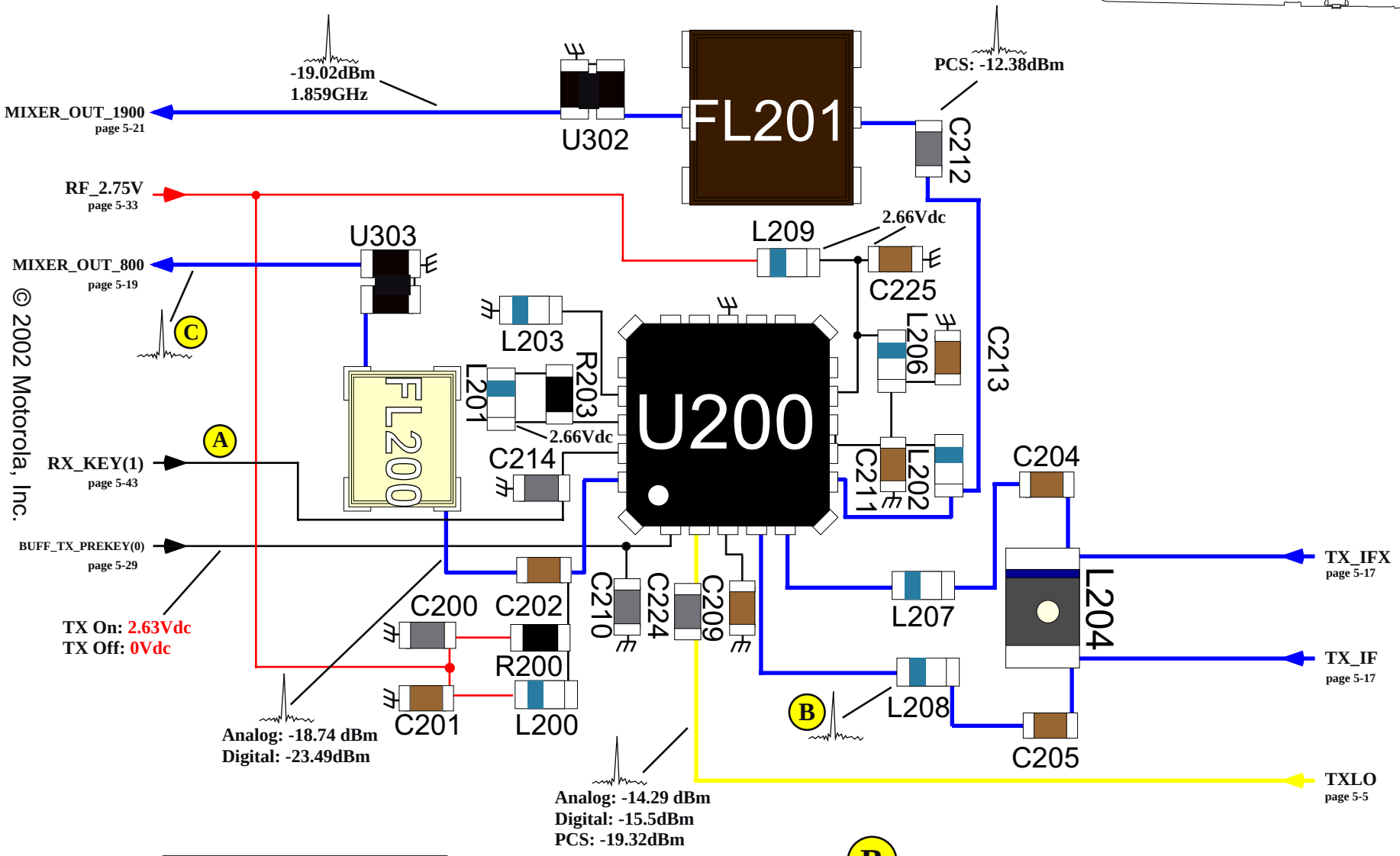
For the 800 MHz band, the transmitter carrier frequency is generated by mixing the main LO signal with the offset VCO signal (TX IF) that is tuned to 157.32 MHz. The TX IF signal is mixed with the main LO signal out of U700 in the upconverter IC, U200, to the carrier frequency at -4 dBm. The output signal is passed through the SAW band pass filter FL200.

For the 1900 MHz band, the TX IF signal is common to the 800 MHz band. The TX IF signal is mixed with the main LO signal from U700 to be up-converted to the carrier frequency. The mixer output signal of -6 dBm is filtered through the SAW band pass filter, FL201, whose typical insertion loss is 3 dB.

RX_KEY(1) controls in which band the Upconverter will be operating. BUFF_TX_PREKEY(0) enables the upconverter.

V120t: Upconverter (LEWIS)





Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4

A

800MHz Carrier On: 0Vdc
1900MHz Carrier On: 2.77Vdc

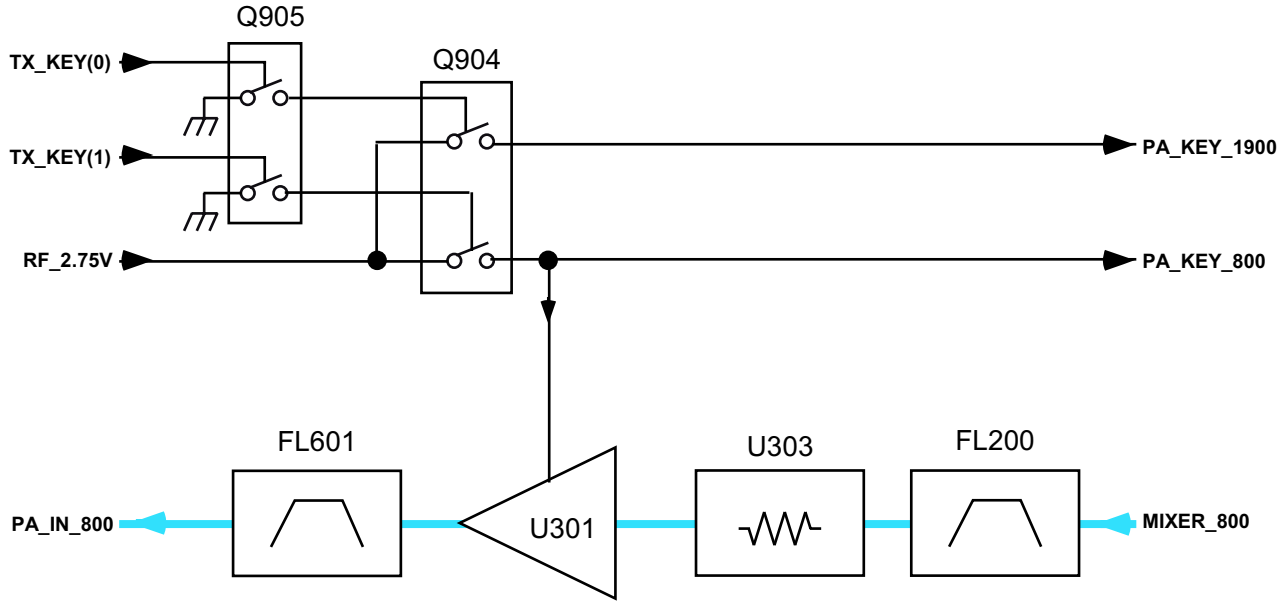
B

Analog: -17.3dBm @ 157.32MHz
TDMA: -17.21dBm @ 157.32MHz
PCS: -13.96dBm @ 157.32MHz

C

Analog: -10.25dBm @ 834.99MHz
TDMA: -16.78dBm @ 834.99MHz

V120t: 800MHz PA Driver (CLARK)



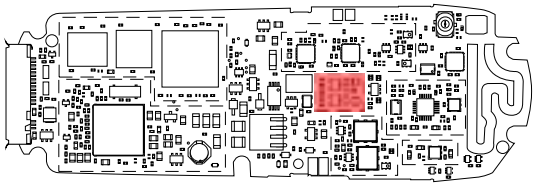
Description

After the carrier frequency is generated, it is injected into a 3 dB pad and then to the 800 MHz PA driver, U301. U301 has typical gain of 19 dB and amplifies the TX signal from -10 dBm to +9 dBm. The output of the PA driver is once again filtered through SAW band pass filter FL601.

The 800MHz PA driver is biased on via the PA_KEY_800 line. The state of PA_KEY_800 is controlled through TX_KEY(1) with the use of switching transistors Q904 and Q905.

PA_KEY_1900 is a line used on the 1900MHz transmit circuits. The state of PA_KEY_1900 is controlled through TX_KEY(0) with the use of switching transistors Q904 and Q905.

V120t: 800MHz PA Driver (CLARK)



D
Analog TX On: 0Vdc
Analog TX Off: 2.6Vdc

Analog: 2.67Vdc
TDMA: 2.72Vpp Setup:1V@10mS

PA_KEY_800
page 5-23

Analog: +1.15dBm
TMDA: -3.52dBm

PA_IN_800
page 5-23

FL601

C304
C308
L301
C306

Analog: +5.26dBm
TMDA: +1.03dBm

U301

C305
C307

Analog: -11.84dBm
TMDA: -14.56dBm

R308
4.09Vdc
B+
page 5-31

B
TX_KEY(0)
page 5-43

C
Q905

TX_KEY(1)
page 5-43

A

R906

2.7Vdc
RF_2.75V
page 5-33

Q904

PA_KEY1900
page 5-21

D

MIXER_800
page 5-17

PCS: 2.72Vpp Setup:1V@10mS

Analog: -10.8dBm
TMDA: -18.3dBm

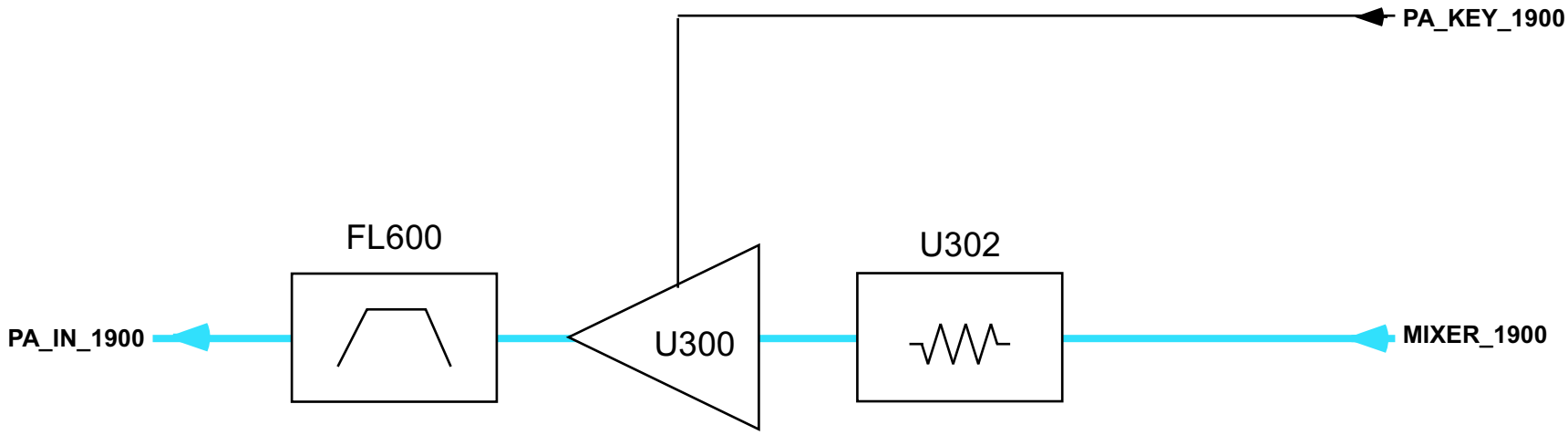
Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4

A
Analog: 2.65Vdc
TDMA: 2.8Vpp Setup:1V@10mS
PCS: 0Vdc

B
Analog: 0Vdc
TDMA: 0Vdc
PCS: 2.8Vpp Setup:1V@10mS

C
PCS TX On: 2.8Vpp Setup:1V@10mS
PCS TX Off: 0Vdc

V120t: 1900MHz PA Driver (CLARK)

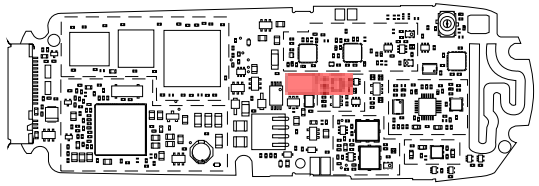


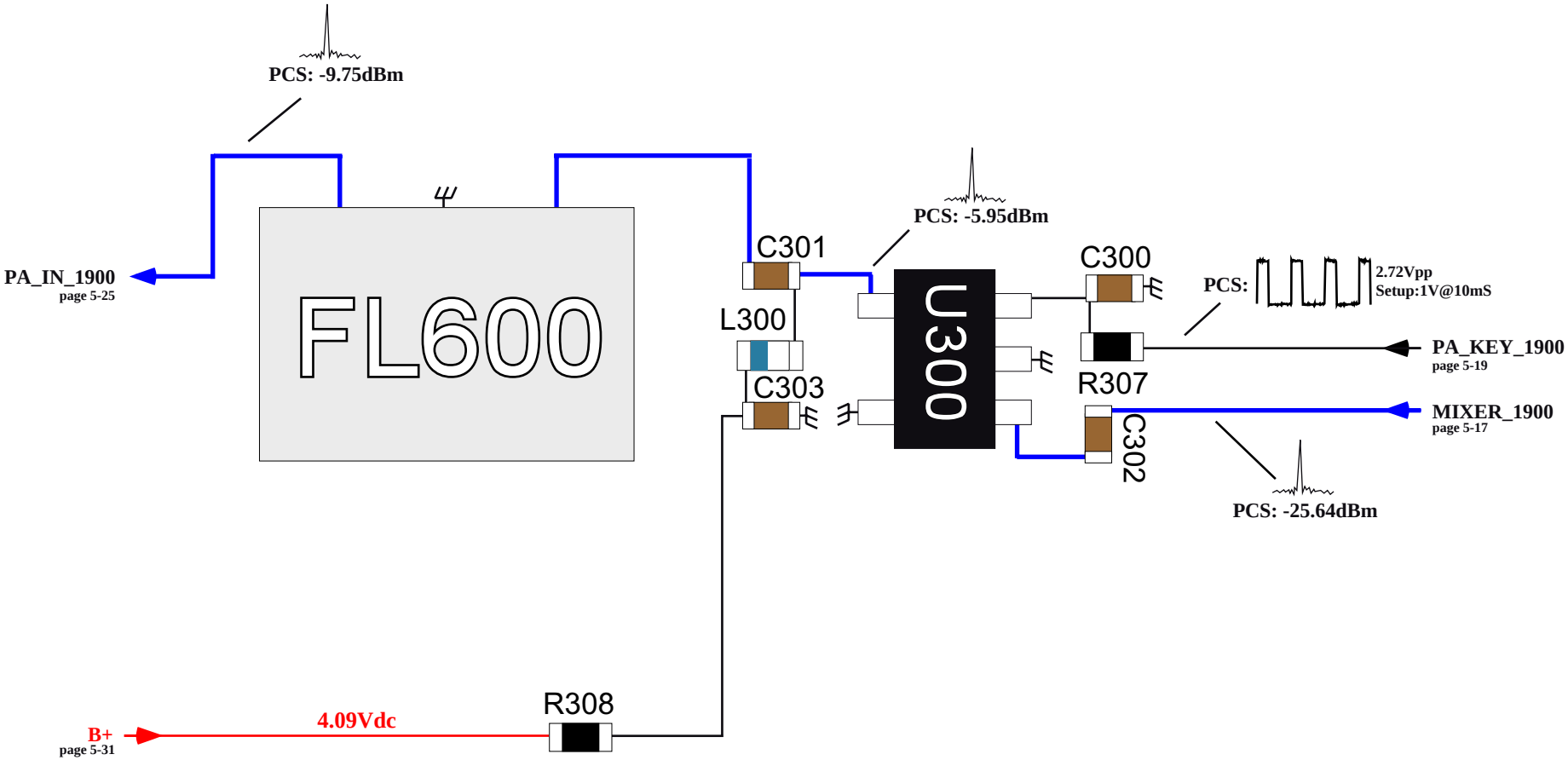
Description

After the 1900MHz carrier frequency is generated, it is injected into a 3 dB pad and then to the 1900 MHz PA driver, U300. U300 has typical gain of 19 dB and amplifies the TX signal prior to injection to the final stage PA. The output of the PA driver is once again filtered through the same SAW band pass filter (FL600).

The 1900MHz PA driver is biased on via the PA_KEY_1900 line.

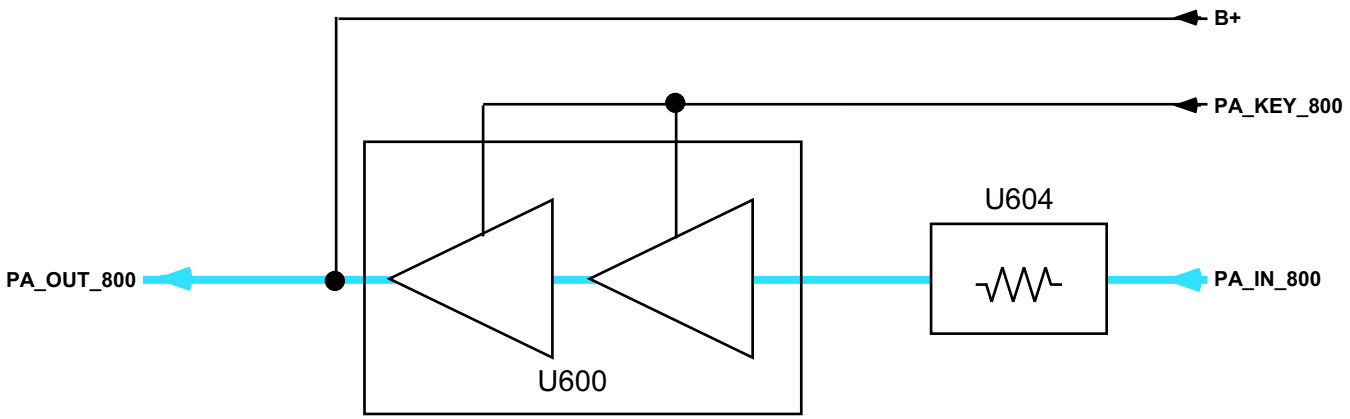
V120t: 1900MHz PA Driver (CLARK)





Troubleshooting Configuration	Page
Digital TX(800)	6-4

V120t: 800MHz PA

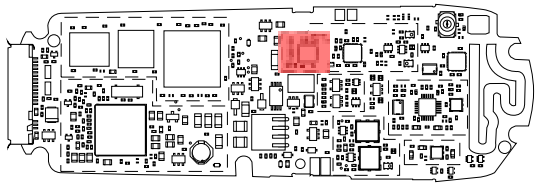


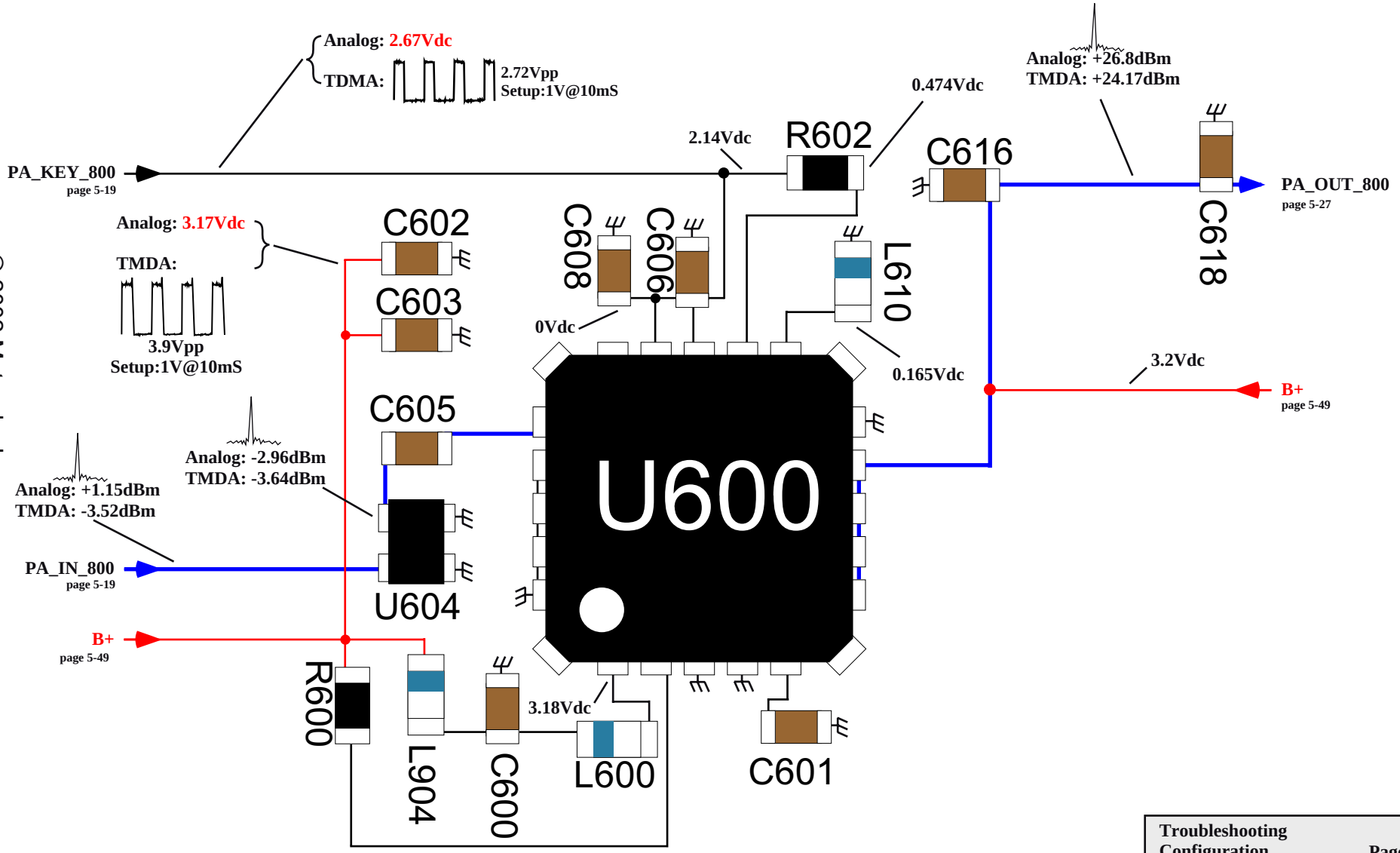
Description

The 800 MHz PA is a two-stage GaAs MMIC (U600) with small signal gain of 32 dB. Since the analog mode signal path has a loss of 4 dB, the PA is required to output +31 dBm in order to feed the TX signal to the antenna at approximately +27 dBm. Whereas the signal path loss for digital mode beyond PA is typically 2 dB.

PA_KEY_800 is used to drive the 800MHz PA on. B+ is the supply voltage to the 800MHz PA.

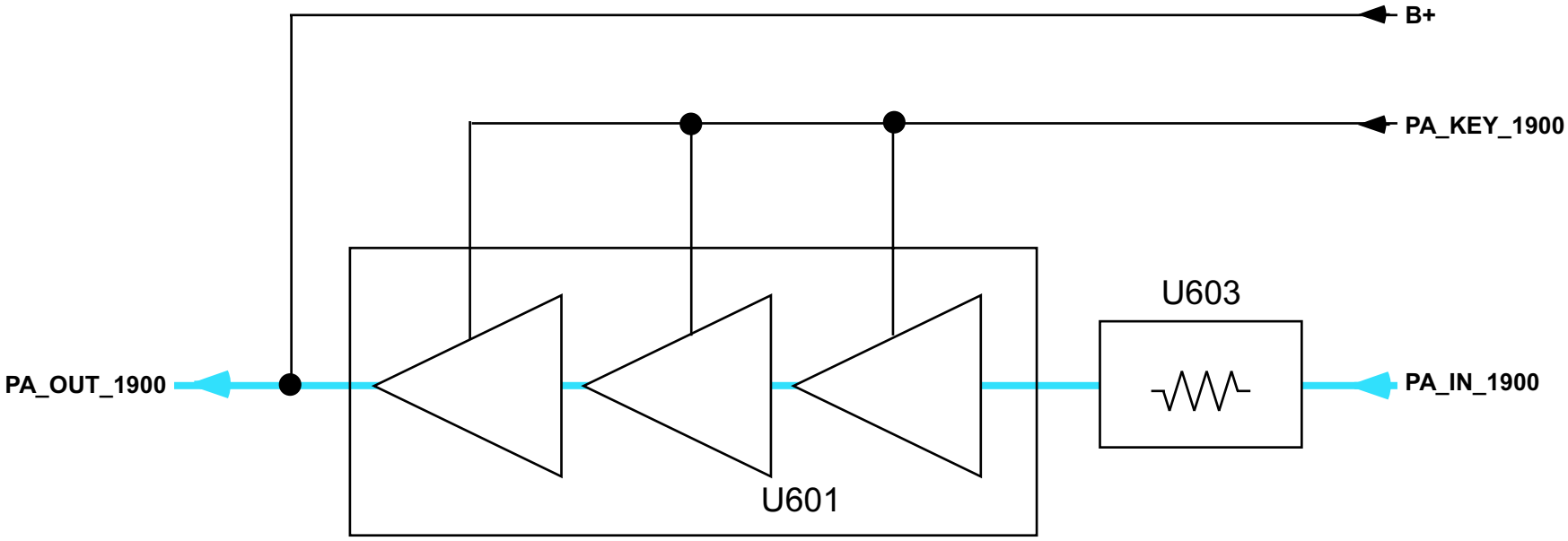
V120t: 800MHz PA





Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4

V60t: 1900MHz PA

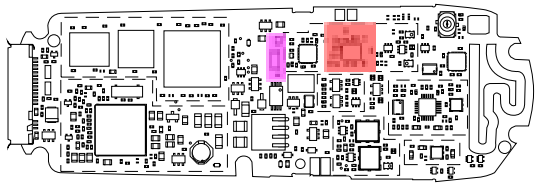


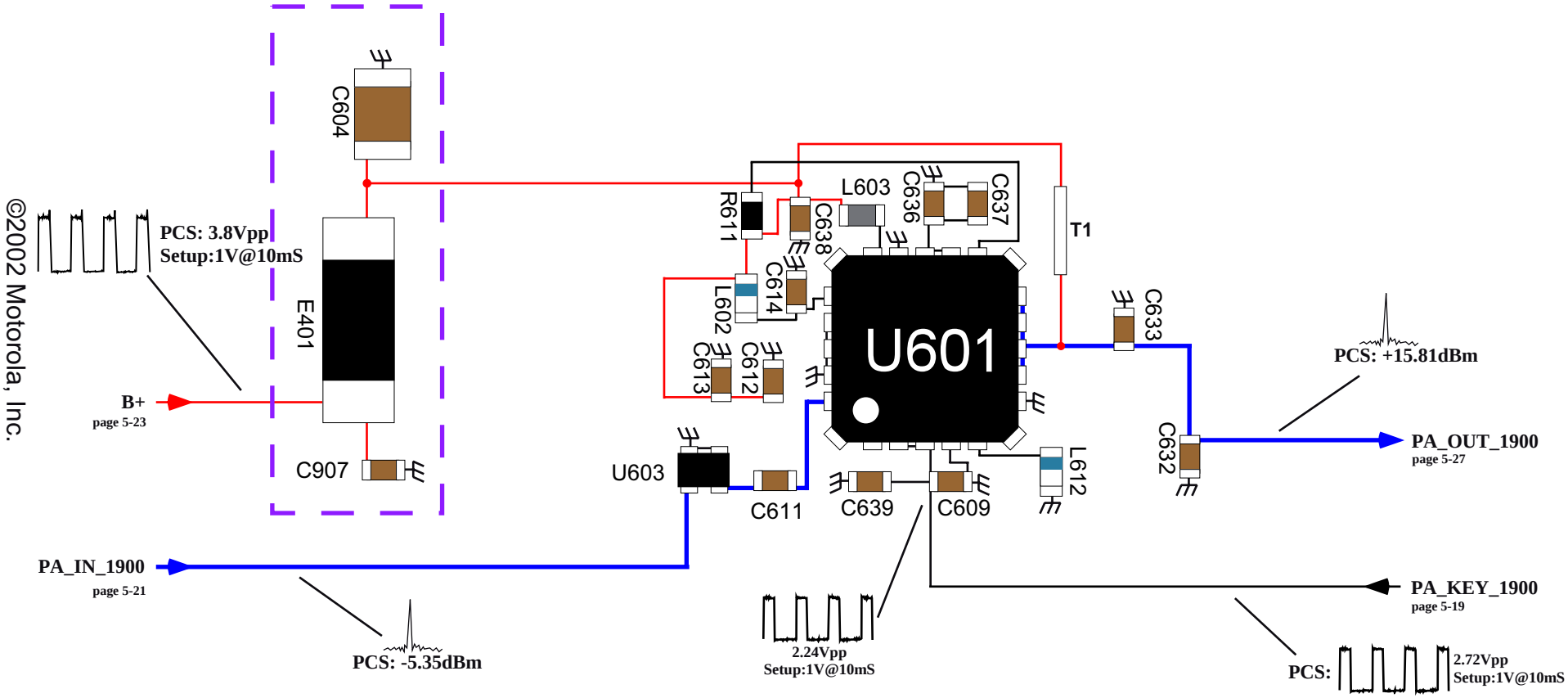
Description

The output of U300 is fed to a 3-stage GaAs MMIC (U601) through another 3 dB pad (U603). Nominal input power to the PA IC, U601, is 0 dBm. The gain of the PA IC is typically 29 dB.

PA_KEY_1900 is used to drive the 1900MHz PA on. B+ is the supply to the 1900MHz PA.

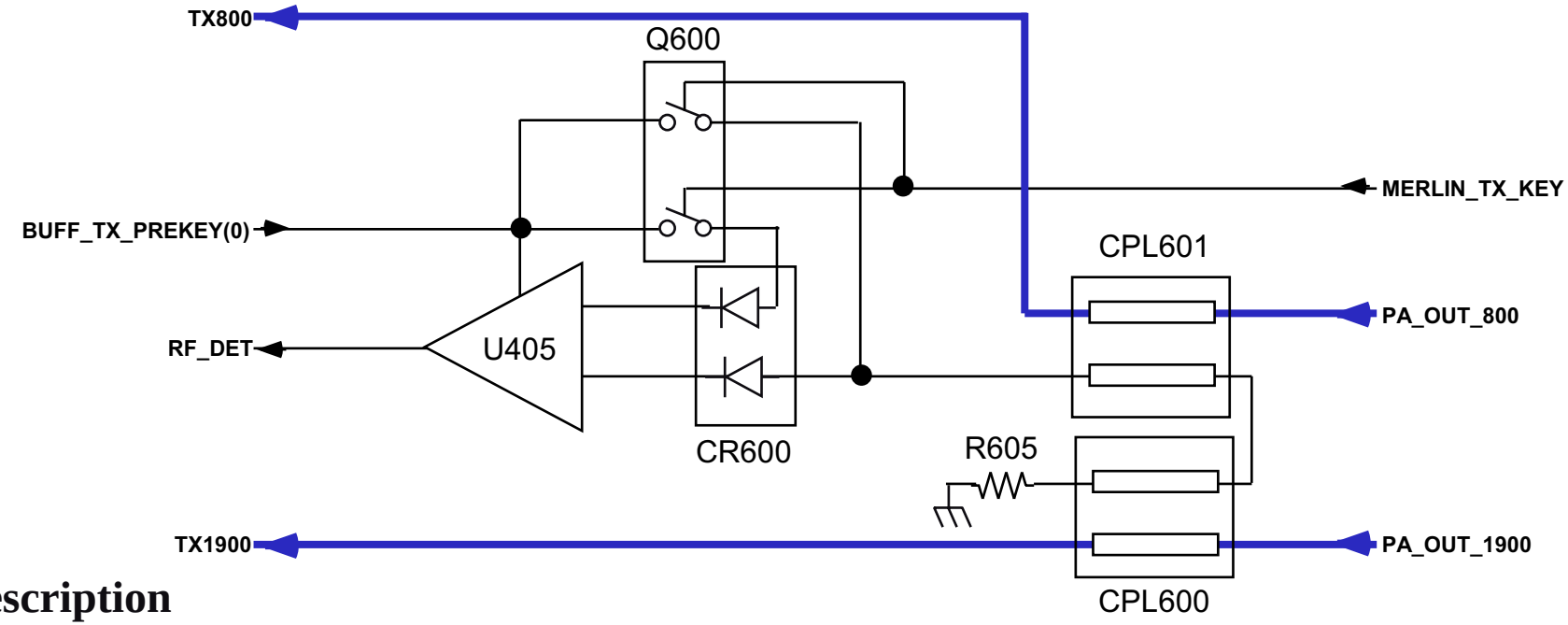
V120t: 1900MHz PA





Troubleshooting Configuration	Page
Digital TX(1900)	6-4

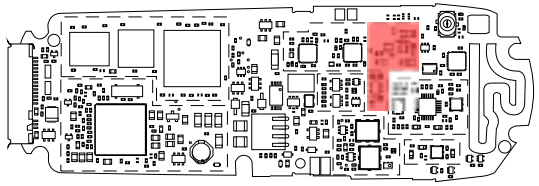
V120t: RF Detect



Description

Both 800 MHz and 1900 MHz transmitter signals at the output of the PA IC are sampled through the couplers (CPL600, CPL601). The coupling factor for both couplers is 20 dB. Both couplers have an embedded LPF to attenuate 2nd and 3rd harmonics out of the power amplifiers to below required levels. The coupled RF signal is fed to one leg of the twin Schottky diode and the rectified DC signal is fed to a single Op-Amp for proper scaling for the detector ADC input (RF_DET). The other diode in the twin diode is used to compensate temperature drift. The detector range is switched between Power Level 5 and 6 by adjusting bias current to both diodes to provide dynamic range of more than 40 dB with sensitivity of 2.5 mV/dB minimum. The DSP reads the preset detector ADC count that corresponds to the given Power Level and adjusts TX IF AOC DAC to maintain the power output level constant.

V120t: RF Detect



Analog: +26.8dBm
TDMA: +24.17

Analog: +20.0dBm
TDMA: +26.41dBm

PA_OUT_800
page 5-23

C634

CPL601

TX_800
page 5-3

C627

R607 C635

R601

TX On: 2.63Vdc
TX Off 0Vdc

CR600

Q600

L611

C623

R605

BUFF_TX_PREKEY(0)
page 5-29

MRLN_TX_KEY
page 5-11

R469

C624

TX On: 2.66Vdc
TX Off: 0Vdc

PA_OUT_1900
page 5-25

Analog: .553Vdc
PCS: .662Vdc

CPL600

TX_1900
page 5-3

R416

R411

PCS: +19.94dBm

Analog: .545Vdc
PCS: .565Vdc

PCS: +18.26dBm

U405

Analog: .547Vdc
PCS: 0Vdc

BUFF_TX_PREKEY(0)
page 5-29

TX On: 2.63Vdc
TX Off 0Vdc

R414

R415

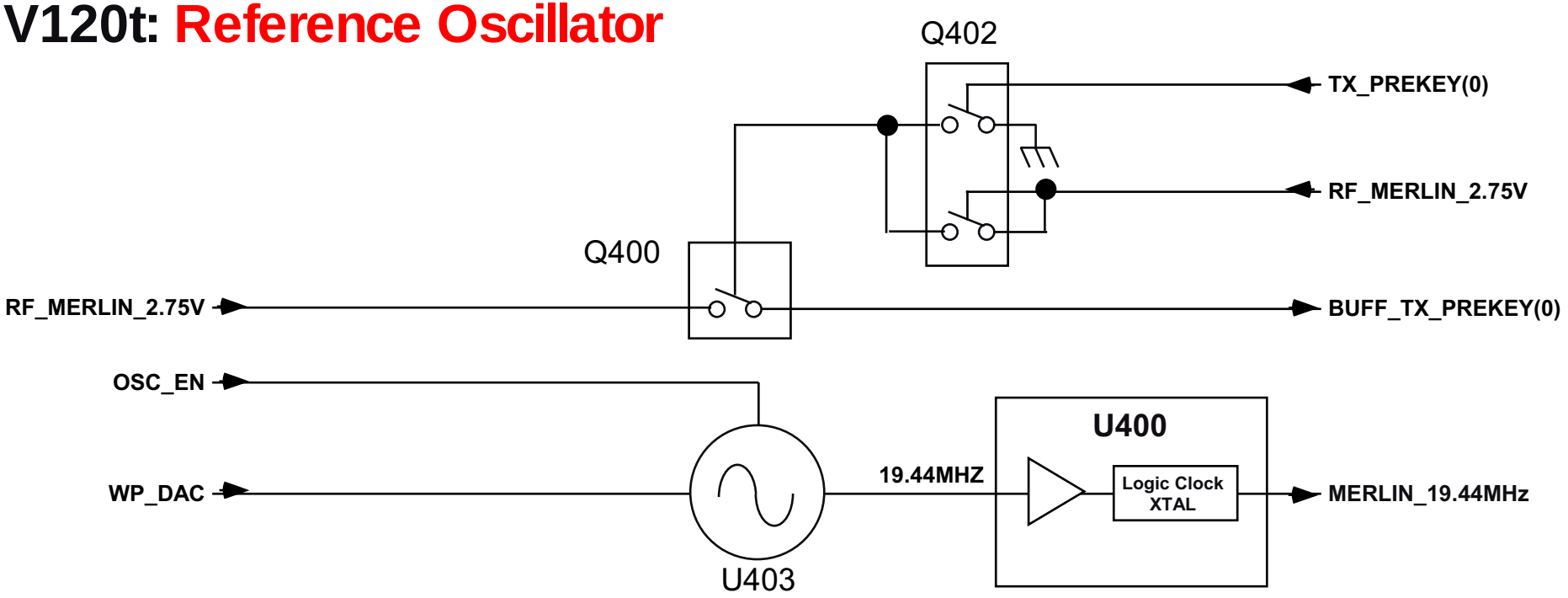
RF_DET
page 5-11

C435

RF_DET		
	Analog	PCS
PS2	.607Vdc	.204Vdc
PS3	.377Vdc	.149Vdc
PS4	.231Vdc	.111Vdc
PS5	.139Vdc	.087Vdc
PS6	.624Vdc	.264Vdc
PS7	.415Vdc	.193Vdc

Troubleshooting Configuration	Page
Analog TX	6-5
Digital TX(800/1900)	6-4

V120t: Reference Oscillator

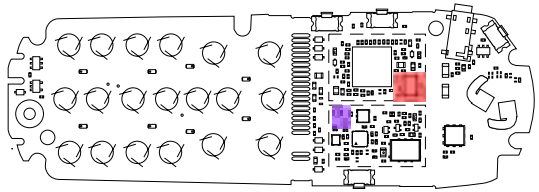


Description

The reference oscillator, U403 is a temperature compensated crystal oscillator with frequency stability of 2.5 ppm over temperature extremes. Its frequency is 19.44 MHz. The buffered reference signal is routed to the DSP and used as a clock source.

To prevent transmit signals from reflecting back to the TX_PREKEY(0) line, Q402 and Q400 are used to drive BUFF_TX_PREKEY(0) and control some transmit circuits.

V120t: Reference Oscillator



TX On: 2.63Vdc
TX Off: 0Vdc

TX_PREKEY(0)
page 5-11

RF_MERLIN_2.75V
page 5-33

2.69Vdc

Q402

Digital TX(800) on: 2.8Vpp Setup:1V@10mS

Analog TX on: 2.65Vdc
Analog TX off: 0Vdc

Q400

BUFF_TX_PREKEY(0)
page 5-5,5-15

1.23Vpp
Setup: 200mV@20nS

19.44MHZ
page 5-11

C437

U403

1.60Vdc

WP_DAC
page 5-11

R425

C419

.495Vdc

OSC_EN

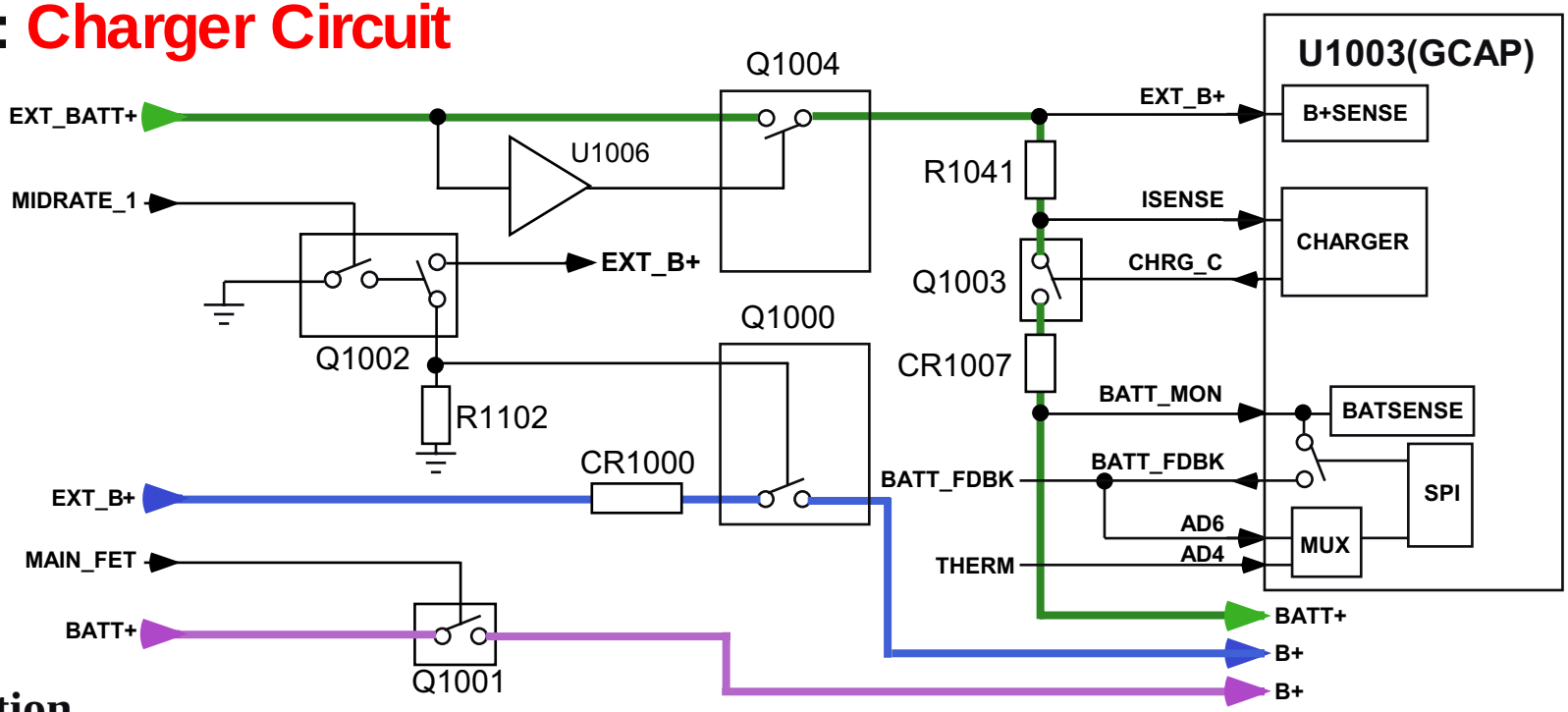
V4
page 5-33

2.76Vdc

C418

Troubleshooting Configuration	Page
Analog TX	6-5

V120t: Charger Circuit



Description

The majority of the charging circuit is integrated in GCAP3. This includes a digital to analog converter, analog to digital converter, battery feedback switch, thermistor switch/pull up, and current control sense. External FETs (Q1004, Q1000, and Q1001) are provided to enable/disable EXT_B+ and BATTERY supply paths to radio circuitry (B+). An external sense resistor (R1041) and a charging FET (Q1003) are provided to control charging current between EXT_B+ and BATTERY.

Due to pin count constraints on the CE bus, the Charger Identification input signal and Battery Feedback output signal share the same accessory connector pin. Software will first detect the Charger ID Voltage (AD6) before enabling the Battery Feedback Voltage via the Battery Feedback Switch in GCAPIII. The Battery Feedback switch must not be enabled at any time for an accessory that is not a valid Fast Charger.

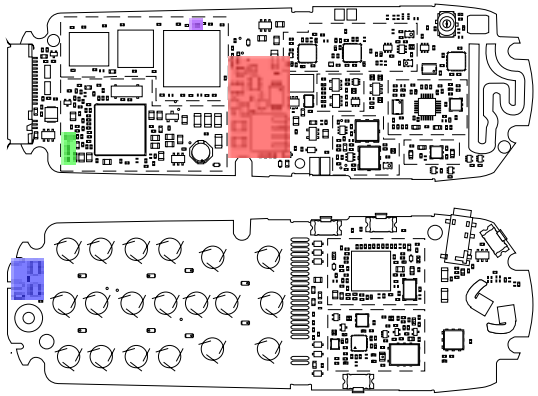
Battery Feedback Voltage provides a reference voltage to the external power supply during charging. The battery feedback switch is needed to remove the battery feedback voltage from the feedback loop of the AC/DC Adapter or VPA when charging is complete or after a fault has occurred. This switch will be enabled before the charger DAC is programmed when charging is to begin. Battery feedback will turn on before the charger is enabled. The charger will be turned off before battery feedback is disabled.

A thermistor in the battery package is used to determine cell temperature of the battery pack before charging begins. The battery EPROM (BATT_SER_D) will contain limit parameters that determine the minimum and maximum temperatures at which charging can occur.

An over-voltage detection IC (U1006) provides protection against damage caused by external charger voltages exceeding 7.0Vdc. If an over-voltage condition occurs, the EXT_B+ FET (Q1004) will be disabled. This will prevent high voltage (>7Vdc) from being applied to radio circuitry (B+).

Mid-rate charging is supported if a valid mid-rate charger and valid battery are detected. A mid-rate charger will source up to 400mA of current to the radio circuitry and charging circuitry during idle mode. The mid-rate charger will supply 5.9Vdc (up to 400mA) to the phone, regardless of the BATT_FEEDBACK voltage. If the phone is in transmit mode, mid-rate current will be supplied to the battery and radio circuitry via the charging path only (EXT_B+ FET (Q1000) will be disabled via the MIDRATE_1 line). Dead battery TX operation or ‘No Battery’ operation is not supported with a mid-rate charger.

V120t: Charger Circuit



BATT_FDBK page 5-45 — M — CR1001 — R1048 R1047 C1011

AD6 page 5-39 — N — 2.76Vdc

V2 page 5-33

EXT_B+ page 5-39

CHRG_C page 5-39 — C

R1039 — Q1002 — G F D

Q1000 — Q1003 — Q1001

CR1000 — R1041 — C1045 — CR1007 — R1038 — H

R1009

E — MIDRATE_1 page 5-43

ISENSE page 5-39

I — MAIN_FET page 5-39

BATT+ page 5-31 — 4.13v

V2 page 5-33

BATT_SER_D page 5-43 — 2.76v

B+ — 4.13v

C1007

BATT+ page 5-39

C1008

M1000 — THERM — J

C1112 — R1012 — R1011 — R1010

K — THERMBIAS page 5-39

L — AD4 page 5-39

EXT_B+ page 5-39 — B — Q1004

EXT_BATT+ page 5-45 — R1040 — A — U1006

5.61v

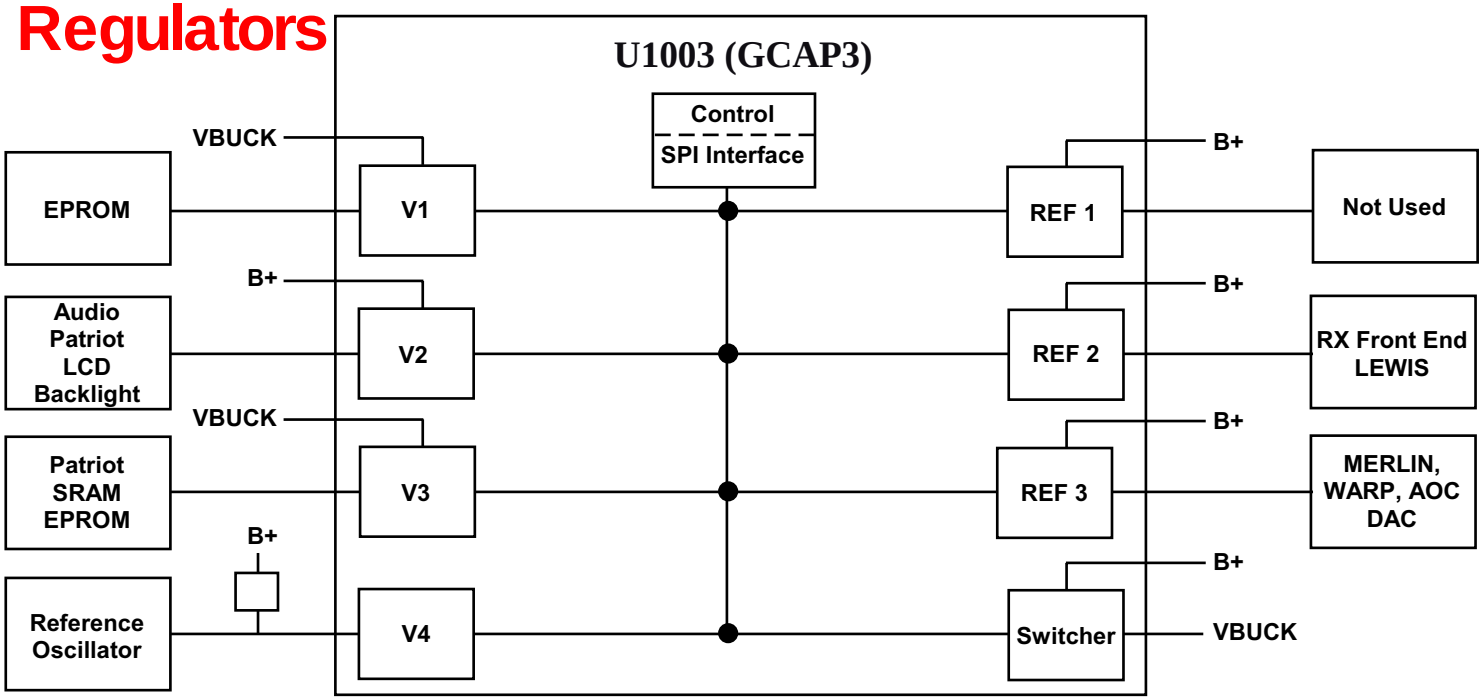
VR1000

	A	G	H	E	M	N
Ext_Batt+<7Vdc	0v	0v	6.73v	Midrate Charger		.839v	1.47v
Ext_Batt+>7.05Vdc	6.8v	6.39v	4.38v	Fast Charger	0v	4.22v	2.75v

	A	B	C	D	F	J	K	L	I
Charger On	0v	5.59v	4.23v	4.64v	5.62v	1.27v	2.76v	1.12v	Battery 0v
Charger Off	0v	4.62v	4.62v	.747v	4.61v	0v	2.76v	2.50v	External 5.57

Troubleshooting Configuration	Page
Charger	6-6

V120t: Regulators

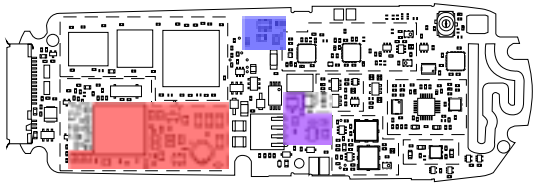


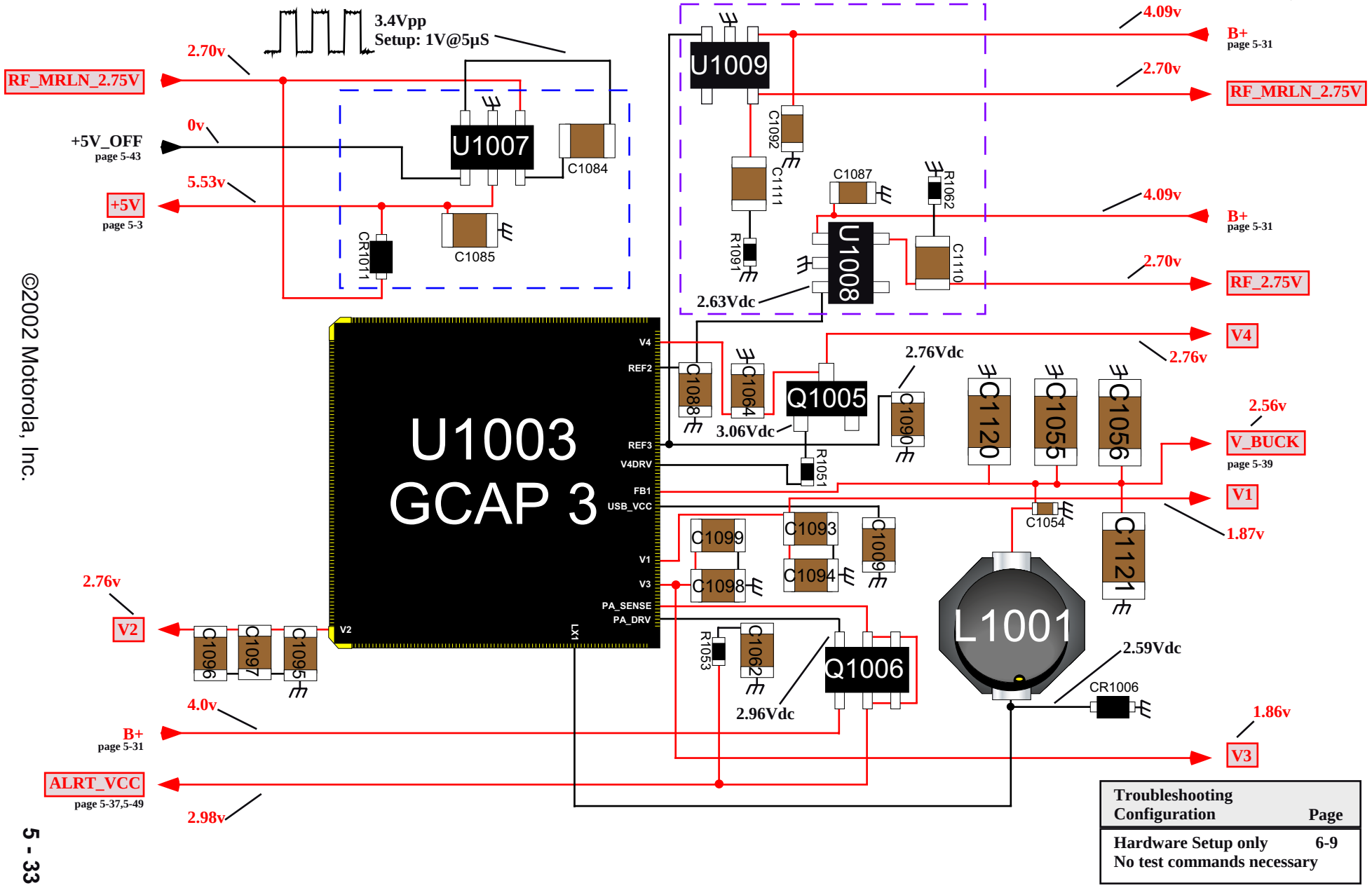
Description

Voltage regulation is provided by the GCAP IC (U1003). Multiple regulators are used to provide better isolation between sensitive load circuitry and noisy circuitry. The regulators and their load circuitry are described below:

- **Vbuck** - Regulates input voltage to V1 and V3
- **V1 (1.875V)** - Flash core
- **V2 (2.775V)** - Audio, ADC/DACs, Baseband Processor Peripherals, LCD and LED back-lighting
- **V3 (1.875V)** - Baseband Processor Core, SRAM, Flash I/O
- **V4 (2.775V)** - TCXO
- **REF1** - Not used
- **REF2** - External 2.9V LDO (U1008) used to supply the RX front end and Lewis IC
- **REF3** - External 2.8V LDO (U1109) used to supply the RF backend IC, WARP DAC, AOC DAC, and Reference Limiter
- **+5V** - Antenna Switch
- **RTC_BATT** - 32kHz clock and SRAM during power cut. Coin battery replaced with a capacitor and a diode
- **PA_B+ (3.6V)** - Power Amplifiers and PA Driver
- **SW_B+** - External Accessories

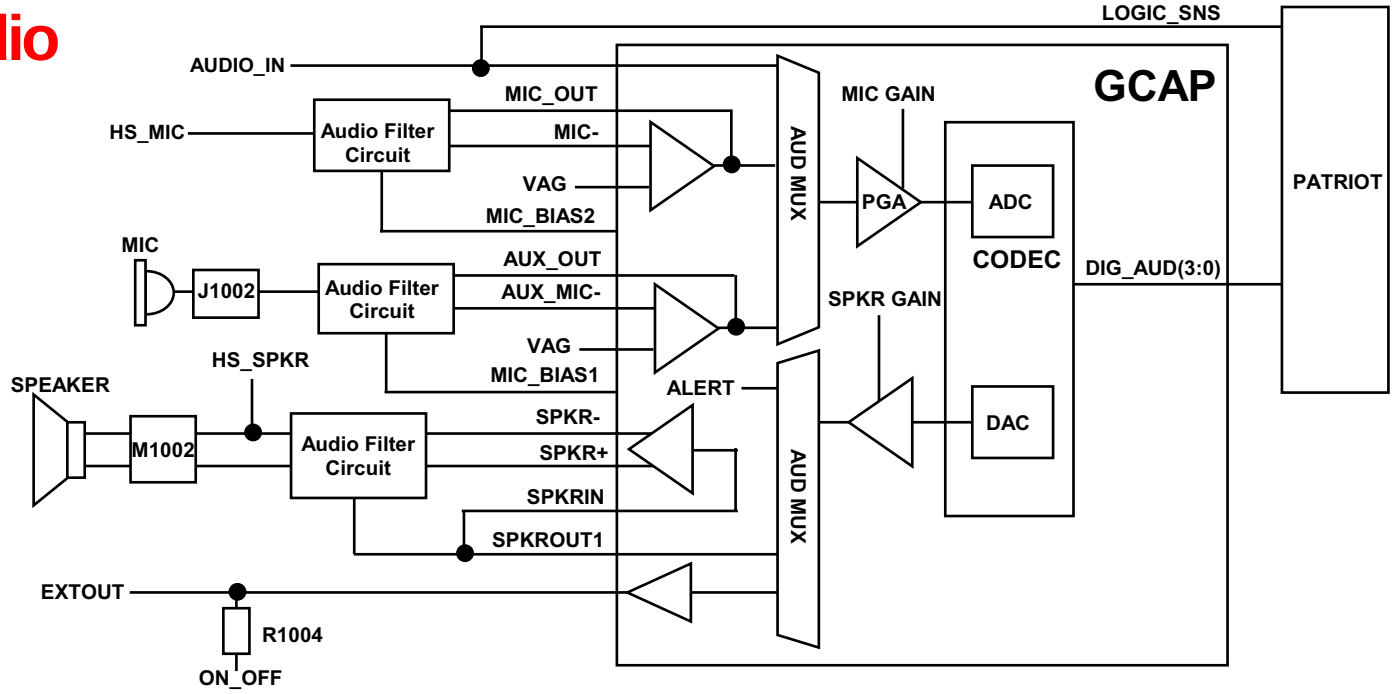
V120t: Regulators





Troubleshooting Configuration	Page
Hardware Setup only No test commands necessary	6-9

V120t: Audio



Description

The Internal Microphone (J1301) is single ended. It is held in housing by a rubber boot and makes contact with gold pads. Following the Internal Microphone path; the microphone is biased by R1034 and R1028 to provide a MIC_BIAS of 2.1 VDC from pin MIC_BIAS1 of GCAP. C1025 is connected to the MIC_BIAS1 pin and MB_CAP1 pin on GCAP to bypasses the gain from the VAG to MIC_BIAS1 to keep the noise balanced. From here the signal is routed through C1040 and R1030 to AUX_MIC- pin on GCAP, which is the input to the A5 Amplifier. The microphone path is tapped off after R1030 before the AUX_MIC- input to C1037 and R1029 in parallel connected to the AUX_OUT pin on GCAP, which is the output of the A5 Amplifier..

The External Microphone input is connected to pin 16 of J1000 (AUDIO_IN), the accessory connector for the mobile phone. The path is routed through R1007 and C1005 to the EXT_MIC pin on GCAP. This signal feeds directly to the input multiplexer without an intervening gain stage.

The Accessory shall have an output impedance of 100 ohms in series with 1.0 µF. The audio signal shall have a nominal level (-18dBm0) of 43.5mVrms at 1 kHz, between 300 Hz and 3 kHz, the audio signal shall have a level of -4 dB to +1 dB relative to the level at 1 kHz.

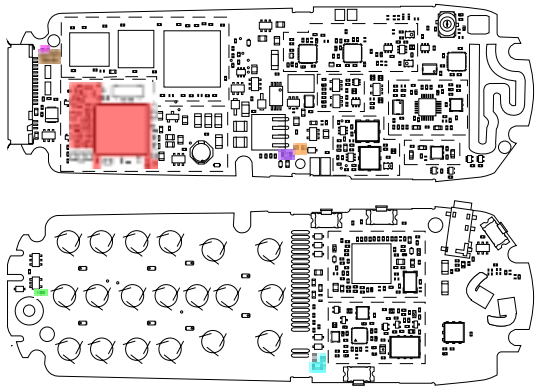
The proper Microphone path is selected by the AUDIS MUX controller and path gain is programmable at the PGA

The Handset Speaker is driven by GCAP‘s internal SPKR differential amplifier. This amplifier is powered by voltage V2 and drives the earpiece transducer in bridged mode or can be switched to single-ended mode by A1CTRL control bit to drive an external boom speaker. (This will be explained in more detail in the Headset section) Following the speaker path from the GCAP pins Speaker- and Speaker+, they are routed through R1026 and R1027 respectively, and then connected to the transducer in the upper housing. Off the Speaker- path, SPKRIN is routed through R1025 and R1023 for the inverting input of the speaker amp A1. SPKROUT1 from GCAP is routed through C1027, R1022 and R1025 to Speaker- which is the DAC output of the CODEC. SPKRIN and SPKROUT1 will output their respective bias voltages on these pins during standby times. This is to maintain the voltage across an external coupling capacitor to avoid audio “pops” when the amplifier is enabled.

The External Speaker is connected to pin 15 of J1000 (AUDIO_OUT ON/OFF), the accessory connector for the mobile phone. The audio path is routed through C1004 and R1008 and connected to EXTOUT of GCAP. The DC level of this Audio_Out signal is also used to externally command the phone to toggle it‘s ON/OFF state. The Audio_Out signal connects to GCAP’s ON2 pin via R1004 to provide this capability. When a DC level of <0.4V is applied by an accessory for a minimum of 700 milliseconds on the Audio_Out line, the phone will toggle it‘s ON/ OFF state.

All outputs use the same D/A converter so only one output can be active at one time. The user can adjust the gain of the audio outputs with the volume control buttons.

V120t: Audio



A1_INT
page 5-37

V2
page 5-33

2.77v

OC3 (LOGIC_SNS)
page 5-43

2.70v

AUDIO_IN
page 5-45

2.96Vpp@1kHz
Setup:2V@1mS

512mVpp
Setup:200mV@100µS

HS_MIC
page 5-37

MIC
page 5-37

680mVpp
Setup:200mV@100µS

2.8Vpp@1kHz
Setup:2V@1mS

1.37v

VR1001

VR1008

U1003
GCAP 3

AUX_MIC+
VAG
MIC_IN-
MIC_OUT
MB_CAP2
MIC_BIAS2
MB_CAP1
MIC_BIAS1
SPKROUT1
AUX_MIC-
SPKRIN
AUX_OUT
SPKR-
SPKR+
A1_INT
EXT_MIC
EXT_OUT
ALRTOUT-

ALERT_OUT
page 5-37

V2
page 5-33

2.77v

CR1002

AUDIO_OUT
page 5-45

352mVpp
Setup:100mV@1mS

ON_OFF
page 5-39

3v

MIC_OUT- 1.38v
MIC_IN-1.37v
MB_CAP1-0v
MIC_BIAS1-0v
MIC BIAS2- .038v
MB_CAP2- .038v
SPKR_IN- 1.38v
AUX_OUT- 1.38v
SPKR_OUT1- 1.38v

117mVpp
Setup: 20mV@500µS

Troubleshooting Configuration	Page
TX Audio	6-7
RX Audio	6-8

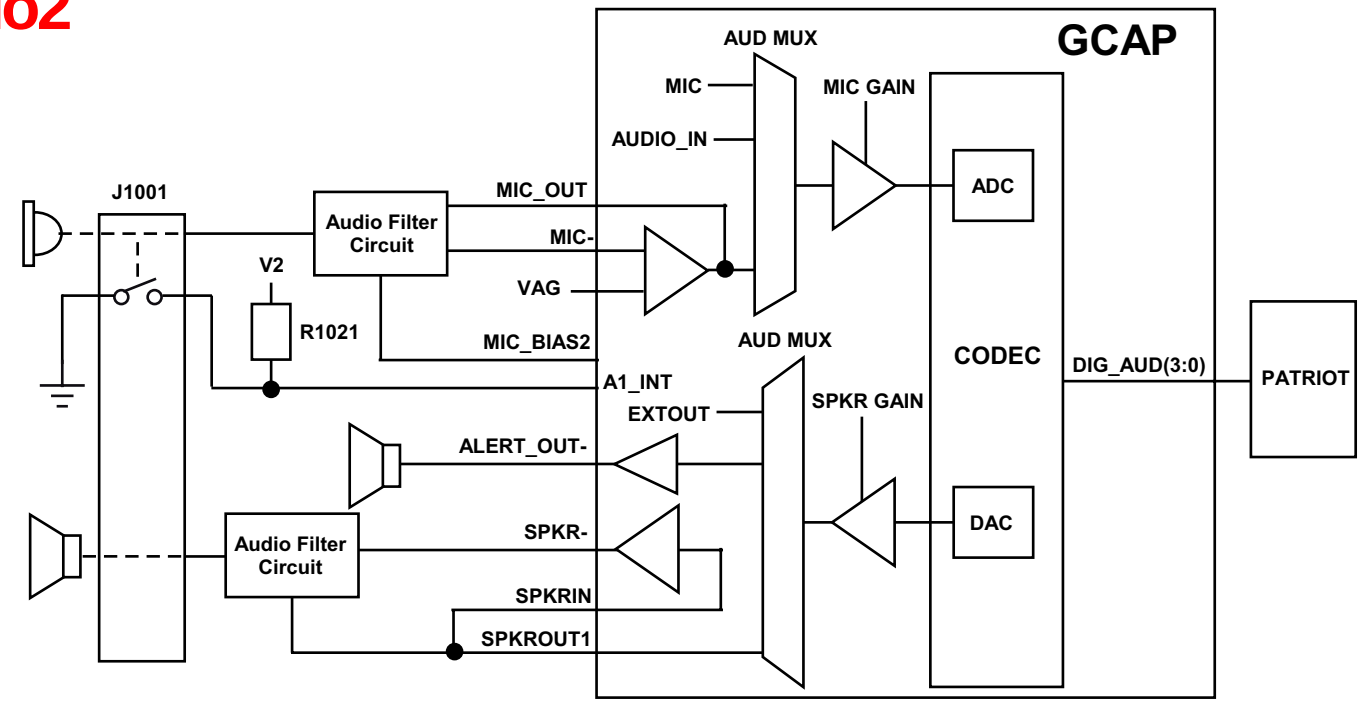
1.1Vpp
Setup: 500mV@500µS

SPKR+
page 5-37

SPKR-
page 5-37

HS_SPKR
page 5-37

V120t: Audio2



Description

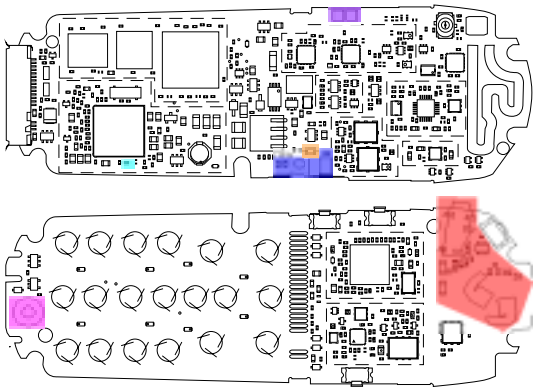
The Headset Microphone is pin 4 of J1001, which is a 2.5mm jack. The microphone path is biased through R1016, which is connected to pin MIC_BIAS2 on GCAP and bypassed with C1059 connected to pin MB_CAP2. From here the signal is routed through C1312 and R1307 to MIC_IN- pin on GCAP, which is the input to the A3 Amplifier. The Microphone path is tapped off after R1307 before the MIC_IN- input to C1310 and R1017 in parallel connected to the MIC_OUT pin on GCAP, which is the output of the A3 Amplifier.

The headset uses a standard 2.5mm phone jack. The phone will detect the presence of a headset using pin 2 on the headset jack, which is pulled high by R1021 and connected to the A1_INT of GCAP (this is the A1 interrupt of GCAP which gets sent to MCU over the SPI bus). This pin is aligned with the ground sleeve of the headset plug and will be pulled to a logic low whenever the headset plug is inserted into the jack. The headset may contain a momentary switch, which is normally closed and is in series with the microphone cartridge. When the momentary switch is pressed, the bias current being supplied to the microphone will be interrupted. The phone will detect this action and make an appropriate response to this action, which could be to answer a call, end a call, or dial the last number from scratch pad.

The Headset Speaker makes use of the same amplifier as the Handset Speaker. The audio path is tapped off the Speaker - line and routed through the combination of C1012, C1117 and R1013 to pin 3 of the Headset Jack. (J1001) If an external headphone jack is plugged into the phone, the A1_INT pin will be pulled to ground and the A1CTRL bit will be set to drive the headset speaker as single-ended off the Speaker - audio path.

The Alert Transducer is located in the upper housing and connects to the board via J1003. It is driven by GCAP‘s ALRT amplifier, which is powered by ALRT_VCC, and controlled via an external FET (Q1006) regulator PA B+, which is driven by GCAP. This amplifier provides a single-ended drive to the Alert transducer. Pin 1 of the Alert is connected to pin ALRT_VCC of GCAP, which is the supply line. Pin 2 of the Alert is connected to pin ALRTOUT- of the GCAP, which is the inverting output of the ALRT amplifier.

V120t: Audio2/Vibrator



Headset In:0v
Headset Out:2.75v

A1_INT
page 5-35

PWR_SW
page 5-39

PWR_SW_STATIC
page 5-47

HS_MIC
page 5-35

SPKR+
page 5-35

SPKR-
page 5-35

512mVpp
Setup:200mV@100µS

1.1Vpp
Setup: 500mV@500µS

2.98v

ALERT_VCC
page 5-33

1.32Vdc
Setup: 500mV@500µS

ALERT_OUT
page 5-35

HS_SPKR
page 5-35

VIB_OUT
page 5-39

Vibe On= 1.27v
Vibe Off= 0v

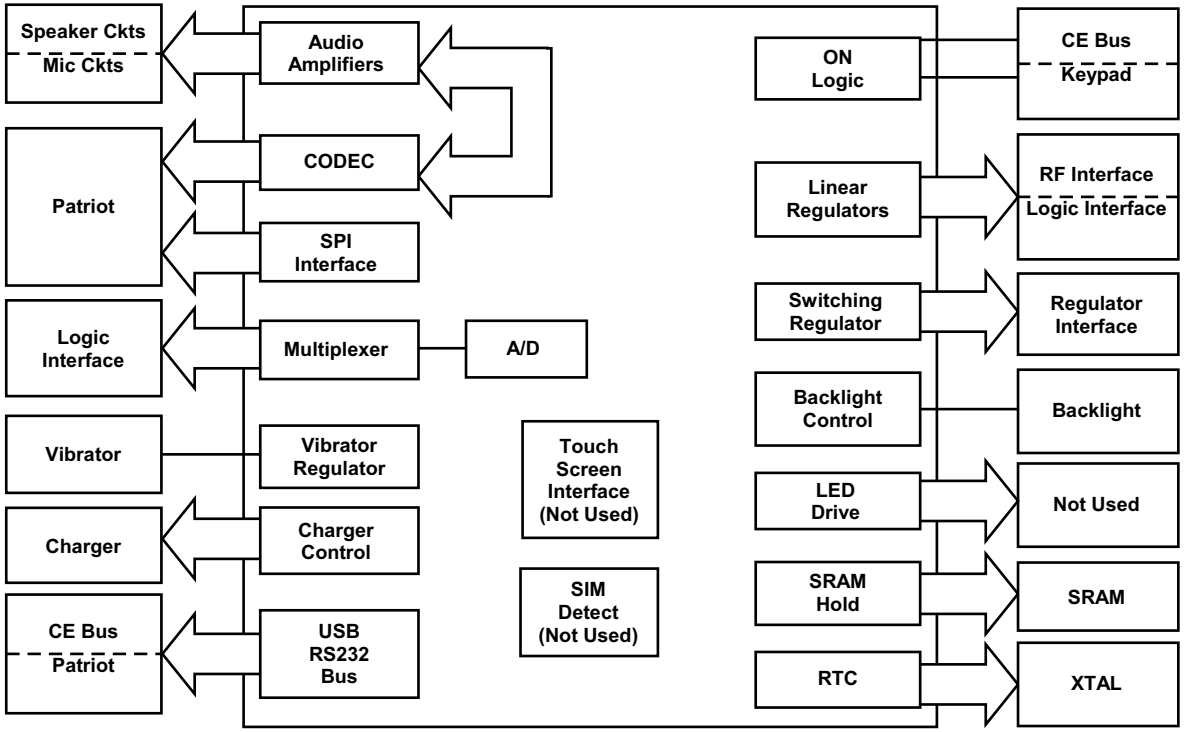
680mVpp
Setup:200mV@100µS

MIC
page 5-35

J1001
J1002
J1003
M1001
M1002
M1003
VS1000
VR1007
C1012
C1013
C1014
C1022
C1023
C1057
C1086
C1117
C1124
C1300
C1549
C1550
CR1010
L1000
R1013
R1014
R1026
R1027
R1069

Troubleshooting Configuration	Page
TX Audio	6-7
RX Audio	6-8

V120t: GCAP3



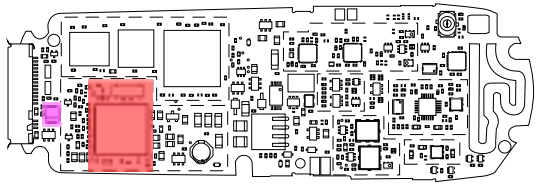
Description

The General Control Audio Power IC (GCAP), U1003, is a mixed signal IC that contains the following features:

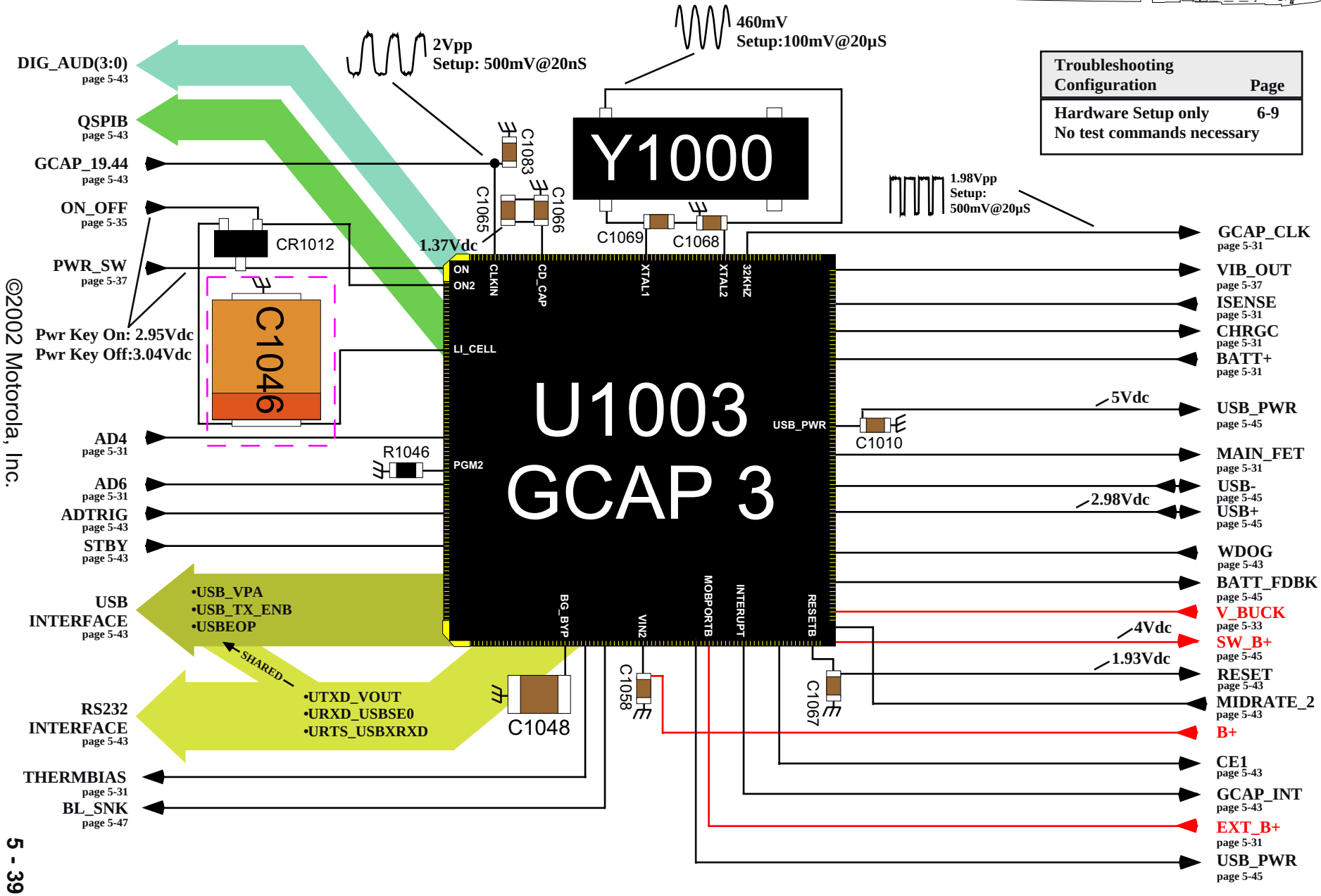
- Audio input/output amplification and filtering
- Audio path selection
- Voltage regulation
- Battery charging control
- Real time clock
- Ringer/vibrator control
- RS-232/USB drivers
- Back-light control
- Multiplexed DAC inputs for temperature and voltage monitoring

The GCAP IC is controlled and configured by the Baseband Processor IC through a four-wire QSPI interface. The Baseband Processor has read/write access to the GCAP IC. Audio data is transmitted/received via the Baseband Processor through a four-wire SSI interface. Audio data is updated at an 8kHz rate.

V120t: GCAP3



Troubleshooting Configuration	Page
Hardware Setup only	6-9
No test commands necessary	



V120t: Memory

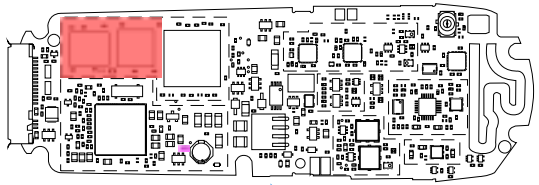
No Block Diagram Necessary
Refer to page 5-41

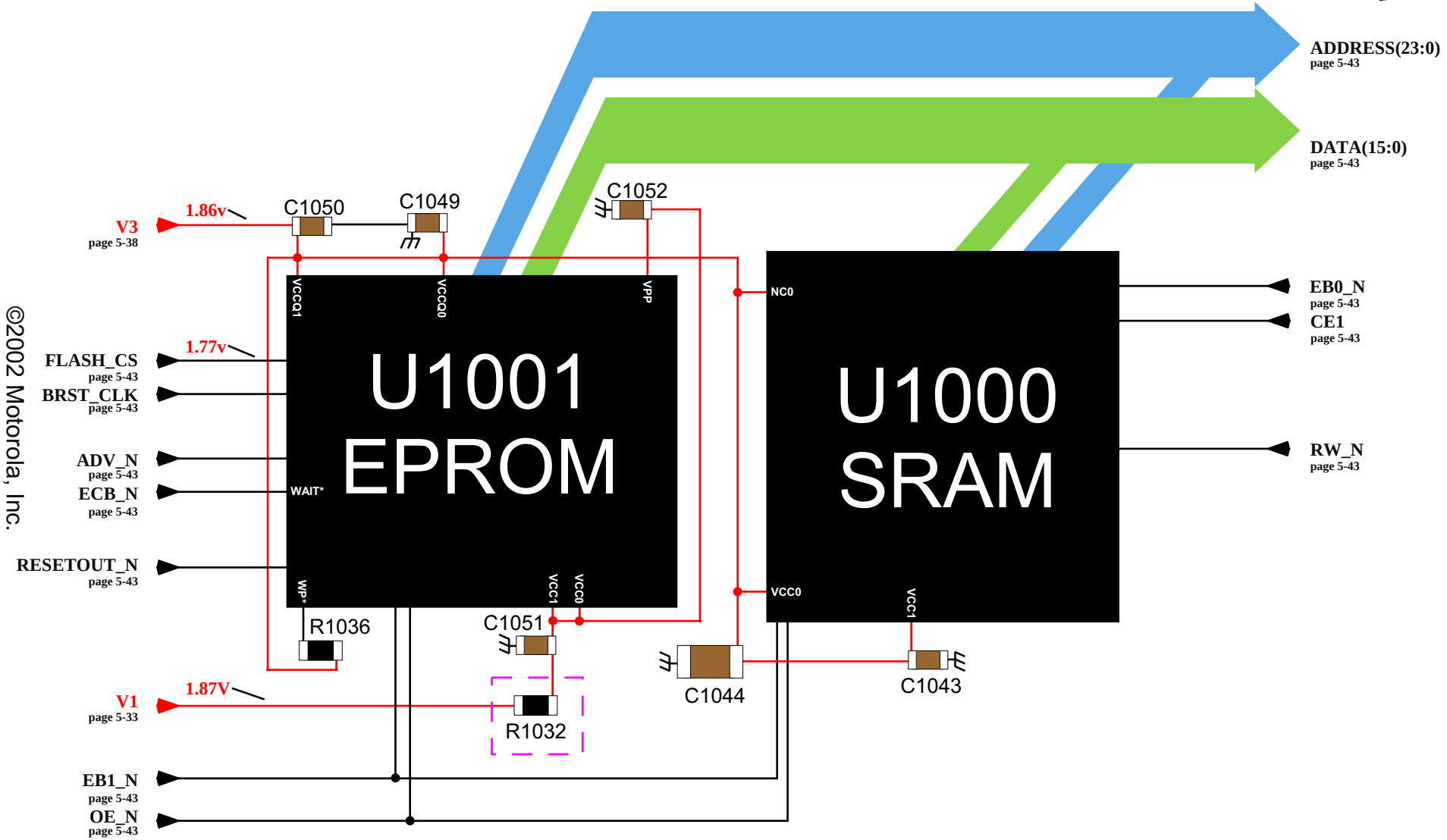
Description

The FLASH IC (U1001) is a 1.8V Dual Bank, synchronous access, 32Mbit device. It consists of two separate partitions that support hardware read while write functionality. The Baseband Processor accesses FLASH memory via a 16 bit asynchronous bus interface. This bus interface is shared with the SRAM device and contention is avoided via the Baseband Processor‘s chip select outputs. FLASH memory contains executable code that is executed directly from FLASH. Flash memory also contains configuration parameters, look-up tables, calibration constants, user selectable option settings, phone book data, call history, etc.

The SRAM IC (U1000) is a 1.8V, 4Mbit, asynchronous access device. SRAM contains run-time dynamic data storage, software stack/heap data, and other data that is frequently modified during run-time operation. This data will not be preserved for extended periods of time during power-off conditions.

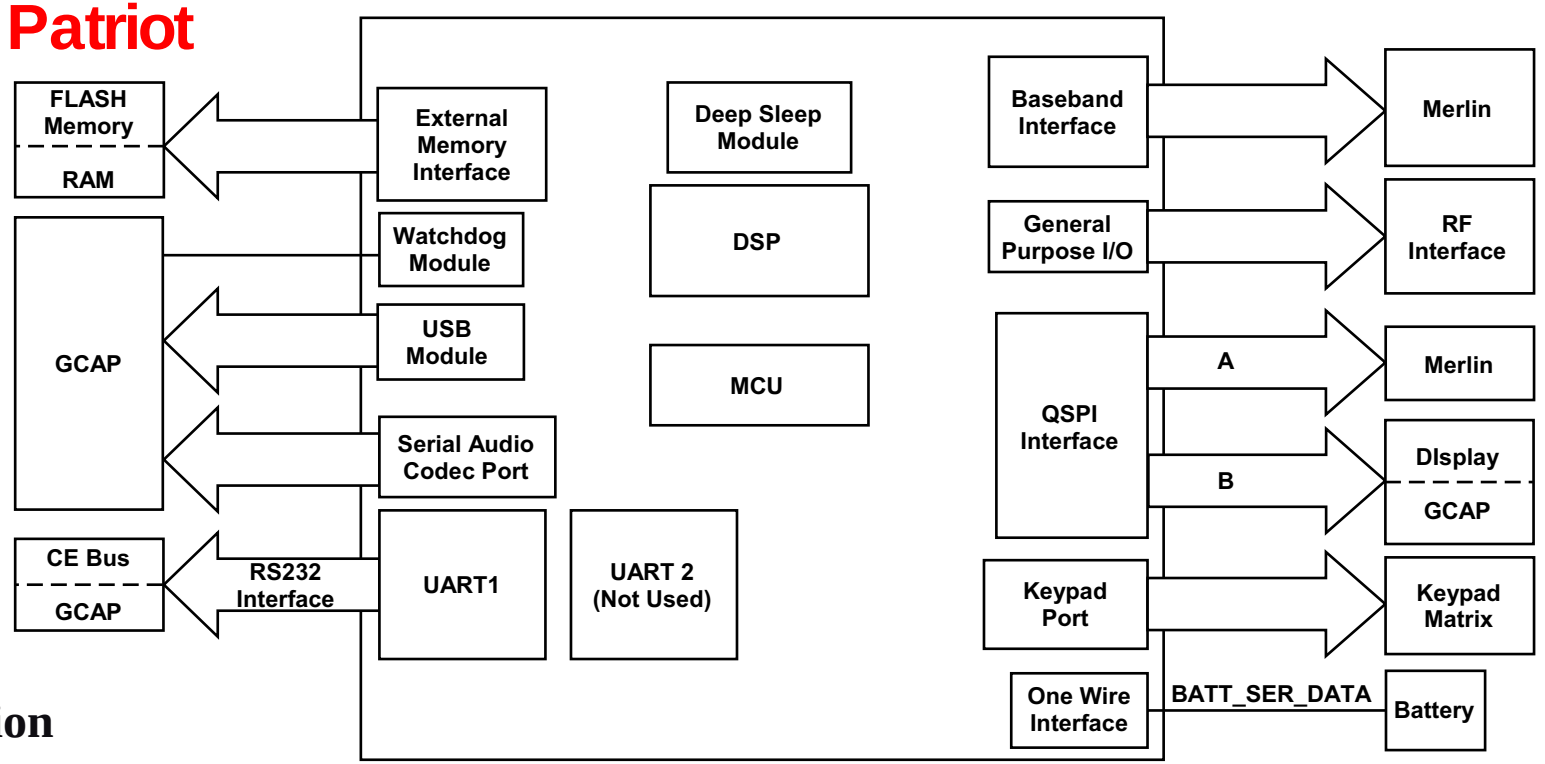
V120t: Memory





Troubleshooting Configuration	Page
Hardware Setup only No test commands necessary	6-9

V120t: Patriot

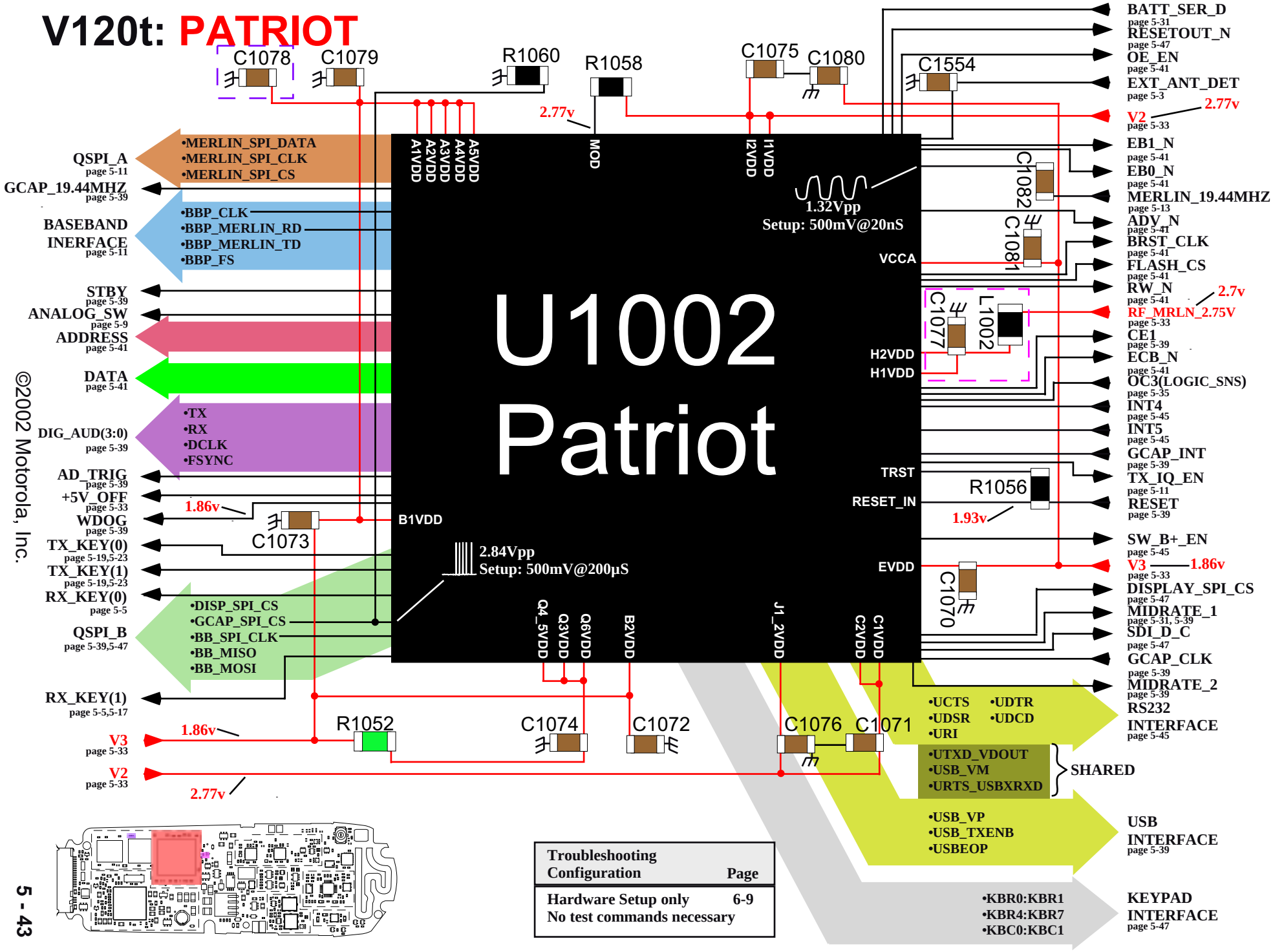


Description

U1002 is a digital baseband Processor that includes integrated peripherals optimized for cellular phone applications. It is a dual core processor that includes an M-CORE 210 MCU core, 56600 DSP Core with internal memory, and custom peripherals. The IC contains the following major features:

- M-CORE 210 with on-chip RAM and bootstrap ROM
- M-CORE External Memory Interface Module provides access to external 32Mbit Flash and 4Mbit SRAM.
- DSP 56600 with full on-chip ROM and RAM program and data memory. 4 ROM patches are supported.
- Dual Port DSP/MCU RAM
- USB Module supports USB communication through the phones external accessory connector. USB signal transceiver is located in the GCAP IC.
- UART module supports RS-232 communication through the phone‘s external accessory connector. External level translators are required.
- Layer 1 Timing Module provides RF receive and transmit path selection and enable control. 800MHz and 1900MHz transmit/receive and antenna switch con trol is provided through the L1 Timing Module.
- Deep Sleep Module controls deep-sleep operation within the Baseband Processor IC.
- Serial Audio Data Port provides a bi-directional SSI data-path to the GCAP IC. Audio data is sent/received over this interface.
- Baseband Interface Port provides a bi-directional synchronous serial digital data-path to the Custom RF interface IC. I, Q, RSSI, and AOC data are sent/received over this interface.
- Watchdog Module provides protection from unexpected application errors. If the watchdog is not serviced periodically, the processor is reset.
- QSPIA interface provides write only control for the Custom RF interface IC.
- QSPIB provides read/write control and status for the GCAP IC. Regulators, charging, audio, power on/off, timers, DACs, and ADCs are monitored and con trolled via this interface.
- QSPIB also provides write control for the display module.
- One Wire Interface provides serial read access to the internal battery EPROM.
- Keypad Port automatically detects assertion of keypad inputs and generates interrupts to the MCU.

V120t: PATRIOT



Troubleshooting Configuration	Page
Hardware Setup only No test commands necessary	6-9

V120t: CE Bus

No Block Diagram Necessary
Refer to page 5-45

Description

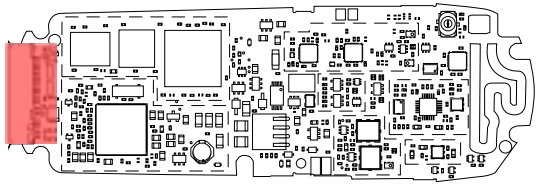
A 17 pin accessory connector (J1000) is provided at the bottom of the main housing. This interface supports charging accessories, analog and digital audio accessories, and data accessories. The accessory interface provides for auto-detection of accessories upon insertion. Depending on the accessory, power can be provided to the phone from an external approved power accessory or power can be provided to the accessory for battery-powered applications.

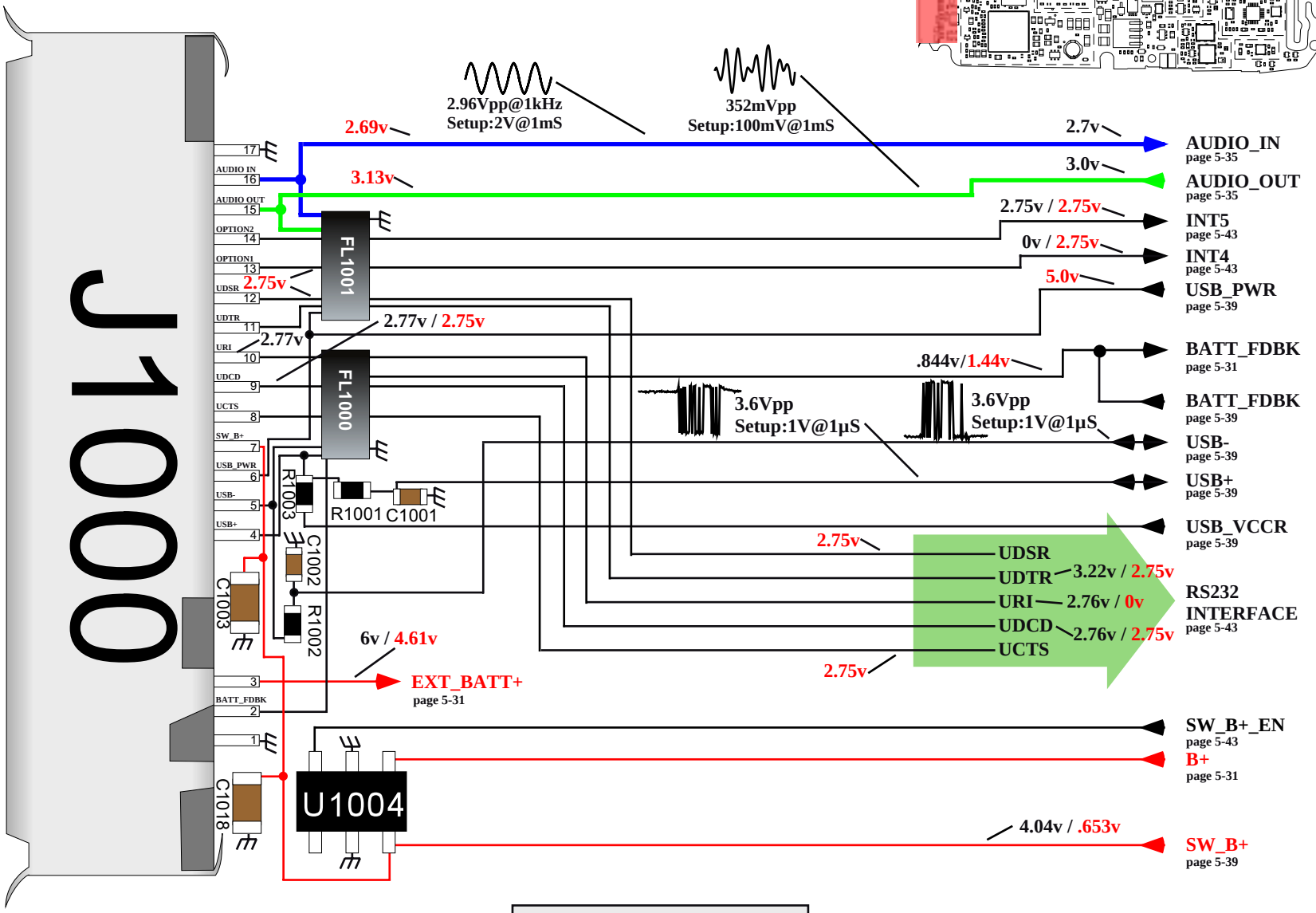
Below is a break-down of the CE bus connections.

USB Interface	-	USB+, USB-, USB_PWR
RS232	-	UTXD, URXD, URTS, URI, UDTR, UDSR, UCTS, UDCD
OPTION 1 and 2	-	Define accessory class, determine USB or RS232
BATT_FDBK	-	Charger type detect, battery feedback for tracking charging supply
EXT_BATT	-	External power source
SW_B+	-	Power for Accessories
AUDIO_OUT	-	External audio output for handsfree kits and test equipment, ON/OFF toggle
AUDIO_IN	-	External audio input from handsfree kits and test equipment, External audio detect

V120t: CE BUS

RED Voltages= USB Cable Connected w/Chgr and w/o battery.
Black Voltages=P2K Cable & Jr. Board connected





Troubleshooting Configuration	Page
TX Audio	6-7
RX Audio	6-8
For logic tests, hardware setup only No test commands	6-9

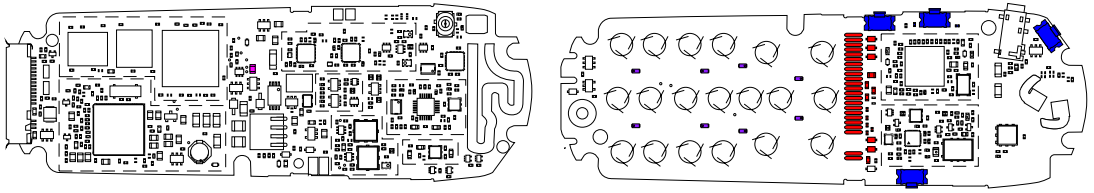
V120t: Display Interface

No Block Diagram Necessary
Refer to page 5-47

Description

The LCD Module interfaces to the transceiver board via J1004. A four-wire write-only QSPI interface sends control and data updates from the baseband processor to the LCD interface IC.

V120t: Display Interface/ Backlighting



DISP_SPI_CS page 4-43 — 2.75v
RESETOUT_N page 4-43 — 1.86v
SDI_D_C page 4-43
BB_SPI_CLK page 4-43
BB_MOSI page 4-43
V2 page 4-33 — 2.76v

U1004

VOUT
C3+
C1-
C1+
C2+
C2-
C4+
V4
V3
V2
V1
V0

C1107
C1109
C1108
C1100
C1102
C1103
C1104
C1105
C1106

VR1003
VR1004
VR1005
VR1006
VR1009

DWN
UP
C1400
C1401

KBR5 page 5-43 — 2.76v

VA

S1A

PWR_SW_STATIC page 5-37

KBR5 page 5-43
KBC1 page 5-43
KBR6 page 5-43
2.76v

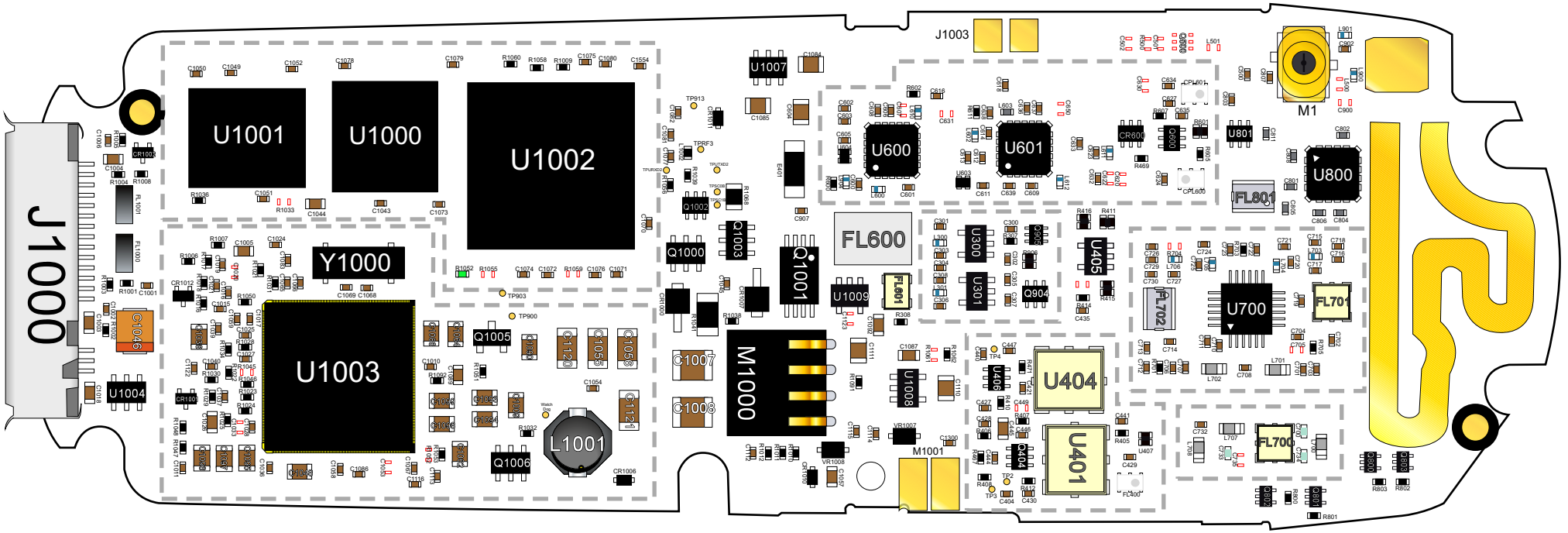
2.98v ALRT_VCC
LED+
LED-
R1067
R1068

D1007
D1003
D1004
D1006
D1001
D1005
D1000
D1002

BL_SNK page 5-39 — 0v

Troubleshooting Configuration
No test commands Test in Standby

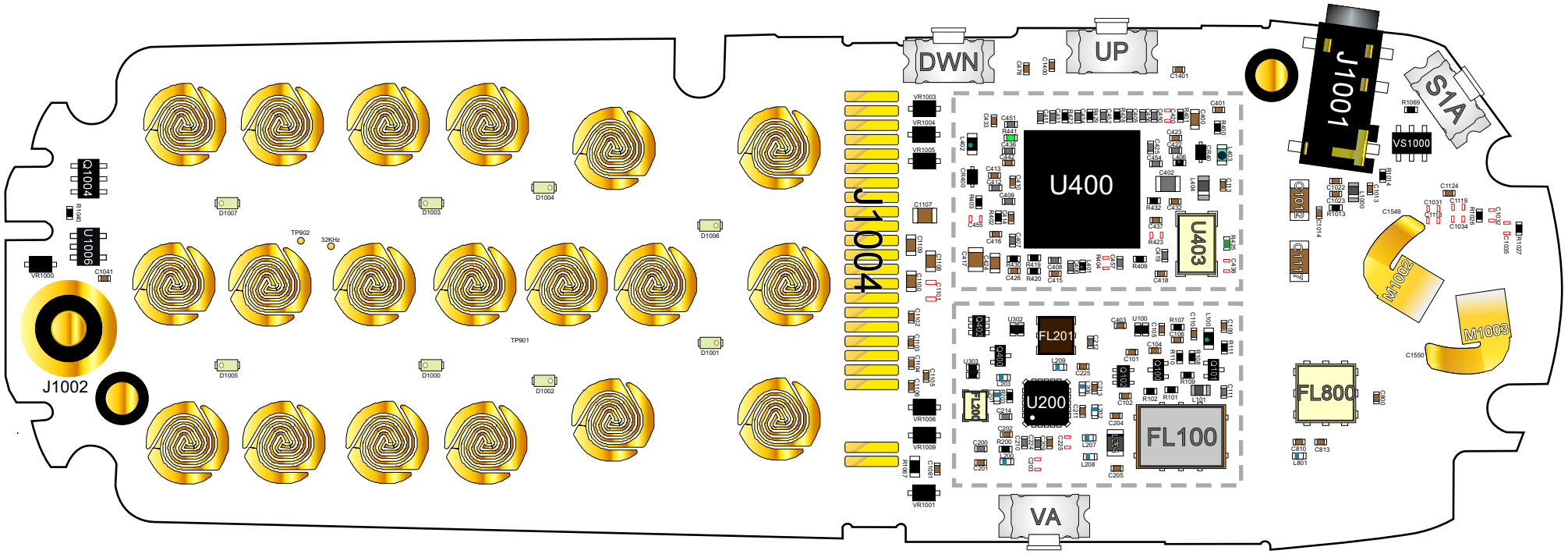
V120t: Board Layout - Side 1



Build Version P3.0

Board Number: 8489369K06

V120t: Board Layout - Side 2



Build Version P3.0

Board Number: 8489369K06

Troubleshooting Configurations

Introduction

Many troubleshooting methods are available that allow service personnel to prepare a failed transceiver for proper analysis. This section will illustrate some suggestions on how the transceiver should be configured for troubleshooting. The suggestions illustrated were used during the development of the service diagrams, therefore, it is recommended that these suggestions are followed to maintain accuracy.

The configurations are described in the following format:

- Test Equipment Setup
- Cable/Fixture Setup
- Test Command Setup

The Service Diagrams section (Section 4) will refer to a configuration illustrated in this section. Each configuration pertains to a specific troubleshooting area. Incorrect configurations will provide incorrect measurements and as a result will mislead the service agent from the root cause of the failure.

Recommended Hardware

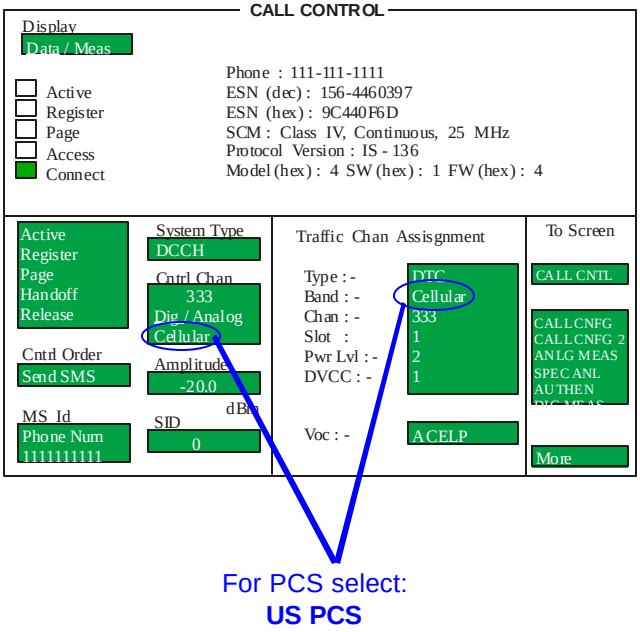
The following tools will be needed in order to configure every setup listed in this section.

- Mid-Rate Charger(SPN4940B)
- Fast Charger(SPN4716B)
- RF Connector(2887920K01)
- Junior Board(SYN8400A)
- CE Junior Board Cable(SKN6304B)
- T6 torx bit
- Battery(SNN5571A)

Any additional hardware will be listed in the configuration illustrations.

RF Digital Receiver

Equipment Setup



Test Commands

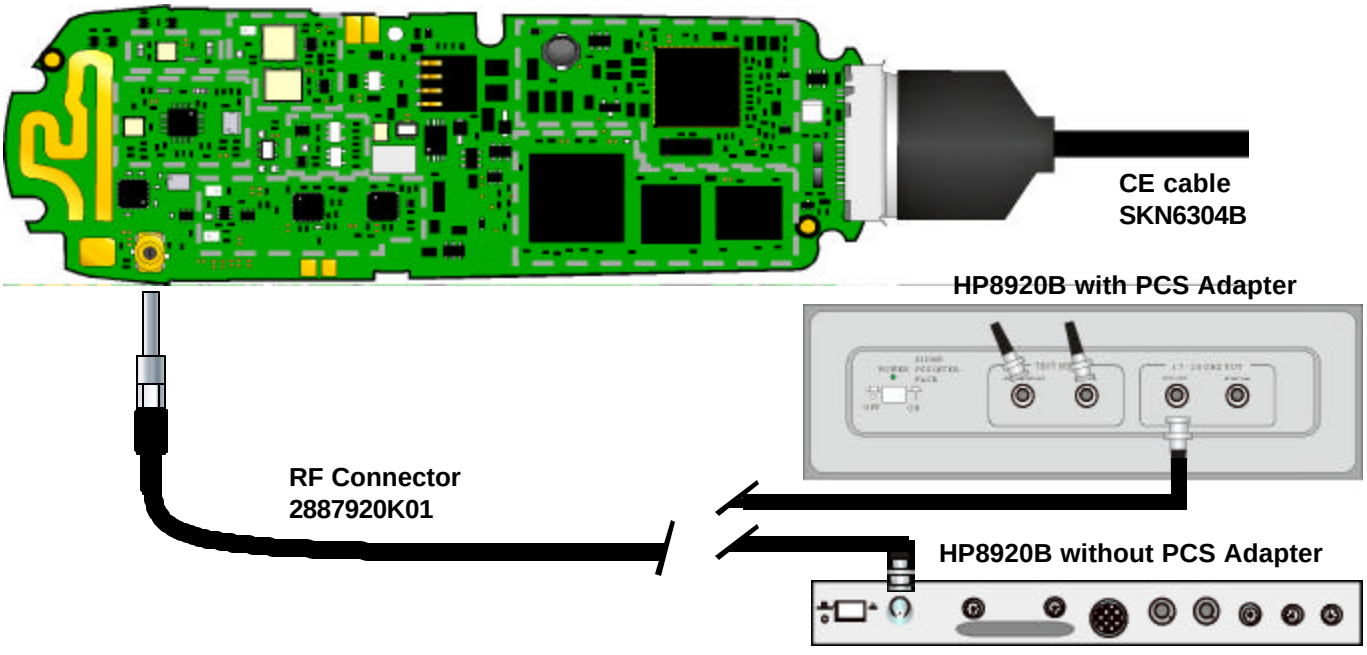
800MHz

54	Suspend
45*7	Power Step 7
20*333*0	Set channel 333 and 800MHz mode
2820*1	Slot 1
2822*1*0*0*0*1	Enable TDMA carrier, DVCC 1, No mask

1900MHz

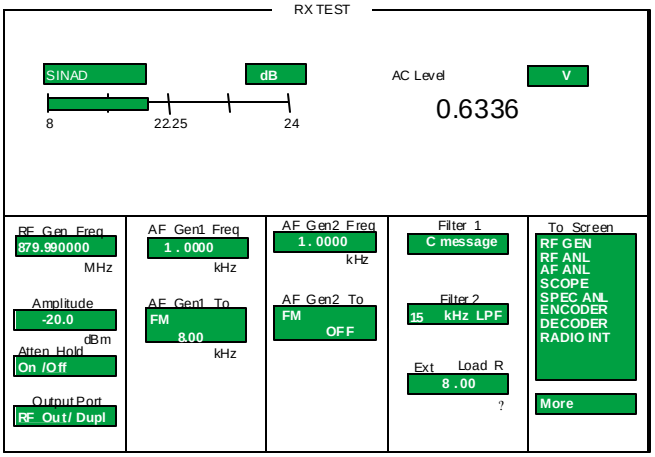
54	Suspend
45*7	Power Step 7
20*333*3	Set channel 333 and 1900MHz mode
2820*1	Slot 1
2822*1*0*0*0*1	Enable TDMA carrier, DVCC 1, No mask

Hardware Setup



RF Analog Receiver

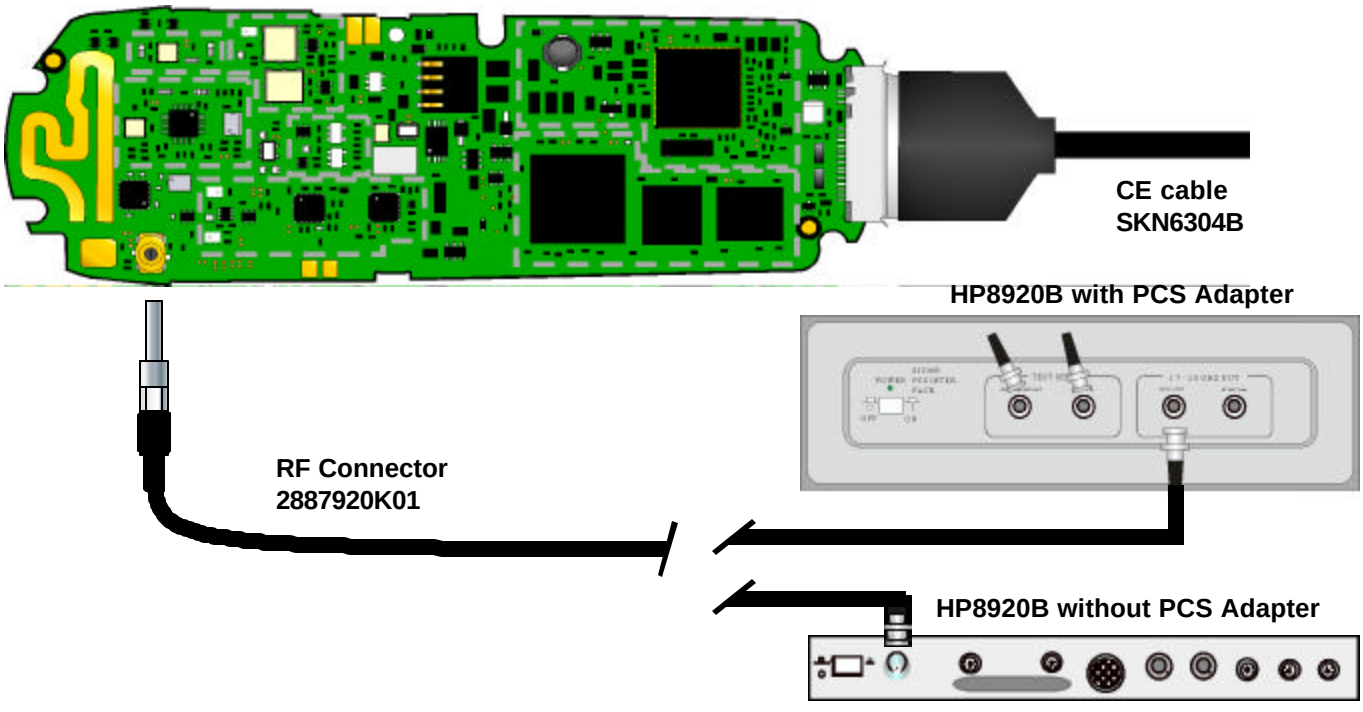
Equipment Setup



Test Commands

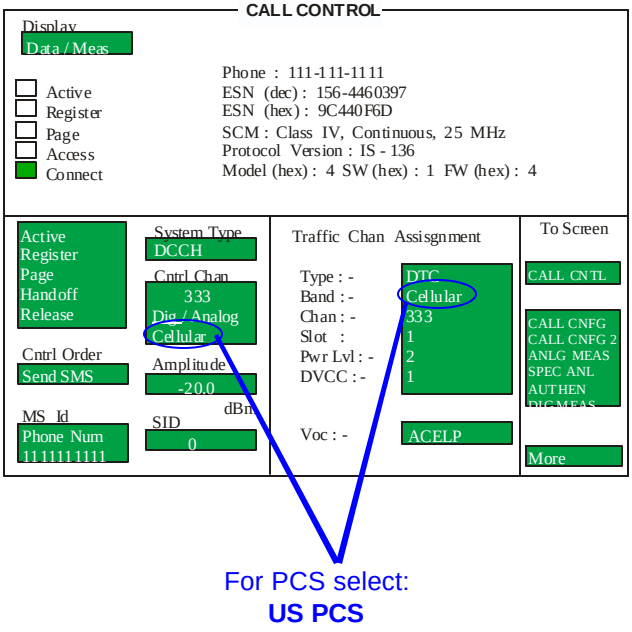
54	Suspend
45*7	Power Step 7
20*333*0	Set channel 333 and 800MHz mode
7*0*1	Carrier On
6*3*4*0*1	Unmute RX audio, mute TX audio, route audio through CE Bus

Hardware Setup



RF Digital Transmitter

Equipment Setup



Test Commands

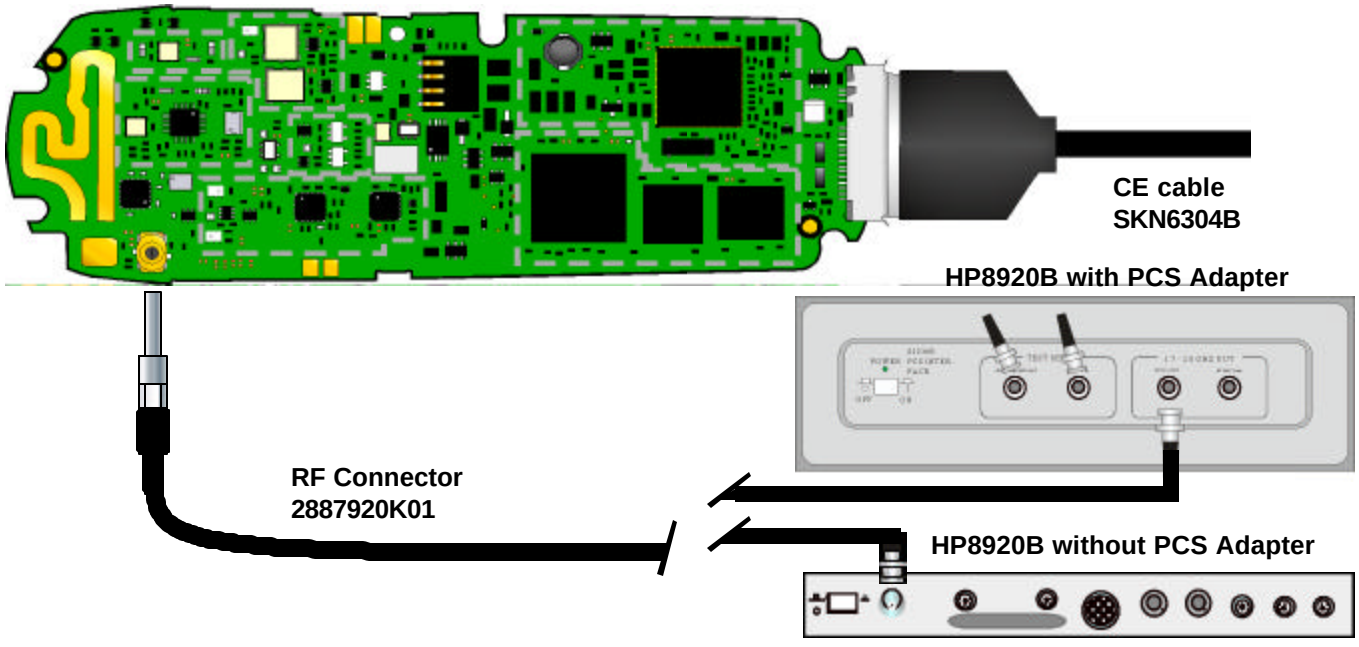
800MHz

54	Suspend
45*2	Power Step 2
20*333*0	Set channel 333 and 800MHz mode
2820*1	Slot 1
2822*1*0*0*0*1	Enable TDMA carrier, DVCC 1, No mask

1900MHz

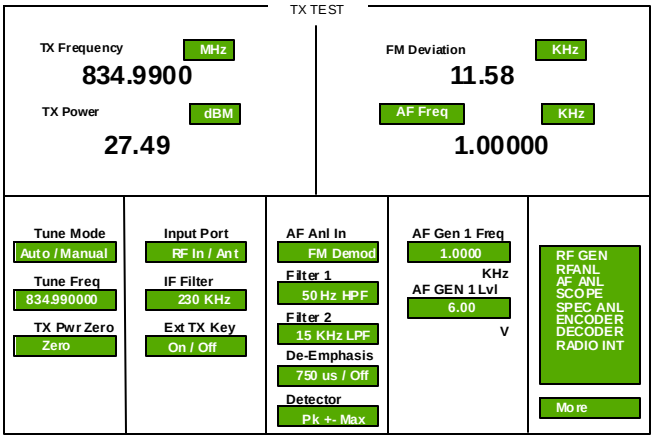
54	Suspend
45*2	Power Step 2
20*333*3	Set channel 333 and 1900MHz mode
2820*1	Slot 1
2822*1*0*0*0*1	Enable TDMA carrier, DVCC 1, No mask

Hardware Setup



RF Analog Transmitter

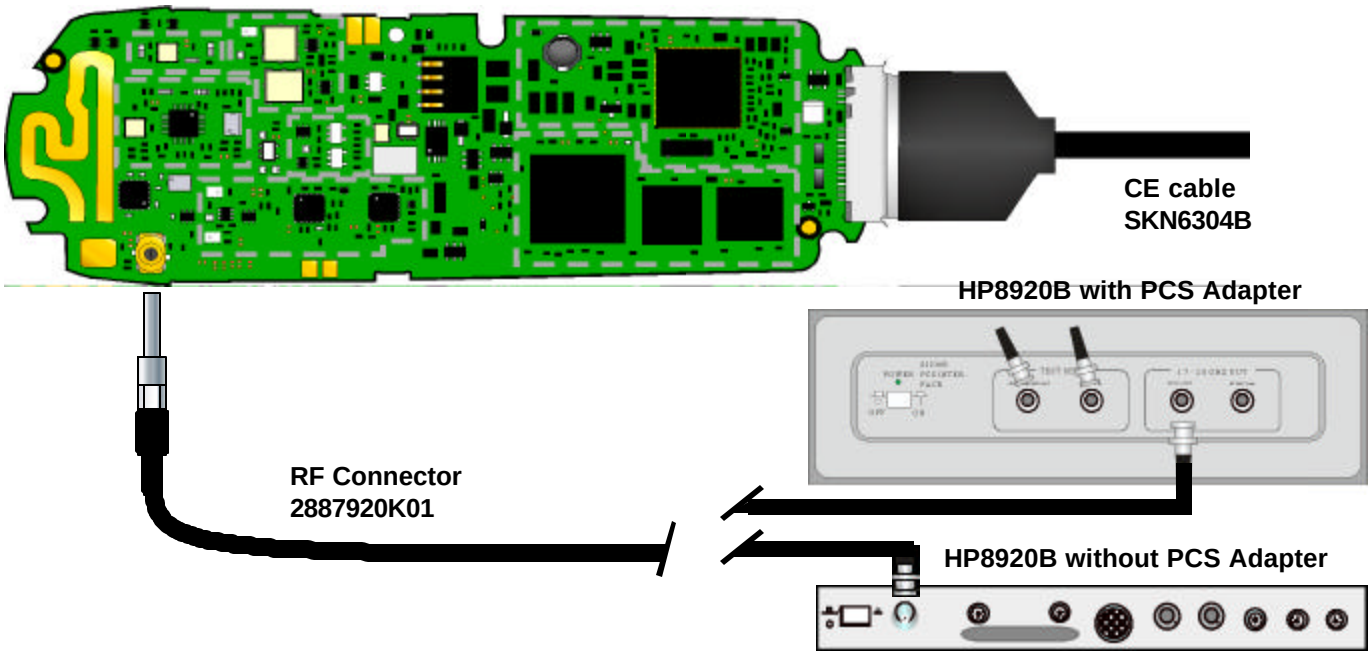
Equipment Setup



Test Commands

54	Suspend
45*2	Power Step 2
20*333*0	Set channel 333 and 800MHz mode
7*0*1	Carrier On

Hardware Setup



Charger Setup

Equipment

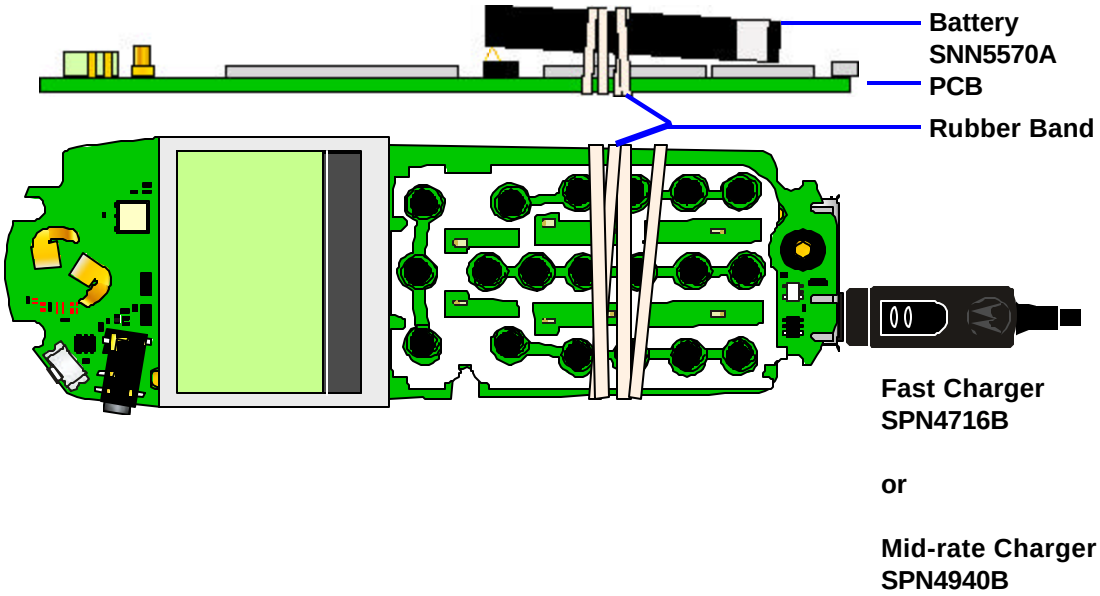
No equipment setup is necessary.

Test Commands

No test commands are necessary

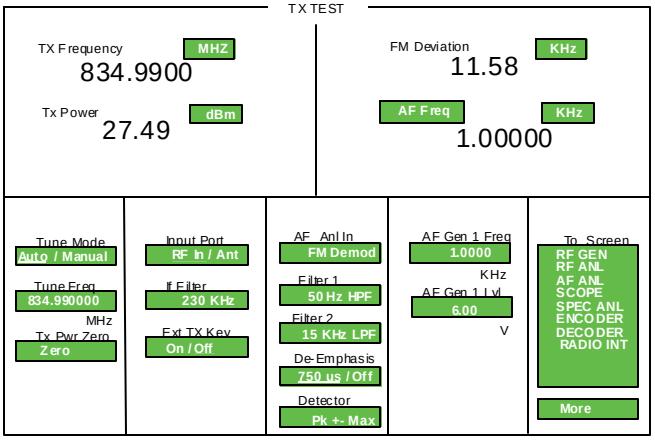
For most charger tests, a fast charger is used. Some tests may require the use of the mid-rate charger. Refer to the service diagrams to determine which charger will be used during charger tests

Hardware Setup



TX Audio Setup

Equipment



Test Commands

External Audio In(CE Bus)

54	Suspend
6*3*0*1*0	Audio in unmuted

Equipment setup required as illustrated

Handset Mic

54	Suspend
6*2*0*1*0	Internal mic unmuted

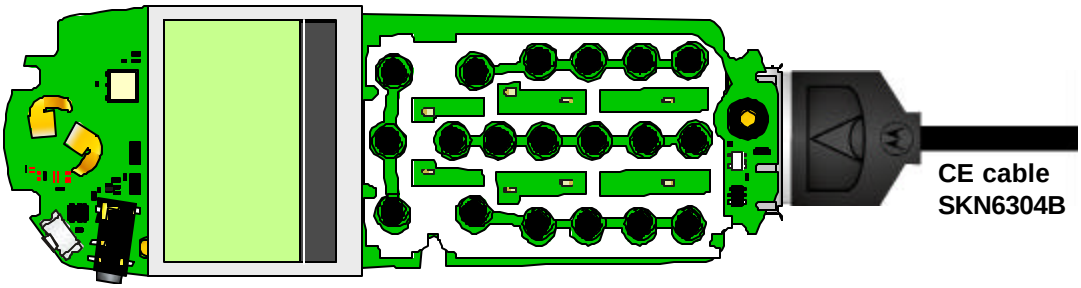
Rub against the mic with your finger while signal tracing. Equipement setup not required

Headset Mic

54	Suspend
6*4*0*1*0	Headset mic unmuted

Rub against the headset mic with your finger while signal tracing. Equipment setup not required.

Hardware Setup



RX Audio Setup

Equipment Setup

No equipment setup is necessary

Test Commands

Handset Speaker

0*0*0	Start DTMF tone “0”
0*1*0	Stop DTMF tone “0”
5*0*2	Volume Level 2
6*0*2*0*1	Handset speaker unmute

Headset Speaker

0*0*0	Start DTMF tone “0”
0*1*0	Stop DTMF tone “0”
5*0*2	Volume Level 2
6*0*6*0*1	Headset speaker unmute

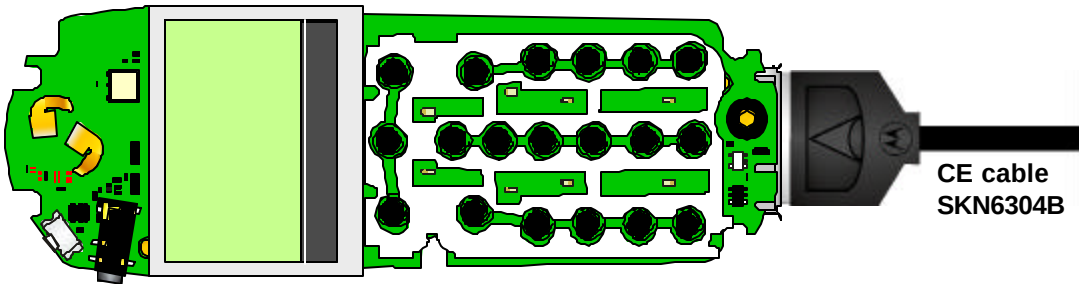
Alert

0*0*0	Start DTMF tone “0”
0*1*0	Stop DTMF tone “0”
5*0*2	Volume Level 2
6*0*3*0*1	Alert unmute

External Audio Out(CE Bus)

0*0*0	Start DTMF tone “0”
0*1*0	Stop DTMF tone “0”
5*0*7	Volume Level 7
6*0*4*0*1	Audio out unmute

Hardware Setup



Vibrator Setup

Equipment Setup

No equipment setup is required.

Test Commands

3*0*1	Enable vibrator
3*0*0	Disable vibrator

Display Circuits

Equipment Setup

No equipment setup required.

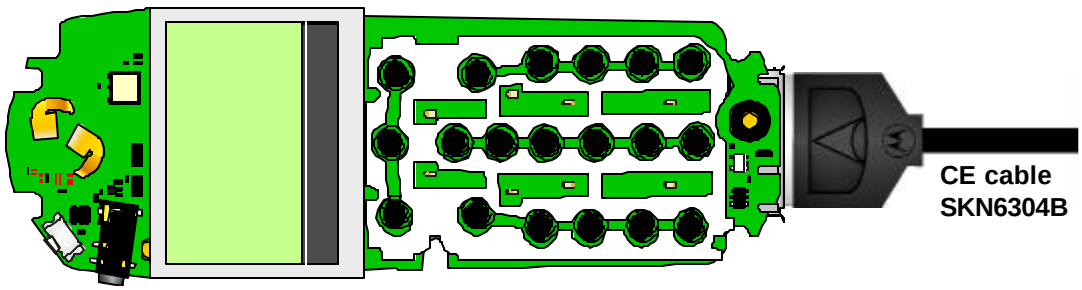
Test Commands

Display

55*1*000	Select Main Display
55*2*001	All pixels on

Hardware Setup

Hardware Setup



Parts List

Introduction

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 listed in this document should be directed to the following Motorola International Logistics Department:

Accessories and Aftermarket (AAD)
Schaumburg, IL, USA

Domestic
Customer Service: 1-800-422-4210
Hours: 7am - 7pm US Central Time

International
Customer Service: 1-847-538-8023
Hours: 8am - 6:30pm US Central Time

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.

Mechanical Explosion

The Mechanical explosion, figure 33., contains a graphical representation of the accessible mechanical parts found in the V120t. The illustration also includes reference numbers that can be matched to table 8 for detailed information about the part.

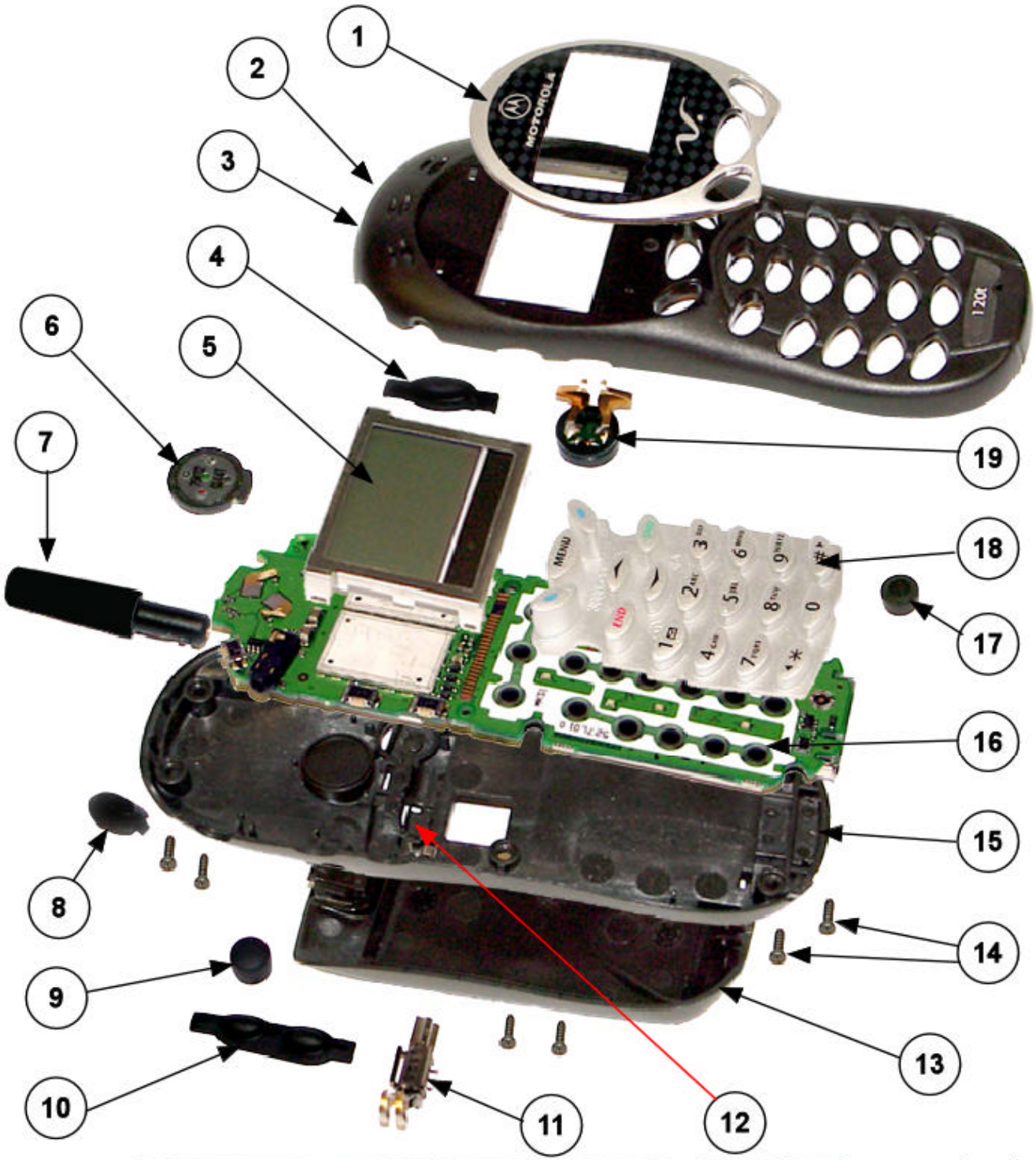


Figure 33. Mechanical Explosion

Mechanical Parts List

The following table lists the mechanical parts list for the TDMA V120t telephone.

Table 12. Mechanical Parts List

Reference Number	Part Number	Description
1	6188789K06	Black Lens
1	6188789K08	Silver Lens
1	6188789K09	Silver (Cingular) Lens
2	1588865K06	Front Housing Assembly - Black
3	1588865K08	Front Housing Assembly - Silver
4	Part of Front Housing	Smart Button
5	7202879Z85	LCD Dispaly
6	5087975K02	Speaker
7	8586403P01	Antenna
8	Part of Front Housing	Power Button
9	0587903L03	RF Grommet - Black
10	Part of Front Housing	Volume Button
11	5987947K12	Vibrator
12	4104539Z01	Spring Mechanical Contact
13	SHN7792A	Battery Cover - Black
13	SHN8061A	Battery Cover - Silver
14	0309315B12	Screw torx

Reference Number	Part Number	Description
15	1588875K07	Back Housing Assembly - Black
15	1588875K06	Back Housing Assembly - Silver
16	4088527L01	Mylar
17	5085600J01	Mic
18	3888526L05	Keypad
19	5009005J10	Alert Transducer

Electrical Parts List

The following table lists the electrical parts list for the TDMA V120t telephone.

Table 13. Electrical Parts List

Reference Number	Part Number	Description
ARROW_DWN	PT39LVLA01	SWITCH
ARROW_UP	PT39LVLA01	SWITCH
C1001	2113743N40	CAP, 39pF
C1002	2113743N40	CAP, 39pF
C1004	2113928P04	CAP, 1.0uF
C1005	2113743E20	CAP, 0.1uF
C1006	2113928N01	CAP, 0.1uF
C1007	2113928J08	CAP, 10uF
C1008	2113928J08	CAP, 10uF
C1009	2113928C04	CAP, 4.7uF
C101	2113743L17	CAP, 1000pF
C1010	2113743L31	CAP, 3900pF
C1011	2113743L41	CAP, .01uF
C1012	2113928K09	CAP, 10uF
C1013	2113743N40	CAP, 39pF
C1014	2113743N40	CAP, 39pF
C1015	2113743N38	CAP, 33pF
C1016	2113743M24	CAP, 0.1uF
C1017	2113743M24	CAP, 0.1uF
C1019	2113743N50	CAP, 100pF
C102	2113743L17	CAP, 1000pF
C1021	2113743M24	CAP, 0.1uF
C1022	2113743N40	CAP, 39pF
C1023	2113743N40	CAP, 39pF
C1024	2113743N40	CAP, 39pF
C1025	2113743M24	CAP, 0.1uF
C1026	2113743E10	CAP, .033uF
C1027	2113743M24	CAP, 0.1uF
C1028	2113743L23	CAP, 1800pF
C1031	2113743N40	CAP, 39pF
C1032	2113743N40	CAP, 39pF
C1033	2113743N40	CAP, 39pF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C1034	2113743N40	CAP, 39pF
C1035	2113743N40	CAP, 39pF
C1036	2113743N40	CAP, 39pF
C1037	2113743L05	CAP, 330pF
C1038	2113928C04	CAP, 4.7uF
C1039	2113743N40	CAP, 39pF
C104	2113743L17	CAP, 1000pF
C1040	2113743M24	CAP, 0.1uF
C1041	2113743N40	CAP, 39pF
C1043	2113743M24	CAP, 0.1uF
C1044	2113928P04	CAP, 1.0uF
C1045	2113743L41	CAP, .01uF
C1046	2311049A65	CAPP, 22uF
C1048	2113928C04	CAP, 4.7uF
C1049	2113743M24	CAP, 0.1uF
C105	2113743L17	CAP, 1000pF
C1050	2113743M24	CAP, 0.1uF
C1051	2113743M24	CAP, 0.1uF
C1052	2113743M24	CAP, 0.1uF
C1054	2113743M24	CAP, 0.1uF
C1055	2113928K09	CAP, 10uF
C1056	2113928K09	CAP, 10uF
C1057	2113928A01	CAP, 1.0uF
C1058	2113743N38	CAP, 33pF
C1059	2113743M24	CAP, 0.1uF
C106	2113743L17	CAP, 1000pF
C1061	2113743N38	CAP, 33pF
C1062	2113928C04	CAP, 4.7uF
C1064	2113928C04	CAP, 4.7uF
C1065	2113743N38	CAP, 33pF
C1066	2113743M24	CAP, 0.1uF
C1067	2113743M24	CAP, 0.1uF
C1068	2113743N30	CAP, 15pF
C1069	2113743N30	CAP, 15pF
C1070	2113743M24	CAP, 0.1uF
C1071	2113743M24	CAP, 0.1uF
C1072	2113743M24	CAP, 0.1uF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C1073	2113743M24	CAP, 0.1uF
C1074	2113743M24	CAP, 0.1uF
C1075	2113743M24	CAP, 0.1uF
C1076	2113743M24	CAP, 0.1uF
C1077	2113743M24	CAP, 0.1uF
C1078	2113743M24	CAP, 0.1uF
C1079	2113743M24	CAP, 0.1uF
C1080	2113743M24	CAP, 0.1uF
C1081	2113743M24	CAP, 0.1uF
C1082	2113743L41	CAP, .01uF
C1083	2113743N30	CAP, 15pF
C1084	2113928C04	CAP, 4.7uF
C1085	2113928C04	CAP, 4.7uF
C1086	2113743N38	CAP, 33pF
C1087	2113928P04	CAP, 1.0uF
C1088	2113928C04	CAP, 4.7uF
C1089	2113928P04	CAP, 1.0uF
C109	2113743L17	CAP, 1000pF
C1090	2113928C04	CAP, 4.7uF
C1092	2113928P04	CAP, 1.0uF
C1093	2113928C04	CAP, 4.7uF
C1094	2113928C04	CAP, 4.7uF
C1095	2113928C04	CAP, 4.7uF
C1096	2113928C04	CAP, 4.7uF
C1097	2113928C04	CAP, 4.7uF
C1098	2113928C04	CAP, 4.7uF
C1099	2113928C04	CAP, 4.7uF
C110	2113743L41	CAP, .01uF
C1100	2113928P04	CAP, 1.0uF
C1102	2113743M24	CAP, 0.1uF
C1103	2113743M24	CAP, 0.1uF
C1104	2113743M24	CAP, 0.1uF
C1105	2113743M24	CAP, 0.1uF
C1106	2113743M24	CAP, 0.1uF
C1107	2113928C03	CAP, 1.0uF
C1108	2113928P04	CAP, 1.0uF
C1109	2113928P04	CAP, 1.0uF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C111	2113743N18	CAP, 4.7pF
C1110	2113928C04	CAP, 4.7uF
C1111	2113928C04	CAP, 4.7uF
C1112	2113743L41	CAP, .01uF
C1113	2113743N40	CAP, 39pF
C1114	2113743N40	CAP, 39pF
C1115	2113743N40	CAP, 39pF
C1115	2113743N40	CAP, 39pF
C1117	2113928K09	CAP, 10uF
C1118	2113743L41	CAP, .01uF
C1119	2113743L41	CAP, .01uF
C1120	2113928K09	CAP, 10uF
C1121	2113928K09	CAP, 10uF
C1122	2113743N40	CAP, 39pF
C113	2113743L17	CAP, 1000pF
C1300	2113743N03	CAP, 1pF
C1400	2113743N03	CAP, 1pF
C1401	2113743N03	CAP, 1pF
C1549	2113743K16	CAP, 0.22uF
C1550	2113743K16	CAP, 0.22uF
C1554	2113743N40	CAP, 39pF
C200	2113743N50	CAP, 100pF
C201	2113743L41	CAP, .01uF
C202	2113743N10	CAP, 2.2pF
C204	2113743N22	CAP, 6.8pF
C205	2113743N22	CAP, 6.8pF
C209	2113743L41	CAP, .01uF
C210	2113743N50	CAP, 100pF
C211	2113743N28	CAP, 12pF
C212	2113743N07	CAP, 1.5pF
C213	2113743L41	CAP, .01uF
C214	2113743N50	CAP, 100pF
C224	2113743N26	CAP, 10pF
C225	2113743N28	CAP, 12pF
C300	2113743N28	CAP, 12pF
C301	2113743N07	CAP, 1.5pF
C302	2113743N26	CAP, 10pF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C303	2113743N28	CAP, 12pF
C304	2113928N01	CAP, 0.1uF
C305	2113743N50	CAP, 100pF
C306	2113743N13	CAP, 3pF
C307	2113743N50	CAP, 100pF
C308	2113743N50	CAP, 100pF
C400	2113743E03	CAP, .015uF
C401	2113928N01	CAP, 0.1uF
C402	2113928C04	CAP, 4.7uF
C403	2113743N20	CAP, 5.6pF
C404	2113743N40	CAP, 39pF
C405	2113928N01	CAP, 0.1uF
C406	2113928N01	CAP, 0.1uF
C407	2113928N01	CAP, 0.1uF
C408	2113743N50	CAP, 100pF
C409	2113743L17	CAP, 1000pF
C410	2113743N28	CAP, 12pF
C411	2113928N01	CAP, 0.1uF
C412	2113743N50	CAP, 100pF
C413	2113743N28	CAP, 12pF
C414	2113743L21	CAP, 1500pF
C415	2113928N01	CAP, 0.1uF
C416	2113743L41	CAP, .01uF
C417	2113928C04	CAP, 4.7uF
C418	2113743L41	CAP, .01uF
C419	2113743N50	CAP, 100pF
C421	2113928N01	CAP, 0.1uF
C422	2113743N26	CAP, 10pF
C423	2113743N44	CAP, 56pF
C424	2113928P04	CAP, 1.0uF
C425	2113743N30	CAP, 15pF
C426	2113743L17	CAP, 1000pF
C427	2113743L33	CAP, 4700pF
C428	2113743L05	CAP, 330pF
C429	2113743N20	CAP, 5.6pF
C430	2113928N01	CAP, 0.1uF
C431	2113743N29	CAP, 13pF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C432	2113928N01	CAP, 0.1uF
C433	2113928N01	CAP, 0.1uF
C434	2113928N01	CAP, 0.1uF
C435	2113743N50	CAP, 100pF
C437	2113743L17	CAP, 1000pF
C440	2113743L01	CAP, 220pF
C441	2113928N01	CAP, 0.1uF
C442	2113743L41	CAP, .01uF
C444	2113743L09	CAP, 470pF
C445	2113743E12	CAP, .047uF
C446	2113743L17	CAP, 1000pF
C447	2113743N40	CAP, 39pF
C450	2113928N01	CAP, 0.1uF
C451	2113928N01	CAP, 0.1uF
C452	2113928N01	CAP, 0.1uF
C454	2113928N01	CAP, 0.1uF
C456	2113743L41	CAP, .01uF
C457	2113928N01	CAP, 0.1uF
C478	2113743N03	CAP, 1pF
C600	2113743L41	CAP, .01uF
C601	2113743N16	CAP, 3.9pF
C602	2113743L41	CAP, .01uF
C603	2113743N50	CAP, 100pF
C604	2113928C04	CAP, 4.7uF
C605	2113743N50	CAP, 100pF
C606	2113743L41	CAP, .01uF
C608	2113743N50	CAP, 100pF
C609	2113743N30	CAP, 15pF
C611	2113743N30	CAP, 15pF
C612	2113743L41	CAP, .01uF
C613	2113743N30	CAP, 15pF
C614	2113743N50	CAP, 100pF
C616	2113743N24	CAP, 8.2pF
C618	2113743N20	CAP, 5.6pF
C623	2113743N50	CAP, 100pF
C624	2113743N26	CAP, 10pF
C627	2113743N50	CAP, 100pF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C632	2109445U11	CAP, 2.2pF
C633	2113743N19	CAP, 5.1pF
C634	2113743N50	CAP, 100pF
C635	2113743N50	CAP, 100pF
C636	2113743L17	CAP, 1000pF
C637	2113743N30	CAP, 15pF
C638	2113743L17	CAP, 1000pF
C639	2113743L41	CAP, .01uF
C700	2113743N16	CAP, 3.9pF
C701	2113743N50	CAP, 100pF
C702	2113743N50	CAP, 100pF
C703	2113743L41	CAP, .01uF
C704	2113743N26	CAP, 10pF
C706	2113743N50	CAP, 100pF
C707	2113743L41	CAP, .01uF
C708	2113743N20	CAP, 5.6pF
C710	2113743N03	CAP, 1pF
C711	2113743N50	CAP, 100pF
C712	2113743N50	CAP, 100pF
C713	2113743L41	CAP, .01uF
C714	2113743N16	CAP, 3.9pF
C715	2113743N07	CAP, 1.5pF
C716	2113743L41	CAP, .01uF
C717	2113743N10	CAP, 2.2pF
C718	2113743N50	CAP, 100pF
C719	2113743N50	CAP, 100pF
C720	2113743N10	CAP, 2.2pF
C721	2113743N50	CAP, 100pF
C722	2113743N50	CAP, 100pF
C723	2113743N50	CAP, 100pF
C724	2113743N19	CAP, 5.1pF
C725	2113743N03	CAP, 1pF
C726	2113743N50	CAP, 100pF
C727	2113743N05	CAP, 1.2pF
C729	2113743L41	CAP, .01uF
C730	2113743N03	CAP, 1pF
C732	2113743N10	CAP, 2.2pF

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
C733	2113743N26	CAP, 10pF
C734	2113743N12	CAP, 2.7pF
C800	2113743N50	CAP, 100pF
C801	2113743N50	CAP, 100pF
C802	2113743N50	CAP, 100pF
C803	2113743N50	CAP, 100pF
C804	2113743N50	CAP, 100pF
C805	2113743N50	CAP, 100pF
C806	2113743N50	CAP, 100pF
C807	2113743N50	CAP, 100pF
C808	2113743N50	CAP, 100pF
C810	2113743N20	CAP, 5.6pF
C811	2113743N50	CAP, 100pF
C813	2113743N22	CAP, 6.8pF
C902	2113743N26	CAP, 10pF
C907	2113743N50	CAP, 100pF
CE_FIDB1	FIDUCIAL_CE	CE_FIDUCIAL
CE_FIDB2	FIDUCIAL_CE	CE_FIDUCIAL
CE_FIDB3	FIDUCIAL_CE	CE_FIDUCIAL
CE_FIDB4	FIDUCIAL_CE	CE_FIDUCIAL
CPL600	5888581K01	LDC15H
CPL601	5888583K01	LDC15H
CR1000	4809653F07	MBRM120ET3
CR1001	4809606E07	DAN221T
CR1002	4809606E07	DAN221T
CR1006	4809924D18	RB520S-30
CR1007	4809653F07	MBRM120ET3
CR1010	4809924D18	RB520S-30
CR1011	4809924D18	RB520S-30
CR1012	4809606E07	DAN221T
CR400	4809877C08	1SV279
CR401	4809877C08	1SV279
CR600	4809924D16	HSMS282K
D1000	4809496B11	QSMG-H799
D1001	4809496B11	QSMG-H799
D1002	4809496B11	QSMG-H799
D1003	4809496B11	QSMG-H799

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
D1004	4809496B11	QSMG-H799
D1005	4809496B11	QSMG-H799
D1006	4809496B11	QSMG-H799
D1007	4809496B11	QSMG-H799
DWN	4009368L08	SWITCH
E401	2487996L01	EXCML45A
END	PT39LVLA01	SWITCH
FL100	9109405J14	05J14
FL1000	4889526L02	CSPEMI-307
FL1001	4889526L02	CSPEMI-307
FL200	9103913K16	13K16
FL201	9109239M07	F6CE
FL400	9185906G12	LFDP15N0056
FL600	9109674L12	74L12
FL601	9103913K16	13K16
FL700	9103917K07	DSF334SAF
FL701	9103913K04	13K04
FL702	9185861J03	MDR660
FL800	9109170T04	855904
FL801	9185861J03	MDR660
J1000	0987636K06	CONN_J
J1001	0987837L02	CONN_J
J1002	5085600J01	SPKR
J1003	5009005J10	SPKR
J1004	PT72LVLA01	VLA01
L100	2409646M98	IDCTR, 100nH
L1000	2409646M13	IDCTR, 39nH
L1001	2589584K11	IDCTR, 47uH
L1002	2409154M75	IDCTR, 100nH
L101	2409646M21	IDCTR, 68.0nH
L200	2409154M14	IDCTR, 12.0nH
L201	2409154M14	IDCTR, 12.0nH
L202	2409154M06	IDCTR, 2.7nH
L203	2409154M03	IDCTR, 1.5nH
L204	2404574Z09	IDCTR, 100nH
L206	2409154M12	IDCTR, 8.2nH
L207	2409154M17	IDCTR, 22.0nH

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
L208	2409154M17	IDCTR, 22.0nH
L209	2409154M17	IDCTR, 22.0nH
L300	2409154M08	IDCTR, 3.9nH
L301	2409154M14	IDCTR, 12.0nH
L401	2409154M75	IDCTR, 100nH
L402	2409377M16	IDCTR, 82nH
L403	2485793G11	IDCTR, 39nH
L404	2413926D24	IDCTR, 120nH
L406	2409134J27	BK1005HM102
L600	2409154M03	IDCTR, 1.5nH
L602	2409154M12	IDCTR, 8.2nH
L603	0662057M01	RES, 0
L610	2409154M18	IDCTR, 27.0nH
L611	2409154M06	IDCTR, 2.7nH
L612	2409154M13	IDCTR, 10.0nH
L700	2413926D27	IDCTR, 220nH
L701	2413926D24	IDCTR, 120nH
L702	2413926D24	IDCTR, 120nH
L703	2409154M10	IDCTR, 5.6nH
L704	2409154M12	IDCTR, 8.2nH
L705	2409154M05	IDCTR, 2.2nH
L706	2409154M03	IDCTR, 1.5nH
L707	2413926D27	IDCTR, 220nH
L708	2413926D29	IDCTR, 330nH
L801	2489711L28	IDCTR, 7.5nH
L900	2409154M11	IDCTR, 6.8nH
L901	2409154M15	IDCTR, 15.0nH
L904	2409154M21	IDCTR, 47.0nH
M1	0987378K01	SWITCH
M1000	3988787K01	CONTACT
M1001	5987947K04	MOTOR
M1002	3989328K01	CONTACT
M1003	3989328K01	CONTACT
Q100	4805793Y01	NE68519
Q1000	4809579E29	SI3443
Q1001	4809579E49	SI6467DQ
Q1002	4809939C03	UMD3NTR

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
Q1003	4809579E29	SI3443
Q1004	4809579E29	SI3443
Q1005	4813824A17	MMBT3906
Q1006	4809579E29	SI3443
Q101	4805793Y01	NE68519
Q102	4809939C38	EMC2, 10K
Q400	4809579E24	2SJ347
Q402	4809939C37	EMH9, 12pF
Q404	4809579E30	HN1K02
Q600	4809579E36	FDG6302P
Q800	4809939C38	EMC2, 10K
Q801	4809939C38	EMC2, 10K
Q802	4809939C38	EMC2, 10K
Q803	4809939C38	EMC2, 10K
Q904	4809579E36	FDG6302P
Q905	4809939C37	EMH9, 12pF
R1001	0662057M30	RES, 15
R1002	0662057M30	RES, 15
R1003	0662057M78	RES, 1.5K
R1004	0662057M74	RES, 1K
R1005	0662057N15	RES, 47K
R1006	0662057N33	RES, 270K
R1007	0662057M74	RES, 1K
R1008	0662057M50	RES, 100
R1008	0662057M74	RES, 1K
R1009	0662057M90	RES, 4.7K
R101	0662057M80	RES, 1.8K
R1010	0662057M98	RES, 10K
R1011	0662057N06	RES, 20K
R1012	0662057N34	RES, 300K
R1013	0662057M45	RES, 62
R1014	0662057M98	RES, 10K
R1016	0662057M90	RES, 4.7K
R1017	0662057N19	RES, 68K
R1018	0662057M98	RES, 10K
R102	0662057M74	RES, 1K
R1021	0662057N15	RES, 47K

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
R1022	0662057N03	RES, 15K
R1023	0662057M88	RES, 3.9K
R1024	0662057M50	RES, 100
R1025	0662057N07	RES, 22K
R1026	0662057M38	RES, 33
R1027	0662057M38	RES, 33
R1028	0662057M68	RES, 560
R1029	0662057N19	RES, 68K
R1030	0662057M98	RES, 10K
R1031	0662057M74	RES, 1K
R1032	0662057M01	RES, 0
R1034	0662057M90	RES, 4.7K
R1036	0662057N15	RES, 47K
R1038	0662057M92	RES, 5.6K
R1039	0662057M98	RES, 10K
R1040	0662057N15	RES, 47K
R1041	0609175L02	RES, .250
R1046	0662057M01	RES, 0
R1047	0662057N13	RES, 39K
R1048	0662057M98	RES, 10K
R1050	0662057M98	RES, 10K
R1051	0662057M50	RES, 100
R1053	0662057M19	RES, 5.1
R1056	0662057M74	RES, 1K
R1058	0662057M74	RES, 1K
R1060	0662057M98	RES, 10K
R1062	0662057M02	RES, 1
R1067	0660076N09	RES, 22
R1068	0662057C27	RES, 10
R1069	0662057M90	RES, 4.7K
R107	0662057M46	RES, 68
R108	0662057M74	RES, 1K
R109	0662057M32	RES, 18
R1091	0662057M02	RES, 1
R110	0662057M77	RES, 1.3K
R111	0662057M66	RES, 470
R200	0662057M64	RES, 390

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
R203	0662057M72	RES, 820
R307	0662057M02	RES, 1
R308	0662057M28	RES, 12
R400	0662057M80	RES, 1.8K
R401	0662057M69	RES, 620
R402	0662057M93	RES, 6.2K
R403	0662057M98	RES, 10K
R404	0662057M34	RES, 22
R405	0662057M01	RES, 0
R406	0662057N06	RES, 20K
R407	0662057N11	RES, 33K
R408	0662057M89	RES, 4.3K
R409	0662057M01	RES, 0
R410	0662057M26	RES, 10
R411	0609591M42	RESNET, 27K
R412	0662057M01	RES, 0
R413	0662057M01	RES, 0
R414	0662057M50	RES, 100
R415	0609591M49	RESNET, 100K
R416	0609591M42	RESNET, 27K
R417	0662057M01	RES, 0
R418	0662057M43	RES, 51
R419	0662057N18	RES, 62K
R420	0662057N13	RES, 39K
R422	0662057M50	RES, 100
R428	0662057M26	RES, 10
R429	0662057M26	RES, 10
R430	0662057M26	RES, 10
R432	0662057M26	RES, 10
R441	0662057M01	RES, 0
R467	0662057M94	RES, 6.8K
R469	0662057M88	RES, 3.9K
R471	0662057N23	RES, 100K
R600	0662057M01	RES, 0
R601	0609591M49	RESNET, 100K
R602	0662057M01	RES, 0
R605	0662057M43	RES, 51

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
R607	0662057M86	RES, 3.3K
R611	0662057M01	RES, 0
R701	0662057M68	RES, 560
R703	0662057M98	RES, 10K
R705	0662057N09	RES, 27K
R800	0662057N15	RES, 47K
R801	0662057N15	RES, 47K
R802	0662057N15	RES, 47K
R803	0662057N15	RES, 47K
R906	0609591M45	RESNET, 47K
R908	0662057M01	RES, 0
R920	0662057M01	RES, 0
S1A	4009368L08	SWITCH
SEND	PT39LVLA01	SWITCH
SH1	2687932M01	SHIELD
SH2	2687933M01	SHIELD
SH3	2687938M01	SHIELD
SH4	2687935M01	SHIELD
SH5	2687937M01	SHIELD
SH6	2687934M01	SHIELD
SH7	2687936M01	SHIELD
SH8	2687869M01	SHIELD
SH9	2687931M01	SHIELD
SOFT_L	PT39LVLA01	SWITCH
SOFT_R	PT39LVLA01	SWITCH
SW_0	PT39LVLA01	SWITCH
SW_1	PT39LVLA01	SWITCH
SW_2	PT39LVLA01	SWITCH
SW_3	PT39LVLA01	SWITCH
SW_4	PT39LVLA01	SWITCH
SW_5	PT39LVLA01	SWITCH
SW_6	PT39LVLA01	SWITCH
SW_7	PT39LVLA01	SWITCH
SW_8	PT39LVLA01	SWITCH
SW_9	PT39LVLA01	SWITCH
SW_AST	PT39LVLA01	SWITCH
SW_MENU	PT39LVLA01	SWITCH

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
SW_PD	PT39LVLA01	SWITCH
U100	5887694L19	EXB24ATG
U1000	5109509A36	KM616FR4010
U1001	5199494A01	28F320W18
U1002	5195015D12	PC56674VHR2
U1003	5109879E83	GCAP3
U1004	5109817F45	BPLUS_SWITCH
U1006	5109731C32	MC33645
U1007	5109817F27	LM2665
U1008	5185355C12	LP2981AIMX-2_8
U1009	5185355C13	LP2981
U200	5109879E53	RF2643B
U300	5109730C30	RF2362
U301	5109730C31	RF2361
U302	5887694L06	EXB24AT3
U303	5887694L06	EXB24AT3
U400	5109879E85	79E85
U401	4809283D57	MQK83D57
U403	4809443R08	XTAL
U404	4809283D55	83D55
U405	5185963A60	LMC7101BIM5X
U406	5109817F62	NC7SB3157
U407	5887694L09	EXB24AT6
U600	5109730C43	RF9157
U601	5109730C44	RF9158
U602	5109768D08	LM20
U603	5887694L06	EXB24AT3
U604	5887694L06	EXB24AT3
U700	5109944C43	MC13748
U800	5109572E38	AC_717
U801	5109572E43	AC751, 3.9pF
UP	4009368L08	SWITCH
VA	4009368L08	SWITCH
VR1000	4809788E06	UDZTE-176.8B
VR1001	4809788E06	UDZTE-176.8B
VR1003	4809788E06	UDZTE-176.8B
VR1004	4809788E06	UDZTE-176.8B

Table 13. Electrical Parts List - cont'd

Reference Number	Part Number	Description
VR1005	4809788E06	UDZTE-176.8B
VR1006	4809788E06	UDZTE-176.8B
VR1007	4809788E06	UDZTE-176.8B
VR1008	4809788E06	UDZTE-176.8B
VR1009	4809788E06	UDZTE-176.8B
VS1000	4809948D18	SMS05
Y1000	4809995L08	95L08