TWO-WAY RADIOS

TXM 2000 INSTRUCTION MANUAL

Foreword

The information contained in this manual relates to the TXM 2000, unless otherwise specified. This manual provides sufficient information to instruct a user on how to use the product. Instructions to enable service shop personnel to troubleshoot and repair the TXM 2000 to the component level are not provided in this manual. In the event a unit needs servicing, refer to Section 9 for ship instructions into an authorized Motorola facility.

RF Energy Exposure Compliance, Awareness and Control Information and Operational Instructions

NOTICE:

Your Motorola two-way radio complies with the IEEE* and ICNIRP** RF energy exposure limits at duty factors of up to 50% talk-50%listen and is intended and approved for use in occupational/ controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet the limits in these standards.

To control exposure to yourself and others and to ensure compliance with the RF exposure limits, always adhere to the following procedures:

- **These user awareness and control instructions should accompany device when transferred to other users.**
- **Transmit no more than the rated duty factor of 50% of the time.** Transmitting 50% of the time, or less, is important because this radio generates measurable RF energy exposure only when transmitting (in terms of measuring for RF energy exposure compliance).
- **Keep the antenna at least 2 inches away from your face and body while you are transmitting.** Keeping the radio at a proper distance is important to ensure compliance.
- **Transmit only when other people near this radio are at least 8 inches away from the antenna.** This separation distance will ensure that there is sufficient distance to satisfy the RF exposure requirements for bystanders, as defined in the standards listed above.
- **Use only Motorola-approved supplied or replacement antennas, batteries, and audio accessories.** Use of non-Motorola-approved antennas, batteries, and accessories may exceed the applicable RF exposure guidelines.

* Institute of Electrical and Electronic Engineers (IEEE) Std C95.1

** International Commission on Non-Ionizing Radiation Protection (ICNIRP)

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SECTION 1 INTRODUCTION

1.1 Notations Used in This Manual

Throughout the text in this publication, you will notice the use of note, caution, warning, and danger notations. These notations are used to emphasize that safety hazards exist, and due care must be taken and observed.

NOTE: An operational procedure, practice, or condition that is essential to emphasize.

CAUTION indicates a potentially hazardous situation which, if not avoided, might result in equipment damage.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.

1.2 Overview

The TXM 2000 is a VHF APX based Transportable Mobile. It contains an APX mid power transceiver in the VHF band (TO5KSS9PW1AN), an internal controller board and charger board, a rugged housing, a top control panel and supports connection to an O3 Hand-Held Control Head (HHCH), an internal battery, and external DC power. TXM 2000 uses a military style Li-Ion battery. It supports recharging of the battery when connected to an external 13.8VDC or 27.6VDC source.

1.3 Supported Accessories

The TXM 2000 is designed for operation using APX VHF mid-power mobile (TO5KSS9PW1AN), and the following accessories.

Table 1.1 TXM 2000 Accessories

Reference	Part No.	Description
1	NAD6183_	Antenna
2	PMUN1034FSP02	O3 HHCH with right angle connector
3	HPN4007_	AC to DC Adapter
4	60009264001	Battery
5	ZMN6038	Surveillance Kit
6	30009391002	DC Power Cable
7	TLN5277	DC Noise Filter Kit
8	0180706K85	AC to DC Converter Cable Adapter Kit
9	2882560N01	Recorder Plug Switchcraft TA5FLX-ND

NOTE: For vehicle installations, it may be necessary to use TLN5277 installed on the DC input supplying the TXM 2000, to prevent possible alternator whine interference.

1.4 Specifications

1.4.1 General Specifications

Table 1.2 General Specifications

General Specifications	
Length	10.43in (26.50cm)
Width	5.40in (13.72cm)
Height	10.41in (26.44cm)
Weight (with battery and O3 HHCH)	16.31 lbs (7.4 kilograms)

1.4.2 Environmental Specifications

Table 1.3 Environmental Specifications

Environmental Specifications	
Operating Temperature (AC to DC wall adapter)	-30C / +60C
Operating Temperature (BB-2590 Battery)	-20C / +55C
Battery Charging Temperature	0C / +45C
Humidity	95% relative humidity
ESD	IEC 61000-4-2
Duty Cycle	EIA/TIA Intermittent Duty Cycle
Random Vibration (without battery)	MIL STD 810-F Method 514.5 Procedure I Category 24

1.4.3 Power and Battery Specifications

Table 1.4 Power and Battery Specifications at 25C

Power and Battery Specifications	
DC Input (s)	13.8VDC +/- 20% Negative Ground 27.6VDC +/- 20% Negative Ground
Standby Current @ 13.8V	0.91 A
Receive Current @ 13.8V at Rated Audio	1.19 A
Additional Charging Current @ 13.8V	3.8 A max
Transmit Current @ 13.8V at 15W*	5.0 A
Battery Life (fully charged, 5-5-90 duty cycle at 15 Watts)	>10 hours

* Charging is suspended during transmission

The TXM 2000 unit provides user with 10 hours of operation at a 5-5-90 duty cycle. With the BB-2590/U installed, TXM 2000 can be operated between -20°C and +55°C. When the battery pack has been removed, using an external power source, the unit will operate from -30°C to +60°C. The battery pack should be charged with the unit at a temperature between 40°F (5°C) and 100°F (38°C) for maximum performance. Charging the battery pack at temperatures lower than 40°F (5°C) is permitted, but may result in shorter equipment runtimes.

WARNING: Do not charge the battery in temperatures above 113°F (45°C) as damage to the battery and/or equipment may occur resulting in injury or burns to nearby personnel. Follow the battery manufacturer's guidelines on battery storage, operation and transport.

1.4.4 AC Current Drain Specifications

Table 1.5 AC Current Drain Specifications

Current Drain Specifications	
Standby Only	0.14 A
Receive Only	0.18 A
Transmit Only	0.75 A
Standby plus Charging	0.71 A
Receive plus Charging	0.75 A
Standby with Modem	0.17 A
Receive with Modem	0.21 A
Transmit with Modem	0.78 A
Standby plus Modem plus Charging	0.74 A
Receive plus Modem plus Charging	0.78 A

* These specifications are based on AC Current, at radio power 15 W

1.4.5 Transmitter and Receiver Specifications

The APX VHF mid-power mobile specifications installed within a TXM 2000 are as follows:

NOTE: This device complies with part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

1.4.5.1 Transmitter Specifications

Table 1.6 VHF Transmitter Specifications

VHF Transmitter Specifications	
Feature	**VHF**
Frequency Range (with antenna NAD6183)	136-174MHz 162-174MHz
Channel Spacing	30/25/12.5 kHz
Frequency Separation	Full Bandsplit
Rated Output Power	15 Watts
Maximum Output Power (with antenna NAD6183)	18 Watts
Frequency Stability (-30 to +60C, 25C Ref.)	+/- 0.0002%
Modulation Limiting	+/- 5kHz / +/-2.5kHz
Modulation Fidelity (C4FM) 12.5kHz Digital Channel	+/- 2.8kHz
Emissions (Conducted/ Radiated)	-85 dBc / -20dBm
Audio Response	+1, -3 dB (EIA)
FM Hum & Noise (25 kHz / 12.5kHz)	50 dB / 40 dB
Audio Distortion	2%

1.4.5.2 Receiver Specifications

Table 1.7 VHF Receiver Specifications

VHF Receiver Specifications		
Feature		**VHF**
Frequency Range (with antenna NAD6183)		136-174MHz 162-174MHz
Channel Spacing		30/25/12.5 kHz
Frequency Separation		Full Bandsplit
Audio Output Power at 3% distortion		2.5W
Frequency Stability (-30 to +60C, 25C Ref.)		+/- 0.0002%
		Pre-Amp | Standard
Analog Sensitivity 12dB SINAD (25.0kHz)		0.20uV | 0.30uV
Digital Sensitivity (12.5 kHz)	1% BER	0.25uV | 0.40uV
	5% BER	0.20uV | 0.30uV
Intermodulation		80 dB | 85 dB
Spurious Rejection		90 dB
Audio Distortion at rated selectivity 25kHz 12.5 kHz 30 kHz		3% -70 dB -90 dB

NOTE: Self-Quieting Spurs Frequency (MHz): VHF (168 MHz)

For additional transceiver specifications, refer to the published specifications R3-1-2053.

1.4.6 External Connection Specifications

1.4.6.1 Antenna Specifications

Table 1.8 Antenna Specifications

Antenna Specifications	
Type	Quarter Wave Monopole
Frequency	162-174MHz
Physical Length	46cm
Gain	0dB (as mounted on chassis)

1.4.6.2 Headset Specifications

Table 1.9 Headset Specifications

Headset Specifications	
Inputs	PTT (active LOW); HDSET MIC
Input Rating	0VDC (PTT); 8mVrms (MIC)
Outputs	Mic Bias; HDSET AUDIO
Output Rating	5.0VDC (MIC); 300mVrms (Speaker)
Connector	Hirose 6-pin connector

1.4.6.3 Recorder Specifications

Table 1.10 Recorder Specifications

Recorder Specifications	
Relay Output	Quantity 2 activity switch, NC (active open)
Audio Output	300mVrms, Transmit and Receive Audio
Connector	Mini-XLR 5-pin panel mount connector

SECTION 2 INSTALLATION

2.1 Initial Assembly of the TXM 2000

1. Attach the O3 HHCH via the J800L connection on the APX Mobile. See Figure 6-1, TXM 2000 Front Panel Exploded View.
2. After attaching the O3 HHCH, install protective cover 07012060001 over the connector using the six screws provided.
3. Attach the antenna to the TXM 2000 antenna jack.
4. Apply power.

   4.1. If operating with external power, connect either the AC to DC Converter (HPN4007) or use an external DC source via the DC Power Cable (30009391002). Before using HPN4007, attach the Cable Adapter Kit (0180706K85) following the instructions enclosed with its kit.

   4.2. If operating using the internal battery, install the BB-2590/U battery pack. See section 2.2 “Battery Installation (Optional)”, for battery installation instructions.

2.2 Battery Installation (Optional)

1. Prior to installing a battery (or removing one), disconnect all external voltage sources to the TXM 2000 and make sure the power switch is rotated to the OFF position. If using a brand new battery, ensure that the connector cap and the label covering the SMBus connections are removed prior to installation.
2. Set the TXM 2000 on its side and remove the battery cover using a phillips screwdriver.
3. Pull the battery cable out of the battery compartment, un-fasten the velcro strap and plug the connector block into the end of the battery. The circular connector on the block is keyed for proper orientation to the battery.
4. Wrap the longer end of the velcro strap around the battery and fasten it to the short end of the strap, snugging it to hold the connector securely in place.
5. Slide the battery and cable into the battery compartment. Re-install battery cover.
6. Refer to Section 3.2 “Battery Charge Capability”, for information regarding charging the battery.

WARNING: Do not store BB-2590/U battery pack above 122°F (50°C). Do not crush, mutilate, reverse polarity, disassemble, or dispose of BB-2590/U battery pack in fire. This warning applies to the TXM 2000 unit when the BB-2590/U battery pack is installed. Injury or burns may occur to nearby personnel.

2.3 APX CPS Programming

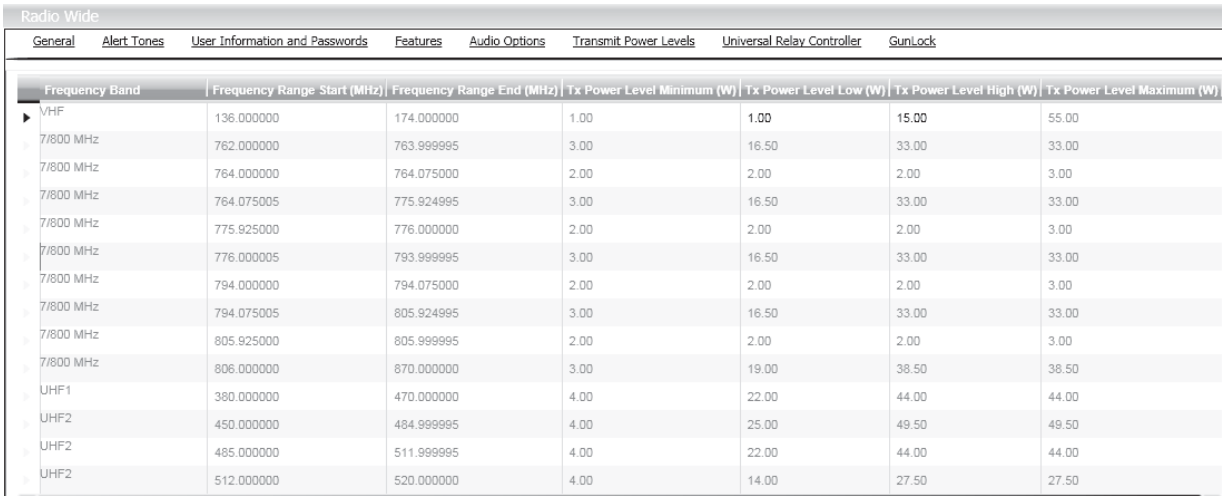
The ASTRO 25 Mobile CPS application is used for set up of the transceiver features including transmit and receive frequencies, the zones and channels, the conventional personalities, the O3 HHCH display, and the Flash upgrade on APX Mobile radio. This requires the APX CPS Programming cable (HKN6184_), for connection between the PC and the GCAI connector (J700) on TXM 2000.

For details on the operation of the transceiver and its settings, refer to the APX Mobile Detailed Service Manual (6875963M01), and the O3 HHCH Mobile Radio User Guide (6816939H01).

2.3.1 Tx Power and Ignition Setting

When configured with radio option GA00800AA, the transceiver codeplug was pre-configured for 2 settings optimal for the TXM 2000:

1. The transmit power high setting was set for 15 watts operation. The field “Radio Wide -> Transmit Power Levels -> Tx Power Level High (W)” is set to 15.0.



Frequency Band	Frequency Range Start (MHz)	Frequency Range End (MHz)	Tx Power Level Minimum (W)	Tx Power Level Low (W)	Tx Power Level High (W)	Tx Power Level Maximum (W)
VHF	136.000000	174.000000	1.00	1.00	15.00	55.00
7/800 MHz	762.000000	763.999995	3.00	16.50	33.00	33.00
7/800 MHz	764.000000	764.075000	2.00	2.00	2.00	3.00
7/800 MHz	764.075005	775.924995	3.00	16.50	33.00	33.00
7/800 MHz	775.925000	776.000000	2.00	2.00	2.00	3.00
7/800 MHz	776.000005	793.999995	3.00	16.50	33.00	33.00
7/800 MHz	794.000000	794.075000	2.00	2.00	2.00	3.00
7/800 MHz	794.075005	805.924995	3.00	16.50	33.00	33.00
7/800 MHz	805.925000	805.999995	2.00	2.00	2.00	3.00
7/800 MHz	806.000000	870.000000	3.00	19.00	38.50	38.50
UHF1	380.000000	470.000000	4.00	22.00	44.00	44.00
UHF2	450.000000	484.999995	4.00	25.00	49.50	49.50
UHF2	485.000000	511.999995	4.00	22.00	44.00	44.00
UHF2	512.000000	520.000000	4.00	14.00	27.50	27.50

Figure 2-1 TX Power Setting

2. The ignition setting of the radio was set to allow power on/off operation to function from the Volume/On/Off knob on the TXM 2000 instead of the on/off using the O3 HHCH. The field “Radio Wide -> Advanced -> Ignition Switch” is set to “Ignition Only Power Up”.

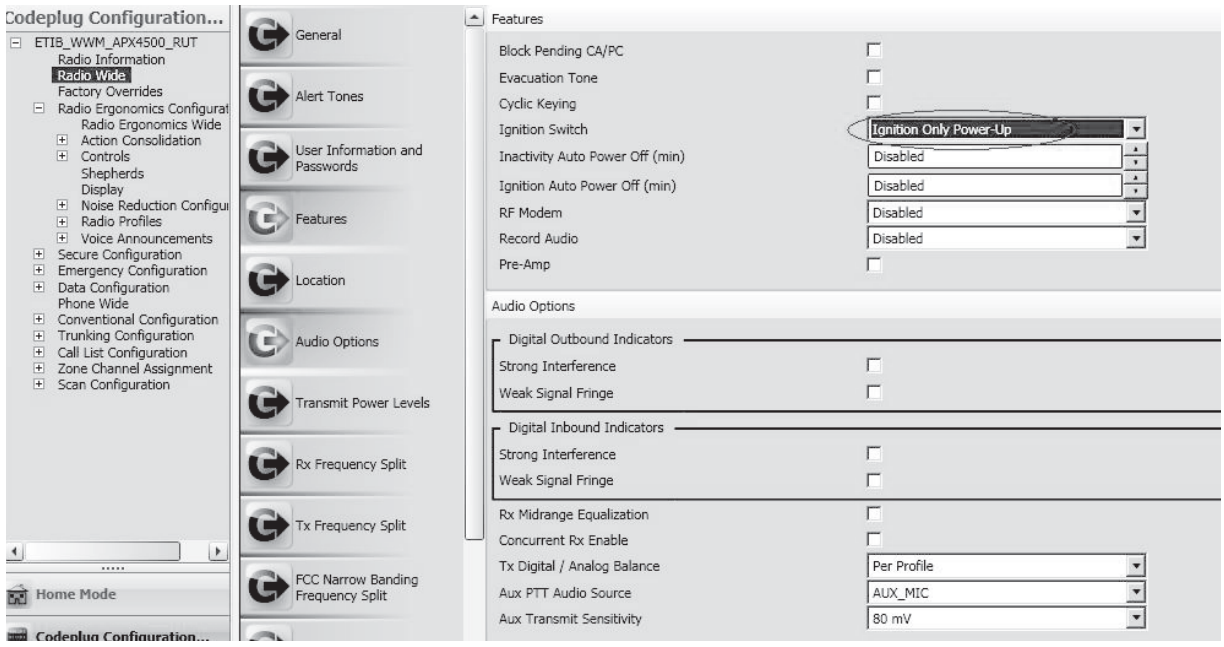


Figure 2-2 Ignition Setting

2.4 Remote Site Interface Configuration

Caution

Failure to follow this caution, may result in equipment damage or improper operation.
Prior to connecting the V.24 accessory, ensure the TXM 2000 unit is powered off, by rotating the power knob until it is turned off, and disconnecting the AC to DC adaptor. Once power is turned off, connect the V.24 accessory. Power can then be supplied to the unit.

The TXM 2000 supports an interface called Remote Site Interface (RSI), that allows connection to a Motorola ASTROTAC comparator. The RSI interface is asynchronous RS232, and is intended to be used in conjunction with a HDLC Converter, and connected to the Motorola ASTROTAC comparator. Additionally it can be used with asynchronous modems for remote installations.

The following functionalities are supported on RSI interface:

- P25 Conventional Voice Transmit
- P25 Conventional Voice Receive
- TSBK messages to support operations from and to the Conventional Console, such as Call Alert, Emergency Alarm, Status Update, Status Query, Message Update, Radio Check, Remote Monitor, and Radio Inhibit and Uninhibited.
- Capability from the Console, to remotely change the TXM2000 radio's channels

NOTE: While on a RSI enabled channel, the TXM 2000 disables its local speaker, mic, headset, and recorder.

RSI is supported on P25 conventional channels only. Refer to sections 2.4.2 “Remote Site Interface on a System”, 2.4.3 “Remote Site Interface on a Personality”, and 2.4.4 “Remote Site Interface on a Zone”, for CPS RSI configuration.

The pinout includes 4-wire RS232 with typical levels at +/- 12V DC. Additionally the port includes an active low output that will be active when the RSI link is being re-established. Refer to section 5.6 “DB25 (V.24) Connector”, for a pinout diagram of this interface.

There are two Link status indications provided by TXM 2000. An icon is provided on the O3 HHCH. See section 3.9 “O3 Hand-Held Control Head (HHCH)”, for information on O3 HHCH. A LED is provided on the side of the unit. Refer to section 3.3.4 “Link Status Icon on O3 HHCH”, for more information.

Please refer to Appendix A, Appendix B, and Appendix C for typical external equipment setup information.

For more information pease contact your Motorola Salesperson.

2.4.1 Use of Ferrite in TXM 2000 RSI Mode

While using the TXM2000 in RSI mode with modem, it is always recommended to use a remote antenna, and a clip on ferrite on the phone line. Figure 2-3 shows a typical clip on ferrite on the phone line. By placing the ferrite close to the modem, it will prevent RF interference to the modem and radio. The ferrite used should be rated at 310 ohms at 100 MHZ.

Figure 2-3 Clip on Ferrite for TXM 2000

2.4.2 Remote Site Interface on a System

1. Under Conventional Configuration ->Conventional System, select the desired system.
2. In the desired system, open the General submenu.
3. Check the Remote Site Interface System checkbox.

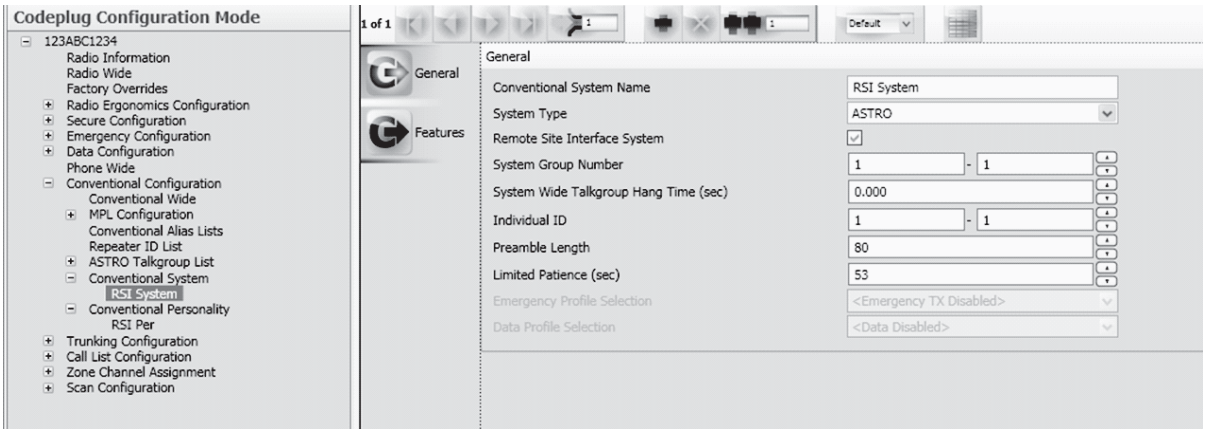


Figure 2-4 Remote Site Interface (System)

2.4.3 Remote Site Interface on a Personality

1. Under Conventional Configuration -> Conventional Personality, select the desired personality.
2. In the desired personality, open the Signaling submenu.
3. Set the ASTRO System field to a system, with Remote Site Interface enabled.

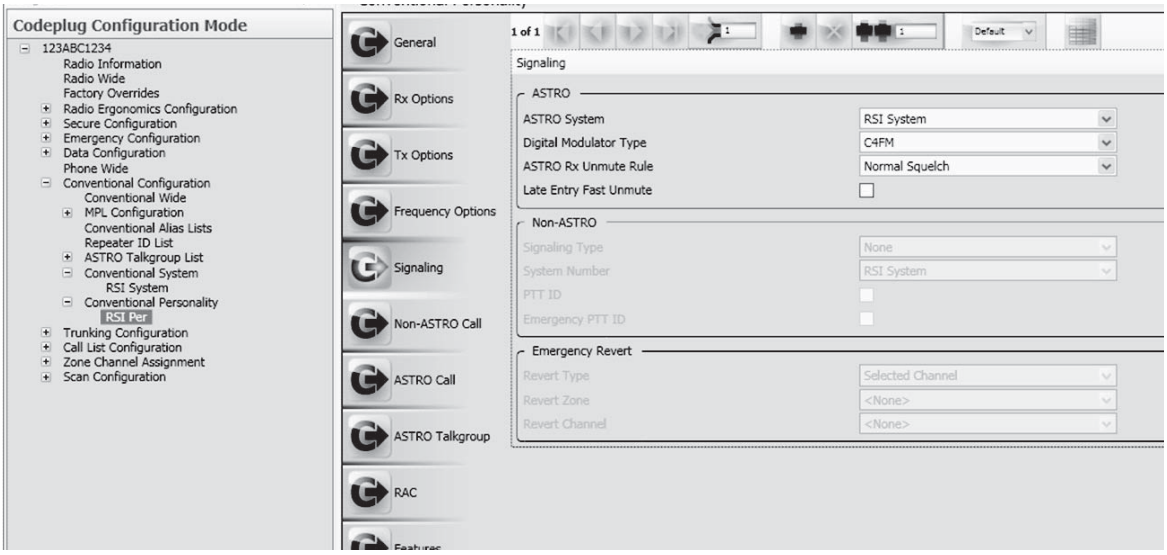


Figure 2-5 Remote Site Interface (Personality)

2.4.4 Remote Site Interface on a Zone

1. Under Zone Channel Assignment, select the desired zone.
2. In the desired zone, open the Remote Site Interface submenu.
3. Set the RSI Mode field to V.24.
4. Set Site Number, Transmit Indication and Autodial as desired.

   4.1. Site Number - Also known as TEI (Terminal Endpoint Identifier), is used as an ID for a Base Station, and used by the TXM2000 in RSI mode as its Base Station ID.

   4.2. TX Indication - When TX Indication is enabled in CPS, the TXM2000 loops back audio to the console. Thus providing indication, that the TXM2000 attempted to transmit the audio sent by the console operator.

   4.3. Autodial - When the autodial setting is enabled in CPS, the TXM2000 attempts to auto dial the modem by toggling the modem's DTR line, using the timer values specified in the CPS. A specific modem or cable, that supports this functionality would be required for this feature to work.

NOTE: All channels in an RSI zone must have an RSI personality.

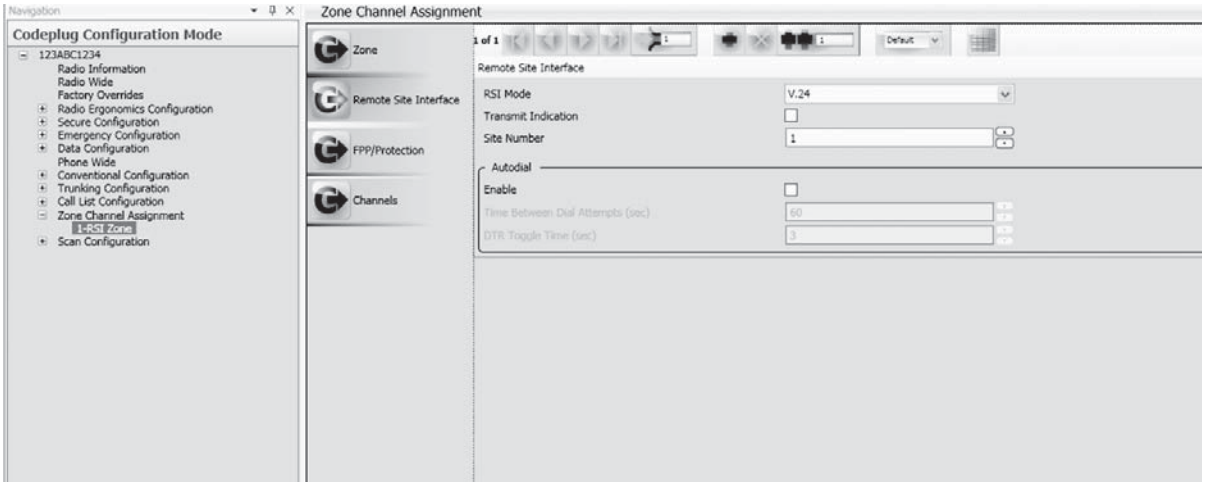


Figure 2-6 Remote Site Interface (Zone)

2.5 Keyloading

Keyloading is only supported via the APX mobile transceiver's GCAI connector (J700). The recommended cables and adapters are:

Table 2.1 Recommended Cables And Adapters For Keyloading

Reference	**Part No.**	**Description**
1	TKN8531	Keyloader Cable KVL 3000 plus
2	HKN6182	Keyloading Cable adapter

SECTION 3 TXM 2000 OPERATION

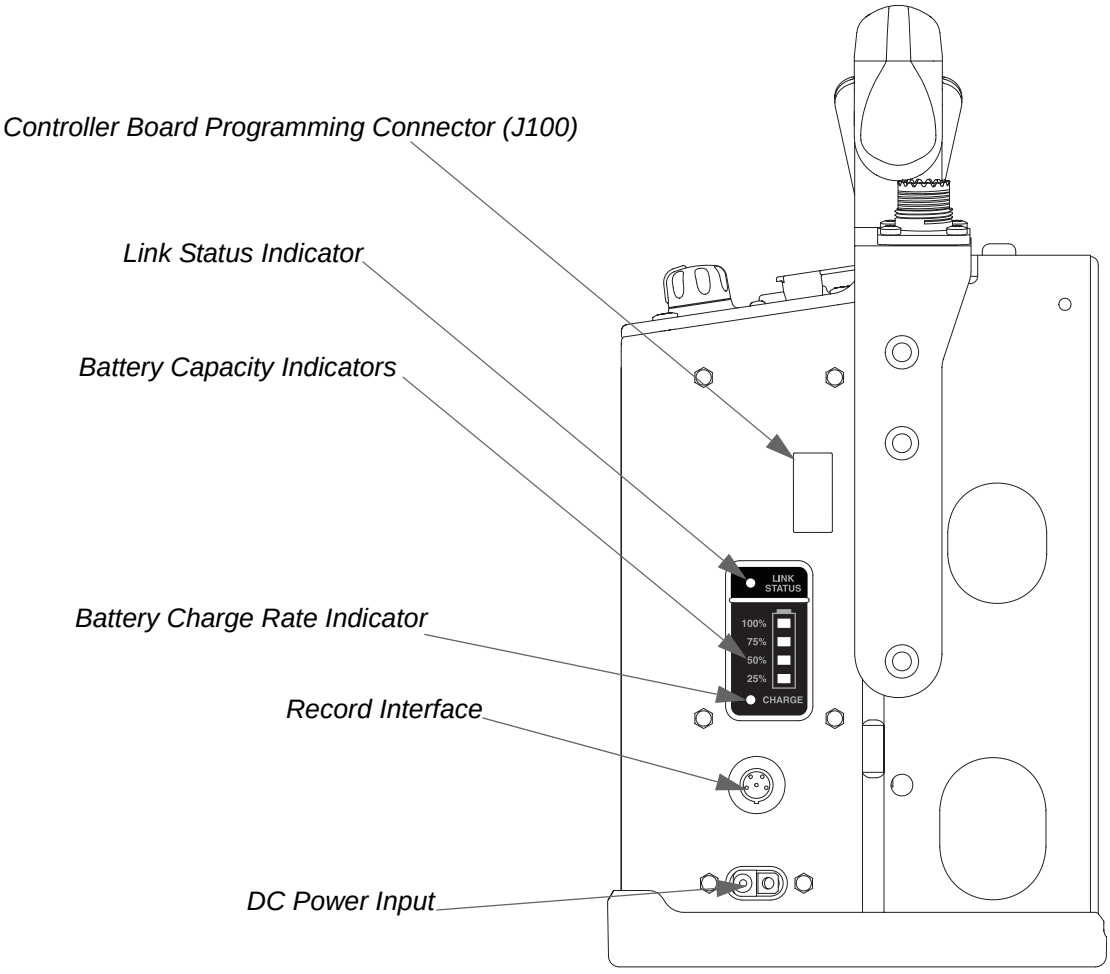


Figure 3-1 TXM 2000 Side Panel View

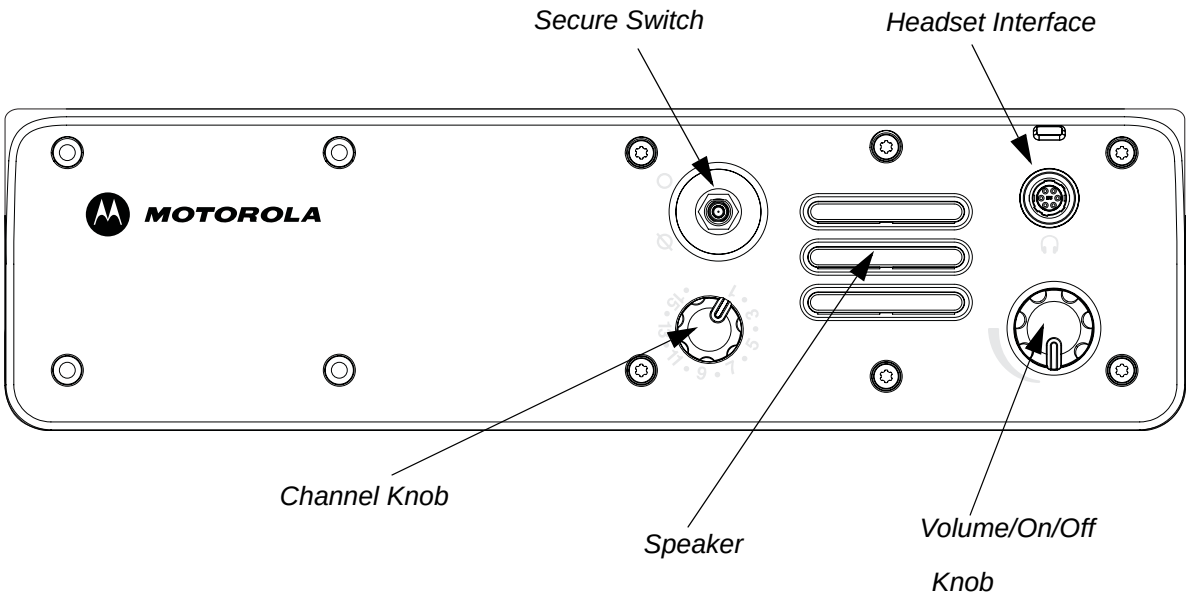


Figure 3-2 TXM 2000 Top Panel View

3.1 Powering the TXM 2000

The TXM 2000 supports operation from either a battery or an external DC source.

3.1.1 Battery Operation

The TXM 2000 supports an internal connection to the BB-2590/U Li-Ion Battery Pack. This battery will provide up to 10 hours of operation when the TXM 2000 is used at 15 Watts output with a 5-5-90 duty cycle.

For further information on the Battery LED indicators, please refer to Section 3.3.1 “Battery Capacity Indication” and Section 3.3.2 “Battery Charge Status Indication”. For troubleshooting, refer to Section 7.3 “Battery System Management”.

3.1.2 AC to DC Adapter Operation

The TXM 2000 supports an external connection to an AC to DC Converter (HPN40007C). It converts 110/220VAC to 13.8VDC and provides power to the TXM 2000. The converter provides 13.8VDC at a maximum of 8A continuous for 60 minutes or 13.8VDC at a maximum of 15A for 20 minutes in any 80 minute period. For TXM 2000 installations, it is necessary to use AC to DC Converter Cable Adapter Kit (0180706K85), in conjunction with the HPN40007C.

WARNING: This unit (HPN40007C) is for indoor use only. Ventilation required for this unit does not protect against liquid intrusion and, if wet, will present a potential shock hazard to personnel. DO NOT use this unit in an explosive environment.

While connected to the external AC to DC Adapter, the TXM 2000 can charge its internal battery. Refer to Section 3.2 “Battery Charge Capability” for additional details.

3.1.3 DC Power Cable Operation

The TXM 2000 supports an external DC power connection from a vehicle using the DC Power Cable (30009391002). The TXM 2000 will accept a 13.8VDC or a 27.6VDC input on its DC Power Input connector. See Figure 3-1.

If using AC to DC Adapter (HPN4007) as the external power source, firstly it is necessary to attach the cable adapter kit (0180706K85) as described in section 2.1. Otherwise the connector on HPN4007 will not engage the unit properly.

For vehicle installations, it may be necessary to use DC noise filter kit (TLN5277) installed on the DC input supplying the TXM 2000, to prevent possible alternator whine interference. While connected to external DC power, the TXM 2000 can charge its internal battery. Refer to Section 3.2 “Battery Charge Capability” for additional details.

3.2 Battery Charge Capability

The TXM 2000 has the capability to charge its internal battery while an external DC source is connected. It can typically charge a low battery within 6 hours while not in use.

While connected to an external DC source, the TXM 2000 will automatically charge the battery. Charging will stop once the battery is fully charged. Charging resumes automatically when the battery charge level starts being depleted. The TXM 2000 unit will operate normally while being charged.

NOTE: Charging is suspended during transmit operation.

3.3 Battery Indicator

3.3.1 Battery Capacity Indication

Figure 3-3 TXM 2000 Unit Battery Capacity Indicator

The TXM 2000 provides battery capacity status using a four segment LED display on the back panel. The following table describes the LED states and their corresponding meaning:

Table 3.1 Battery Capacity Indicator

Capacity Indicator LED State	Description
Green Solid (1 to 4 segments)	Indicates battery capacity level in 25% increments
Flashing Amber on bottom LED	Low battery indication*
All solid Red	Internal communication not established
All solid Amber	Battery requires conditioning
Flashing Red LED (25%) and top 3 segment (100%,75%,50%) solid Red	Low battery and communication error simultaneously

* An audible low battery alert tone is present when the amber LED is flashing, and charging is not active.

3.3.2 Battery Charge Status Indication

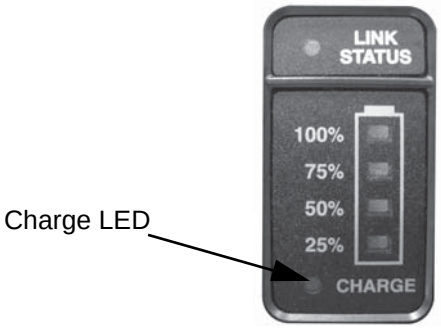


Figure 3-4 TXM 2000 Unit Battery Charge Indicator

The TXM 2000 provides charge rate status using a single LED on the back panel. The following table describes the LED state and its corresponding meaning:

Table 3.2 Battery Charge Status Indicator

Charge LED state	Description
LED Off	Unit is not charging
Charge LED Solid Green	Charge complete
Charge LED Solid Red	High current charging
Charge LED Blink Green	Trickle current charging
Charge LED Blink Red	Battery communication error
Charge LED Blink Amber	Battery temperature error/ charging inhibited

3.3.3 Link Status Indication

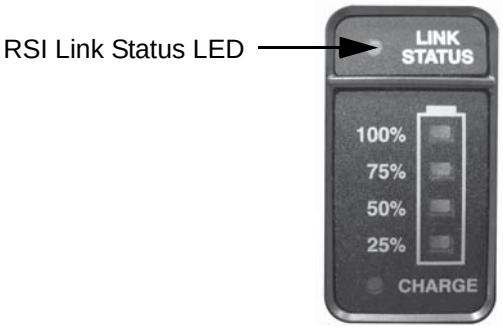


Figure 3-5 TXM 2000 RSI Link Status Indicator

Table 3.3 RSI Link Status Indicator

Link Status LED State	Description
LED Off	Non-RSI zone
Link LED Solid Green	Connected/link established
Link LED Blink Green	Connecting/link being established

3.3.4 Link Status Icon on O3 HHCH

Figure 3-6 TXM 2000 Link Status Icon on O3 HHCH

NOTE: The Link Status icon on the O3 HHCH serves the same purpose as the Link Status LED.

Table 3.4 Link Status Icon on O3 HHCH

Link Status Icon State	Description
Icon Off	Non-RSI zone
Icon Solid	Connected/link established
Icon Blinking	Connecting/link being established

3.4 Volume/On/Off Knob

The Volume/On/Off knob allows the unit to be turned On or Off as well as to adjust the volume.

In the On position, the top panel and the O3 HHCH are active. When in the Off position, the top panel and the O3 HHCH are no longer active. Current drain on the internal battery is at a minimum to allow for maximum battery shelf life.

Volume is increased with clockwise rotation of the knob and decreased with counterclockwise rotation. Also note that the volume can be adjusted using the O3 HHCH. The user-selected volume will be set by the last input device; either the O3 HHCH or the TXM 2000 Volume knob.Channel Selector Knob

The top panel on TXM 2000 contains a rotary knob for radio channel selection. A total of sixteen (16) channels are selectable (if programmed). Channel selection is also supported via the O3 HHCH. The user-selected channel will be set by the last input device; either the O3 HHCH or the TXM 2000 channel knob.

NOTE: The rotary knob selects channels within the selected zone. Zone selection is made via the O3 HHCH.

3.5 Coded/Clear Switch

The top panel contains a two-position switch for radio encryption selection. Encryption selection is also supported via the O3 HHCH.

The user-selected encryption state (coded or clear) will be set by the last input device; either the O3 HHCH or the TXM 2000 Coded/Clear toggle switch.

3.6 Internal Speaker

The TXM 2000 contains a 20-ohm audio speaker rated at four (4) watts output and is driven by the APX transceiver’s audio amplifier. The audio level is adjusted by the Volume/On/Off knob on the top panel of the TXM 2000 or via the O3 HHCH. While the headset is connected, this internal speaker is muted.

NOTE: In order to limit the volume level that is output on the headset, the internal speaker volume max setting follows the headset setting, where the headset max volume is set at the factory to be at a safe level.

3.7 Headset Interface

The TXM 2000 supports a headset interface for use with the Two Piece Surveillance Mic (Motorola P/N ZMN6038A) and has the following connections:

Table 3.5 Headset Interface

Headset Interface	Description
HDSET PTT	Active low signal that when pulled below 1VDC will cause the radio to transmit
HDSET MIC	This supports an audio input with a nominal level of 8mVrms
MIC BIAS	This is a 5.0VDC output to bias the attached microphone
HDSET AUDIO	This is a receive audio output at 300mVrms nominal level

NOTE: Plugging the headset into the 6-pin Hirose connector mutes the internal speaker. Recorder output remains functional for both TX and RX audio.
The 6-pin Hirose headset jack does NOT support a connection to a keyloader. Refer to section 2.5 “Keyloading” for information on keyloading the APX transceiver.

3.8 Recorder Interface

The TXM 2000 has an interface to a recorder and provides both receive and transmit audio to this jack. To properly balance the volume levels of the transmit and receive audio recordings, modify the following settings in CPS:

1. Radio Wide -> Advanced -> Aux Transmit Sensitivity, set pull-down menu to "80mVrms".
2. Radio Wide -> TX Audio Control Per Mode, disable all AGC settings and leave all Gain settings at "0". AGC is meant for varying microphone input levels and can impact the recorded audio when it is enabled.

The recorder jack has the following connections:

Table 3.6 Recorder Interface

Recorder Interface	Description
REC SW A device	This is a normally-open activity switch used to activate recording
REC SW B device	This is a normally-open activity switch used to activate recording
REC AUDIO nominal level	This is the Receive and Transmit audio output at 300mVrms

3.9 O3 Hand-Held Control Head (HHCH)

Access to the APX transceivers's CAN port (J800L) for connection to the O3 HHCH is provided on the TXM 2000. The hang-up clip is located on the handle of the unit and provides Hang-up-box (HUB) functionality.

Refer to the O3 HHCH User Guide (6816939H01) for more information.

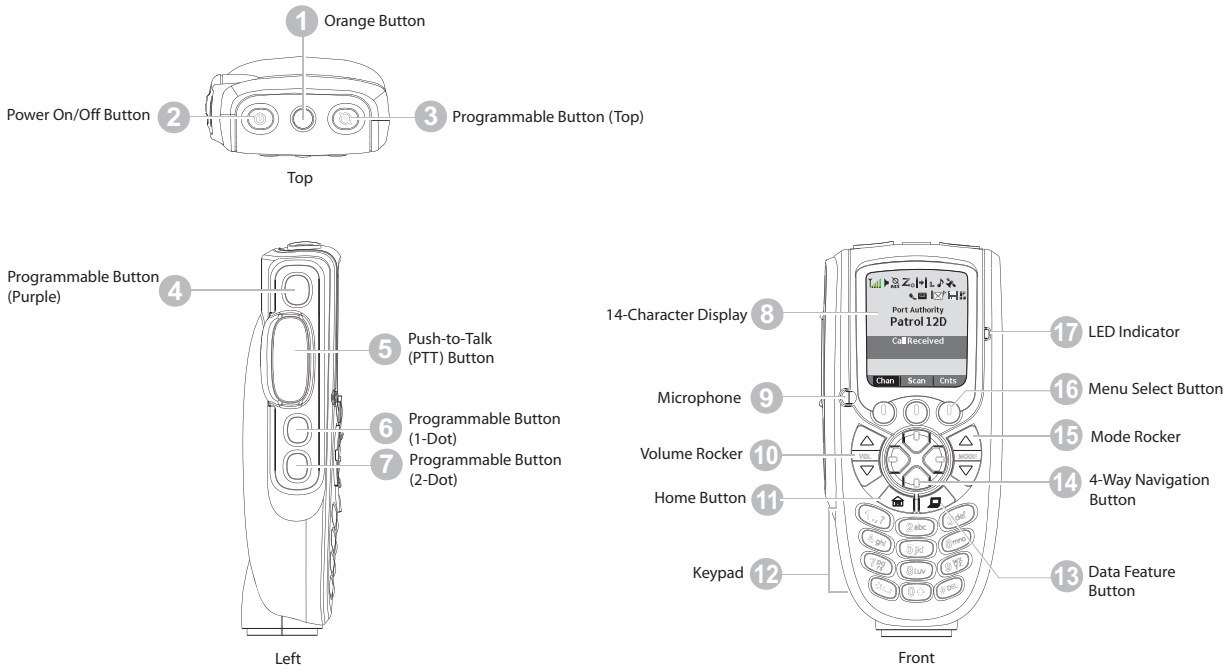


Figure 3-7 O3 HHCH

3.9.1 O3 Controls

- POWER ON/OFF BUTTON – Turns the radio on and off. When shipped as part of the TXM 2000 unit, this feature is disabled by CPS selection.
- ORANGE BUTTON – Programmed at the factory to activate the Emergency feature.
- TOP PROGRAMMABLE BUTTON – Button that can be custom programmed by system manager.
- PROGRAMMABLE SOFTKEYS – Field-programmable buttons.
- NAVIGATION KEYS – Used to scroll through menu items and selections.
- VOLUME ROCKER – Adjust the volume level up or down.
- MODE ROCKER – Scroll up or down through the list of available modes.
- HOME BUTTON – Used to exit all menu functions.
- WAP BUTTON – Optional data button.
- NUMERIC KEYPAD – Features 12 keys and used to enter menus,scroll through a list of displayed options, and enter data.
- PUSH TO TALK BUTTON – Pressed to transmit on the displayed mode and released to receive.

- LED INDICATOR – Green/red light-emitting diode that indicates radio status as you operate various features.
- SIDE PROGRAMMABLE BUTTONS – Buttons that can be custom programmed by system manager.

SECTION 4 THEORY OF OPERATION

4.1 System Overview

The TXM 2000 consists of an APX Mid-power transceiver in the VHF band (M20KSS9PW1AN), an internal controller board and charger board, a rugged housing and a top control panel. The TXM 2000 supports connection to an O3 HHCH, an internal Li-Ion battery and external DC power. Recharging of the battery is supported when connected to external 12VDC or 24VDC system voltages.

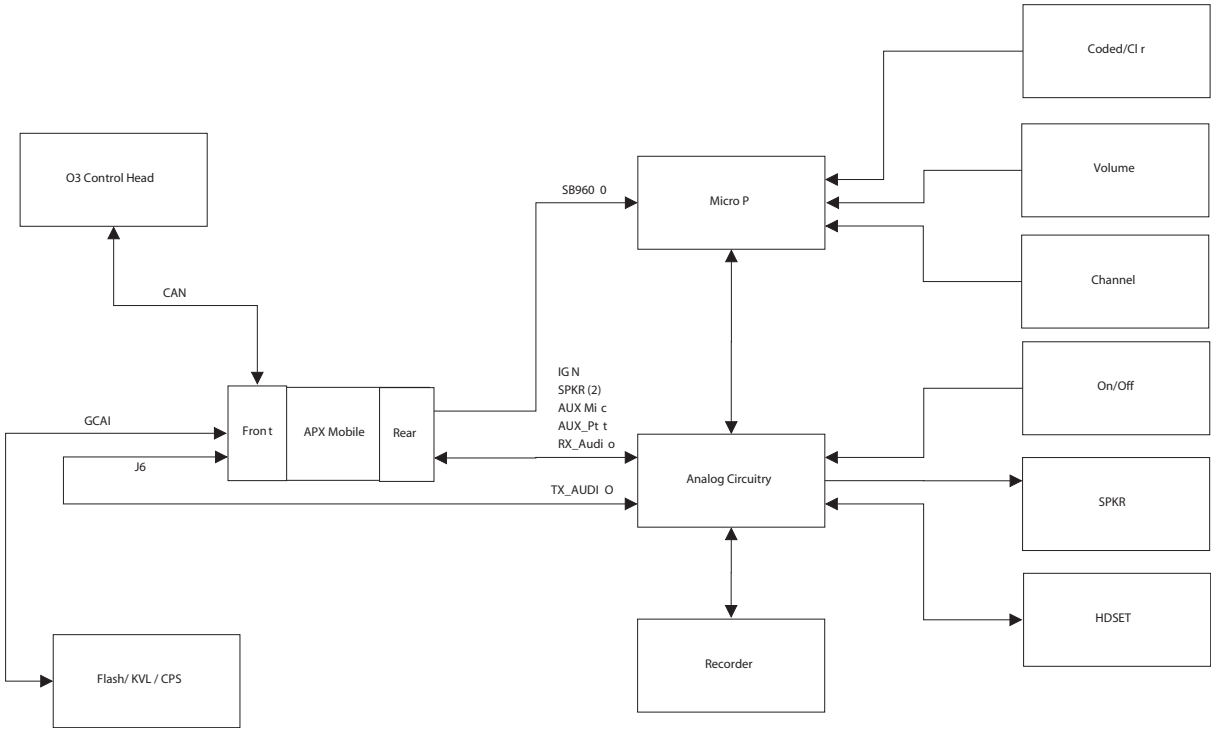


Figure 4-1 TXM 2000 Controller Block Diagram

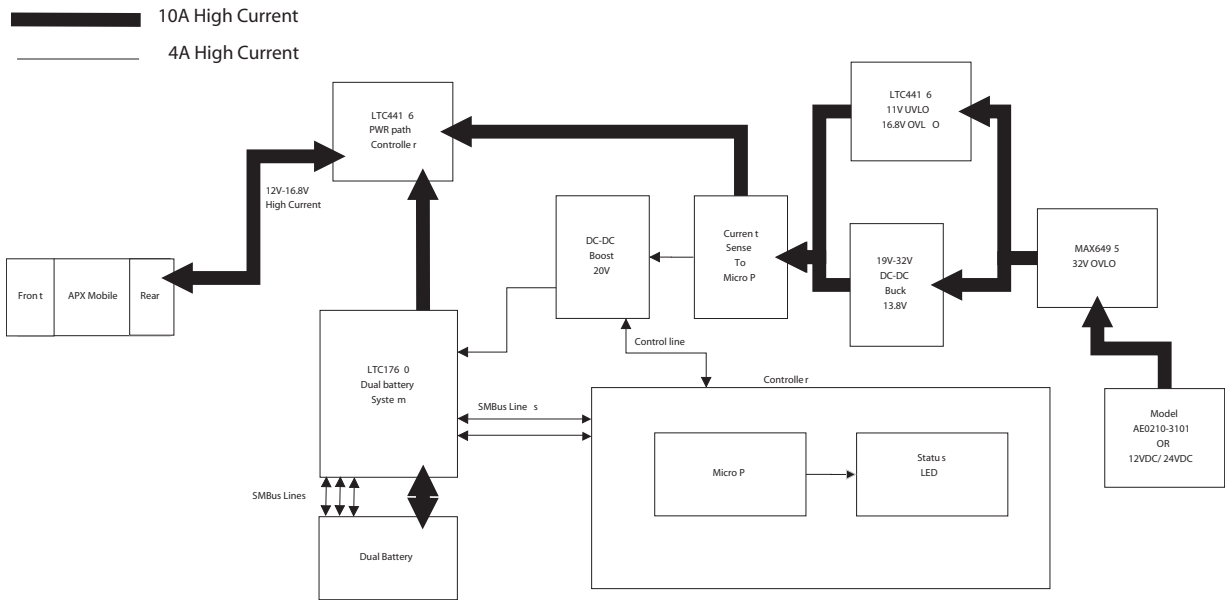


Figure 4-2 TXM 2000 Charger Block Diagram.

4.2 Power Distribution

The TXM 2000 sources power from either the internal 13.8V Lithium battery or the external DC power input jack that supports both 12VDC and 24VDC system voltages.

On the charger board the DC IN power path is selected by voltage: between an 11V to 16.8 V under/over voltage shutdown circuit, and a 19V to 32V input which is regulated to 13.8V by a DC-DC buck regulator. The output from either input path passes through a current sensor and is then used to supply a 20V DC-DC boost regulator and an automatic power path switchover circuit. The boosted 20V is regulated by the smart battery charging system's DC-DC buck IC to charge the battery pack. The automatic power path switchover circuit selects the power source from the DC input or the battery system in order to supply B+ power to the mobile radio and controller board. An unswitched 5V regulator sources power from either DC IN or the battery for standby power.

On the control, B+ is regulated in series to 9.3V then down to 5V then to 3.3V. The 9.3V is used to supply the audio circuitry for biasing and power. The 5V is used to supply switching logic used by the top panel control interface and the PIC processor. The 3.3V supplies power to the PIC processor core and logic I/O signals.

4.2.1 11V to 16.8V UVLO/OVLU Powerpath

U302 is a power path controller that is configured to be used in an under and overvoltage lockout circuit to pass 11V up to 16.8V from DC_IN_OVP to node 13.8V_BUCK. The circuit is designed to support a nominal 10A of current.

4.2.2 13.8V DC-DC Buck

U201 is a synchronous switching buck regulator configured with an under voltage lockout set to 19V sourced from node DC_IN_OVP. It has a nominal 10A output current at 13.8V to node 13.8V_BUCK with its over-current protection set to 15A output.

4.2.3 20 Volt DC-DC Boost

U203 is a Texas Instruments TPS40210 device configured as a 20V boost regulator with a 4A nominal output current used to supply DC power to the charger Smart Battery Management IC, U1. This regulator sources power from node 13.8V, which is derived from node 13.8V_BUCK after passing though current-sense resistor R232.

4.2.4 Automatic Powerpath Switchover

The controller device, U205, is configured to be used in an automatic power path switchover circuit. The circuit will source power from node 13.8V in order to supply power to node B+ and has an undervoltage lockout set to 11V. If the UVLO is triggered, the power provided to node B+ falls back to the battery source.

4.2.5 LTC1760 Dual Smart Battery System Manager IC

U1 is an SMBUS level 3 battery charger and selection system management IC. It sources 20V DC input from node CHG_IN to be regulated for charging the dual smart battery pack. U1 also monitors and supervises the discharge of the battery pack and provides a SMBUS host interface to PIC processor on the controller board through connector P1.

4.2.6 Unswitched 5 Volt Regulator

U202 is a Texas Instrument TPS7A4901 adjustable voltage regulator with a low quiescent current. The regulator provides an unswitched 5V output that is sourced from a diode “OR” configuration of the battery pack and the DC input. It supports standby mode by providing power to logic circuits that control input FETs (Q210 and Q213) at the battery terminals. This is controlled via the On/Off knob on the interface panel. The output from this regulator is also switched to provide 5V for the charge enable circuitry and the DC input current monitoring circuit.

4.2.7 9.3 Volt Regulator

U108 is a National Semiconductor LM2941 adjustable regulator with an output current of 1A and voltage set to 9.3 Volts. This regulator provides voltage to the 5V regulator (U109). It also provides power to a quad op-amp device, U106, for audio gain control and biasing.

4.2.8 5 Volt Regulator

U109 is a National Semiconductor LP38693 fixed 5V regulator with an output current of 500 mA. This regulator provides voltage to the 3.3V regulator (U107). It also provides power to logic circuits for SB9600 communication and audio control.

4.2.9 3.3 Volt Regulator

U107 is a National Semiconductor LP38691 adjustable regulator with an output current of 500 mA and voltage set to 3.3Volts. This regulator provides voltage to the core and logic I/O signals of the PIC processor IC, U100.

4.3 System Communications Overview

The controller board communicates with the radio transceiver via the SB9600 bus and with the charger board via SMBUS two-wire serial signals. The controller board also has a dedicated I2C programming interface.

The TXM 2000 adds to the mobile radio interface an On/Off volume knob, channel knob, and a secure/clear selection switch. It also adds speaker outputs with surveillance headset support and recorder support.

The 03 Hand Held Control Head communicates to the radio transceiver via the CAN (Controller Area Network) bus interface.

Please refer to O3 HHCH user's guide and the mobile radio DSM manual for more information.

4.3.1 Micro Controller

The TXM 2000 controller board uses a Microchip PIC24FJ32GA micro controller (U100) running off a 12 MHz reference clock. The PIC is configured to support SB9600 BUS, SMBUS and I2C communications. The PIC processor drives five LEDs that are used for battery capacity and battery charge/error status based on SMBUS data and U204 current sensor data. This data is also used to control charge enable through U203 with SB9600 messages from the PIC processor to the mobile radio. The PIC processor translates volume, channel and secure select activity from the TXM 2000 top panel to the radio transceiver via SB9600 messages. The PIC also monitors the radio transceiver via SB9600 bus to control the recorder output. The PIC processor uses signal "REC_ACT" to control switch Q103, which activates relay K102. The PIC also uses signal "REC_SOURCE" to control multiplexer U110, which routes either transmit or receive audio to the recorder output.

4.3.2 User Interface

The user interface for the TXM 2000 includes the 03 HHCH along with the top panel On/Off volume knob, channel knob and secure/clear switch. There are five LED indicators for battery capacity, charge and error status. The volume knob acts as a potentiometer and is input to the PIC processor (U100) analog to digital converter ports. The knob also has a switch actuator that creates a ground connection used to control ON/Off State using Q108 and Q116. Channel selection is translated to the PIC processor (U100) through four signals using a binary-coded switch to select the sixteen (16) channels. The secure/clear switch is activated by creating a ground connection to a 3.3V pull up.

4.3.3 Receive Audio Paths

The speaker audio from the mobile transceiver is attenuated by approximately 9.5dB, using an op-amp device (U106). This receive audio (SPKR+ and SPKR -) also routes to the top panel speaker through relays K100 and K101, which mutes the top panel speaker when the headset is plugged in. Inserting a headset provides a low signal on Q112, which turns off Q102 that in turn opens the relays. A line-level receive audio (RX_AUDIO) from the mobile is multiplexed through U110 into the record audio output path.

4.3.4 Transmit Audio Paths

Transmit audio on the TXM 2000 is obtained from the attached 03 HHCH microphone or from the surveillance headset microphone. The surveillance microphone signal is amplified by 20dB into the radio transceiver AUX_MIC port, in order to match the 03 HHCH microphone level. This level will produce 60% of FSD deviation with an input level of 80mVrms. The mobile transceiver outputs the transmit audio at the DAC_AUDIO port. This is amplified by approximately 11.5 dB to be multiplexed through U110 into the record audio output path.

Notes

SECTION 5 TXM 2000 EXTERNAL CONNECTORS

5.1 Headset Jack

Hirose 6-pin connector used with a Two Piece surveillance Mic. (Motorola P/N: ZMN6038A).

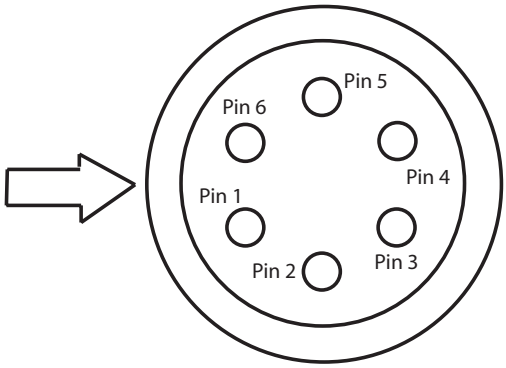


Figure 5-1 Headset Jack

Table 5.1 Headset Jack Pin Output

PIN	PIN Name
PIN 1	HDSET MIC
PIN 2	MIC BIAS
PIN 3	HDSET Audio
PIN 4	HDSET GND
PIN 5	HDSET PTT
PIN 6	HDSET Enable

5.2 DC Jack

DC Power Input connector accepts 13.8VDC or 27.6VDC input.

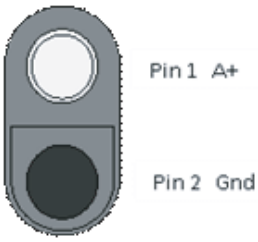


Figure 5-2 DC Jack

5.3 Recorder Jack

Mini XLR 5-pin connector accepts cabling for audio recording capabilities.

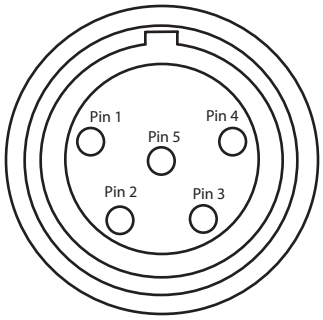


Figure 5-3 Recorder Jack

Table 5.2 Recorder Jack Pin Output

PIN	PIN Name
PIN 1	Record Switch A
PIN 2	Record Switch B
PIN 3	Tx/Rx Audio
PIN 4	GND
PIN 5	N/C

5.4 Programming Jack

The programming jack (J100) accepts a custom cable for programming the internal Control Board. This jack is for service center personnel and is not intended for use in the field.

5.5 APX Mobile Connections

The following drawing shows the front of the APX transceiver. Some connections are eclipsed by the TXM 2000 and some are accessible.

- J800R is accessible, and is used for connection to the O3 HHCH.
- RJ45 is covered, and reserved for future, which requires feature update.
- J700 is accessible and is used for radio keyloading and programming.
- J600 provides recording capability to the TXM2000, and also provides a J600 interface outside the radio.

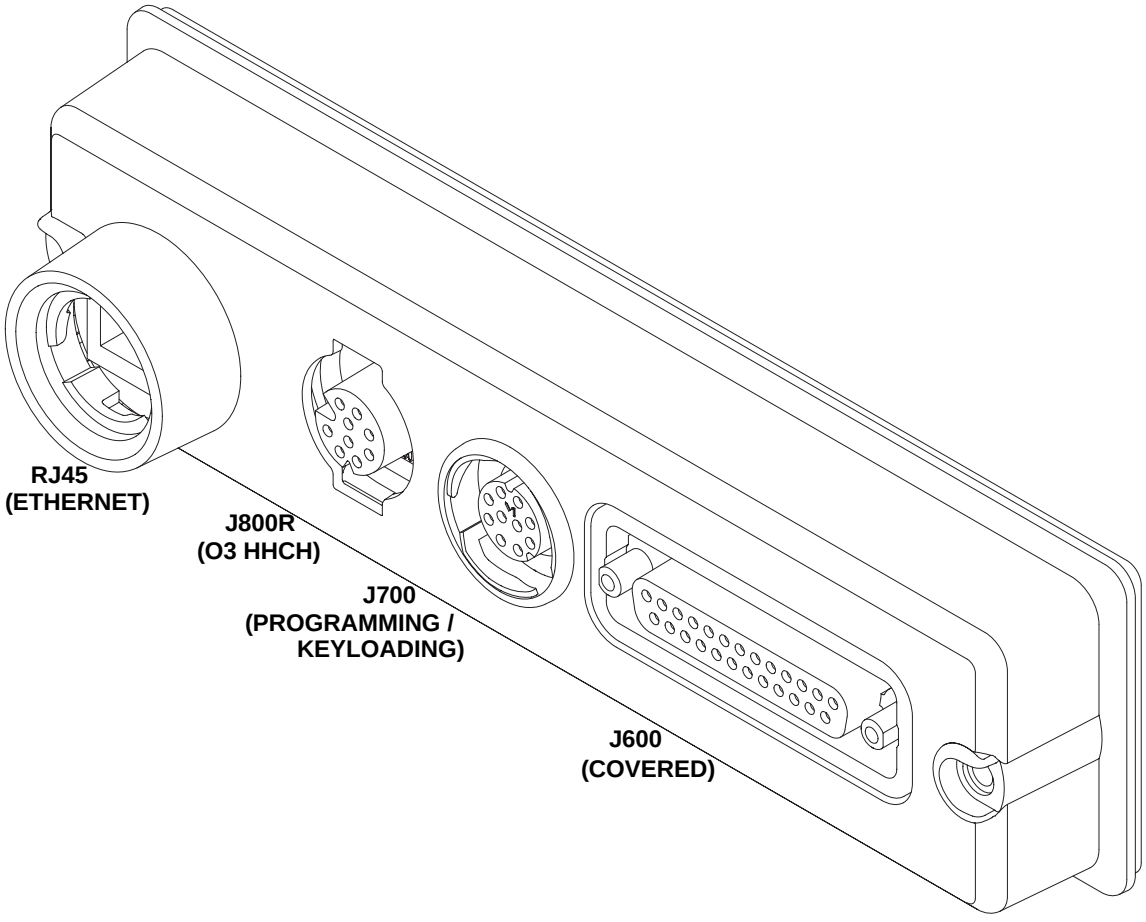


Figure 5-4 APX Mobile Connections

5.6 DB25 (V.24) Connector

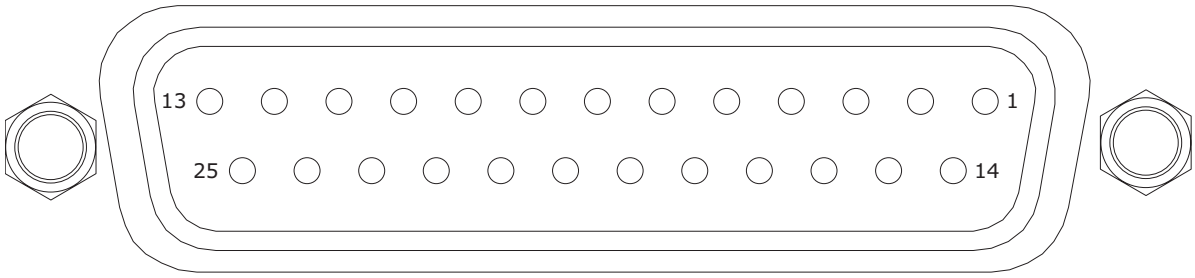


Figure 5-5 DB25 Connector

Table 5.3 DB25 Pin Output

PIN	PIN Name
PIN 2	Transmit Data
PIN 3	Receive Data
PIN 4	Clear-To-Send
PIN 10	Ground
PIN 15	Vehicular Interface Port 1
PIN 17	Request-To-Send
PIN 20	Switched Battery Voltage

SECTION 6 ASSEMBLY AND DISASSEMBLY

This chapter contains the exploded view of the radio, and instructions to disassemble the radio. Reassembly will be steps done in the reverse manner.

6.1 Exploded View

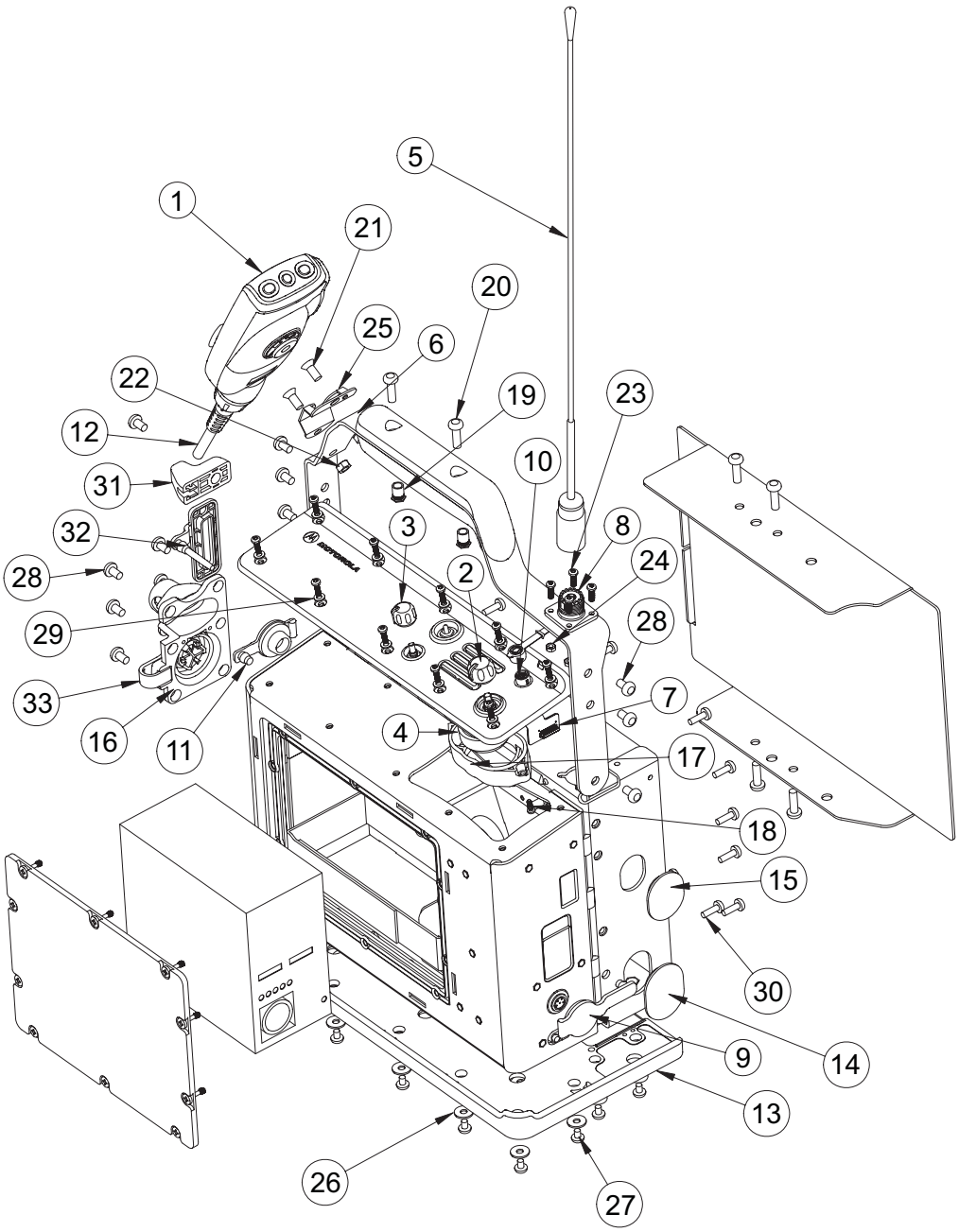


Figure 6-1 TXM 2000 Exploded View

6.2 Parts List

Reference	Part Number	Description
1	PMUN1034FSP02	03 CONTROLHEAD W/ RIGHT ANGLE CAN
2	3675581B01	VOLUME KNOB
3	3675590B02	CHANNEL KNOB
4	5015134H01	SPEAKER
5	NAD6183B	ANTENNA
6	07012059001	BRKT, HANDLE
7	84009603001	CONTROL FLEX
8	30009405001	CABLE, ANT. COAX
9	38009325002	DUST COVER, RECORD
10	38009326001	DUST COVER, HEADSET
11	32012257001	DUST COVER, GCAI
12	01009625001	CABLE, RT. ANGLE '03' CONTROL HD
13	75012217001	ANTI-SKID PAD
14	38009327001	PLUG, RF PORT
15	38009328001	PLUG, DC PORT
16	07012060001	PROTECTOR, RJ45 AND CAN CONNECTOR
17	07009374001	BRACKET, SPEAKER
18	0371370L01	SCREW, PLASTIC, SPKR BRKT
19	02009273001	NUT, M5, HANDLE GRIP
20	03009379004	SCREW, M5X16, HANDLE & RADIO
21	03009379008	SCREW, M5X12, FLAT, CLIP
22	02012029001	M5x0.8 HEX NUT
23	03009379005	SCREW, M3X10, ANT / CNTL PANEL
24	0205681N02	NUT, M3, ANTENNA
25	HLN9073_	CLIP, HANG UP, '03'
26	04009299001	WASHER, M4, BASEPAD
27	03009379001	SCREW, M4X5, BASEPAD
28	03009379003	SCREW, M5X8, HANDLE
29	04009299002	WASHER, M3, CNTL PANEL
30	03009379007	SCREW, M4X12, REAR BATT. SUPPORT
31	07012068001	DB25 PROTECTOR SUPPORT
32	32012251001	DB25 DUST COVER, TETHER
33	32012249001	RJ45 DUST COVER, TETHER

Reference	Part Number	Description
*	HPN4007C	AC TO DC ADAPTER
*	03009379002	SCREW, M3x20, DC CONN.
*	0315284H01	SCREW, M3x35, DC CONN
*	30009391002	DC PWR CORD
*	30009494001	CABLE, DC POWER EXTENSION
*	07009405001	CLAMP, EXTENSION CABLE OUTER
*	07009406001	CLAMP, EXTENSION CABLE INNER
*	2882560N01	PLUG 5 PIN

6.3 Disassembly

6.3.1 Battery Removal

1. Use a #2 Phillips screwdriver to loosen the battery cover screws and remove the battery cover.

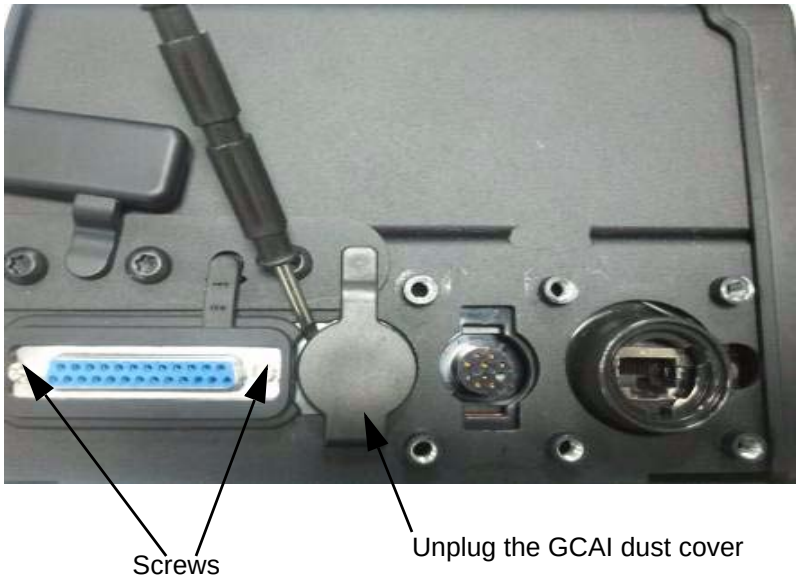
2. Unfasten the Velcro strap and use the strap ends to slide the battery out of the battery compartment.

3. Disconnect the battery cable connector from the battery and remove battery.

6.3.2 Radio Removal

1. If attached, disconnect the 03 HHCH from the radio.
2. Unplug the DB25 dust cover.

3. Use a small flat blade screw driver, to loosen the two screws on DB-25 connector. Insert the driver blade into the slot on the side of the connector, and gently pry to loosen it from the connector on radio. Unplug the GCAI dust cover.

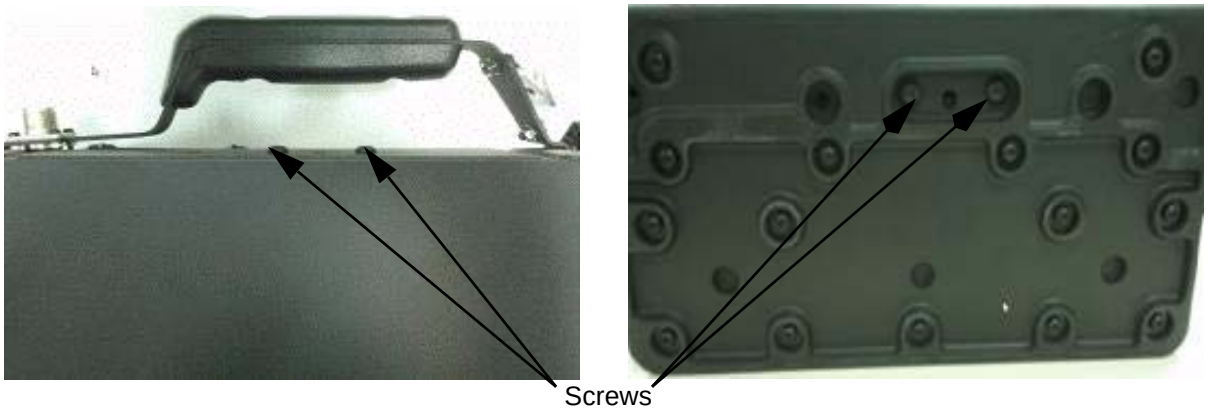


4. Unplug the DB25 connector and rotate it out of way.

Caution

This connector will remain connected to the unit by a single wire. Do not pull on the connector any more than necessary to disengage it from the radio.

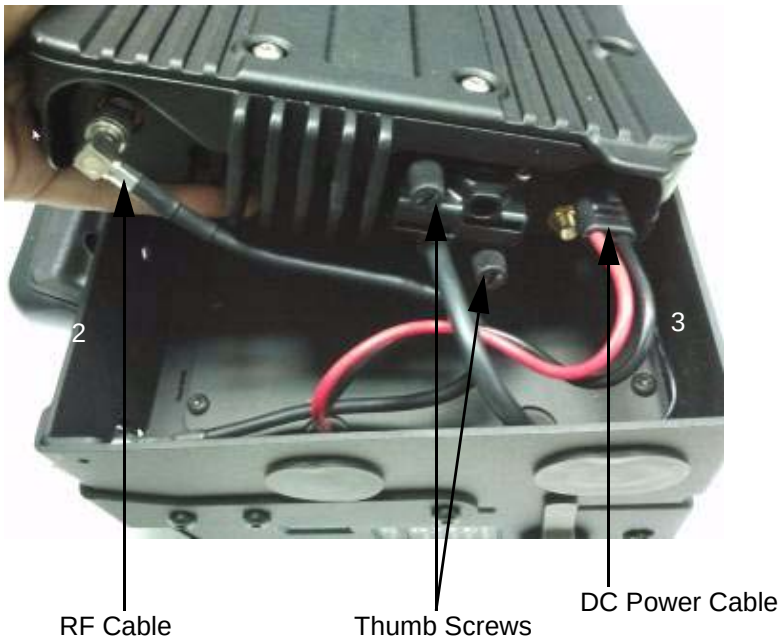
5. Using a driver with a TORX T-20 bit, remove the 4 screws retaining WWM radio and its cover.



6. Remove the cover, to expose the radio.

7. Lift the radio from housing, and disconnect the RF and DC power cables. Loosen the two thumb screws on accessory connector, and disconnect accessory cable. Remove the radio.

NOTE: Securing the accessory connector thumb screws will require the T32-1487 Accessory-Scr-Driver at 1.5 lbf.in +/- 0.3.



Notes

SECTION 7 TROUBLESHOOTING

7.1 Power On

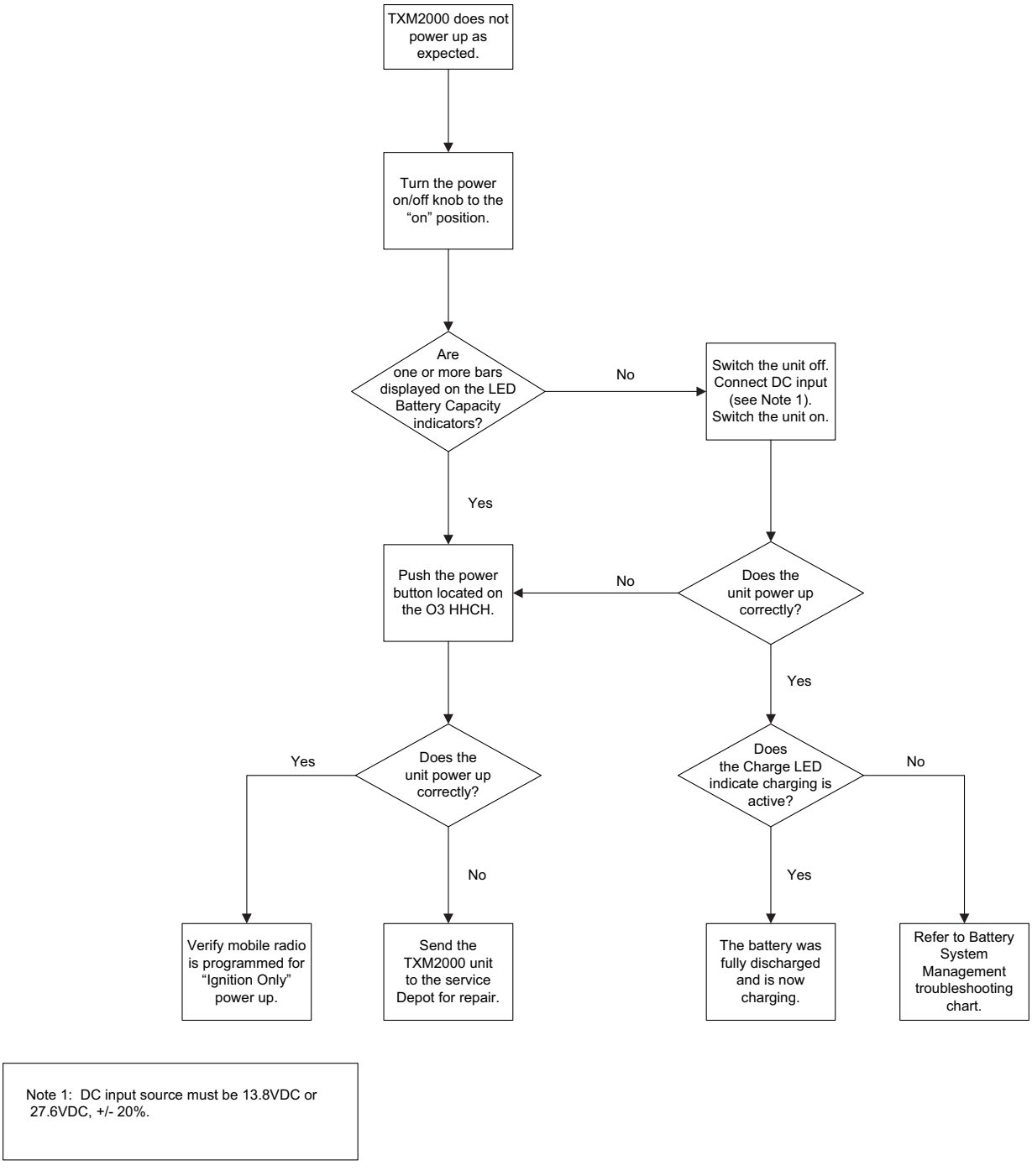


Figure 7-1 TXM 2000 Power On Troubleshooting

7.2 Power Off

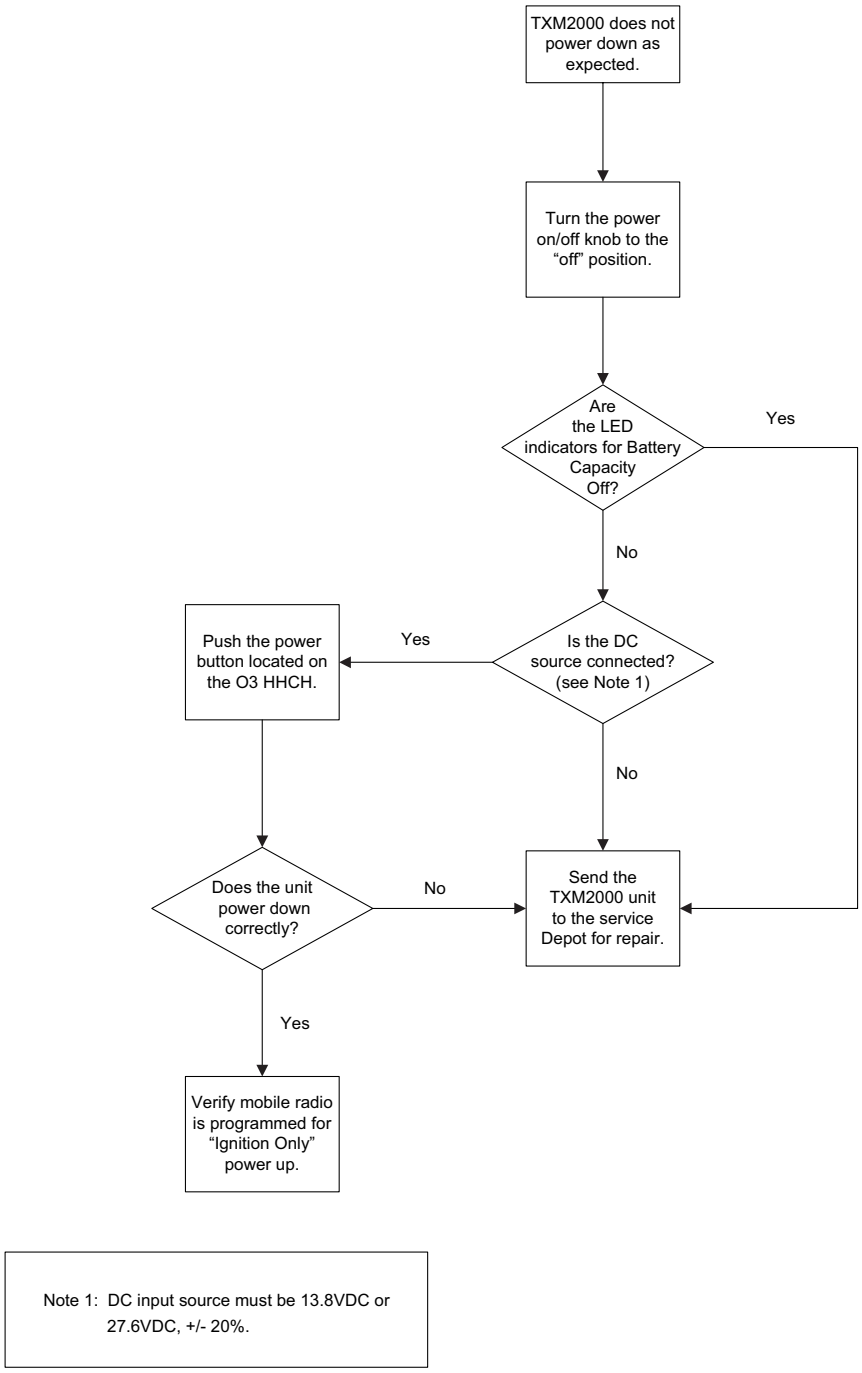


Figure 7-2 TXM 2000 Power Off Troubleshooting

7.3 Battery System Management

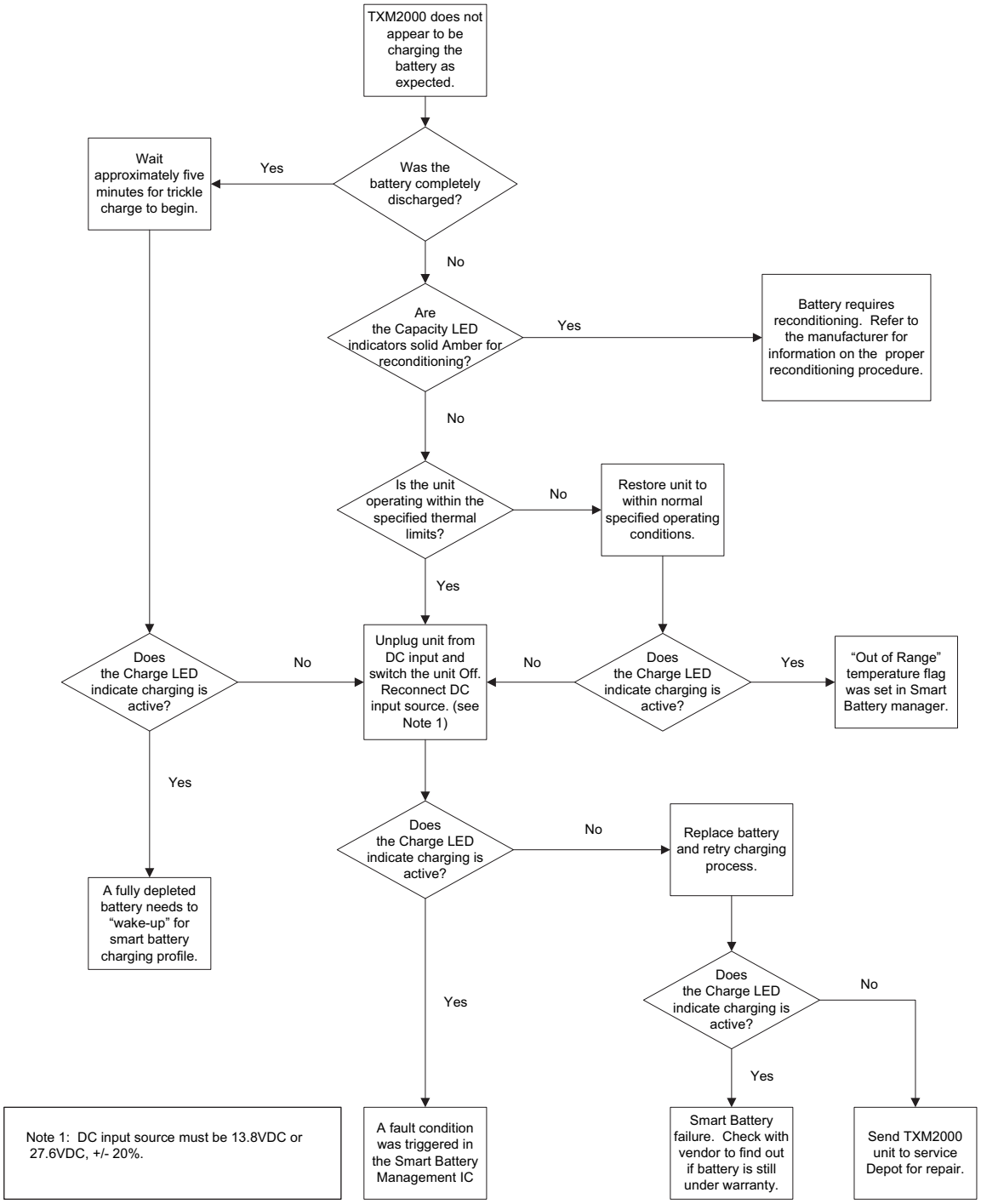


Figure 7-3 Battery System Management Troubleshooting

7.4 Record Audio

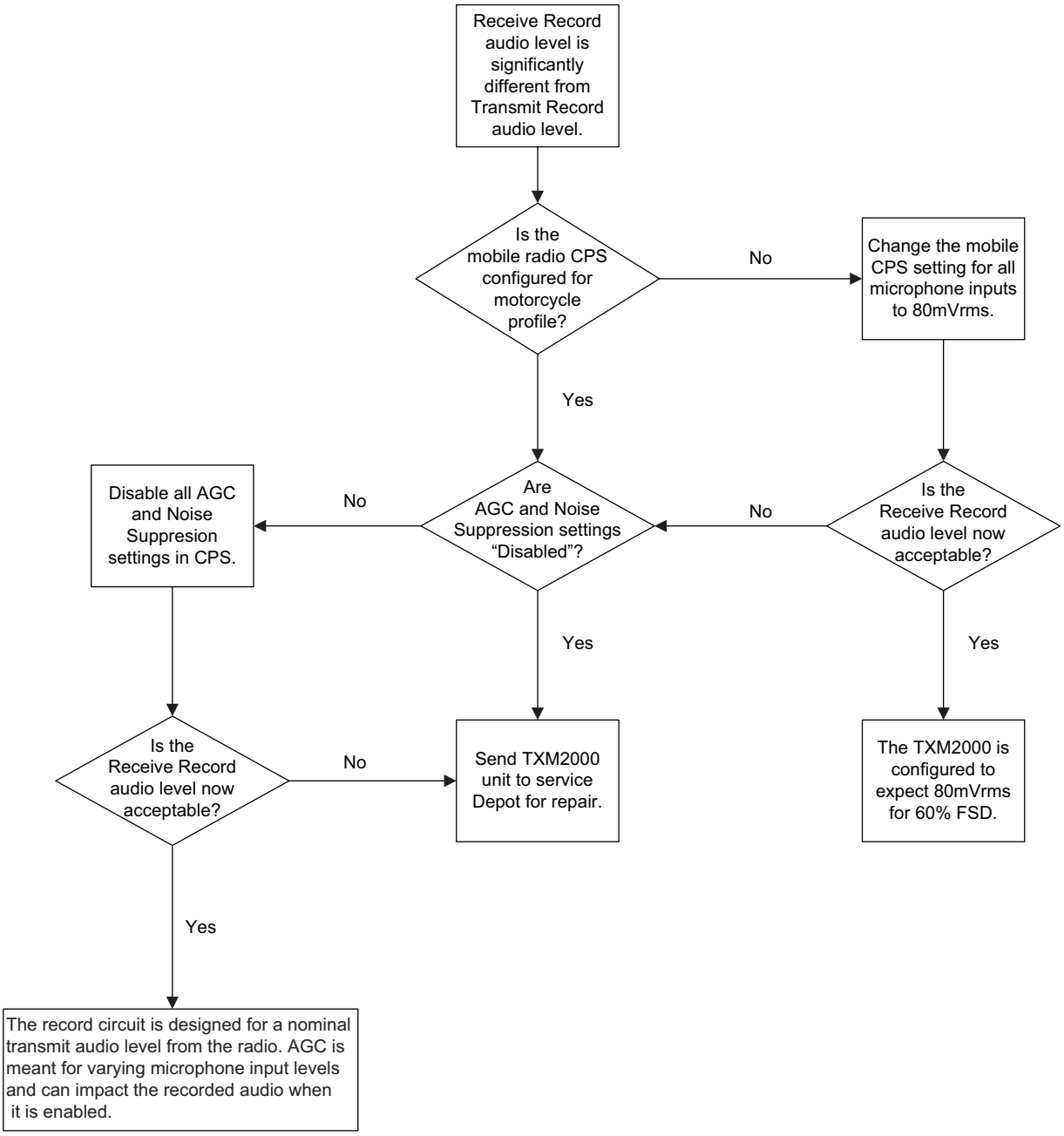


Figure 7-4 Record Audio Troubleshooting

SECTION 8 SCHEMATICS, BOARD LAYOUTS, AND PARTS LISTS

This chapter contains schematics, board layouts, and parts lists. These should be used as a guide in determining the problem areas. They are not a substitute for knowledge of circuit operation and astute troubleshooting techniques. It is advisable to refer to the related detailed circuit descriptions in the theory of operation chapter prior to troubleshooting a radio.

8.1 Schematics, Board Layouts, and Parts Lists

Table 8-1. List of Schematics, Board Layouts, and Parts Lists

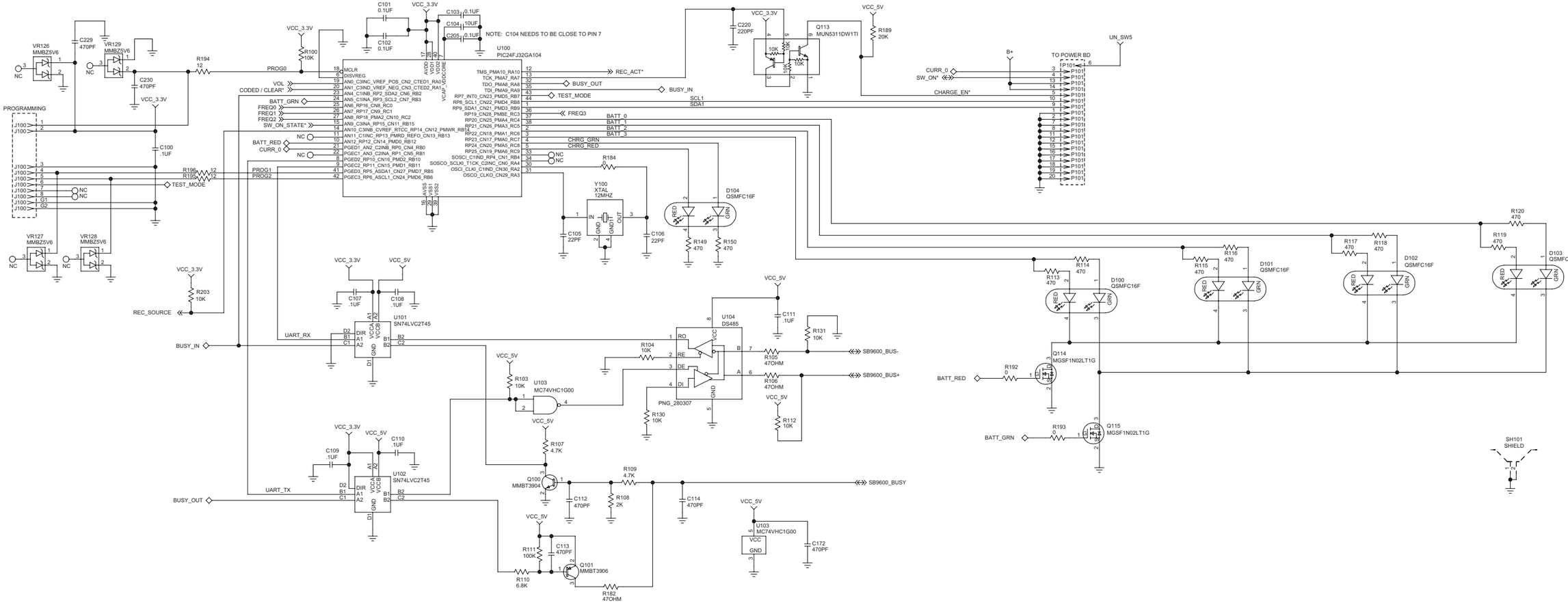


Figure 8-1. 84009544001 Control Board Schematic - A

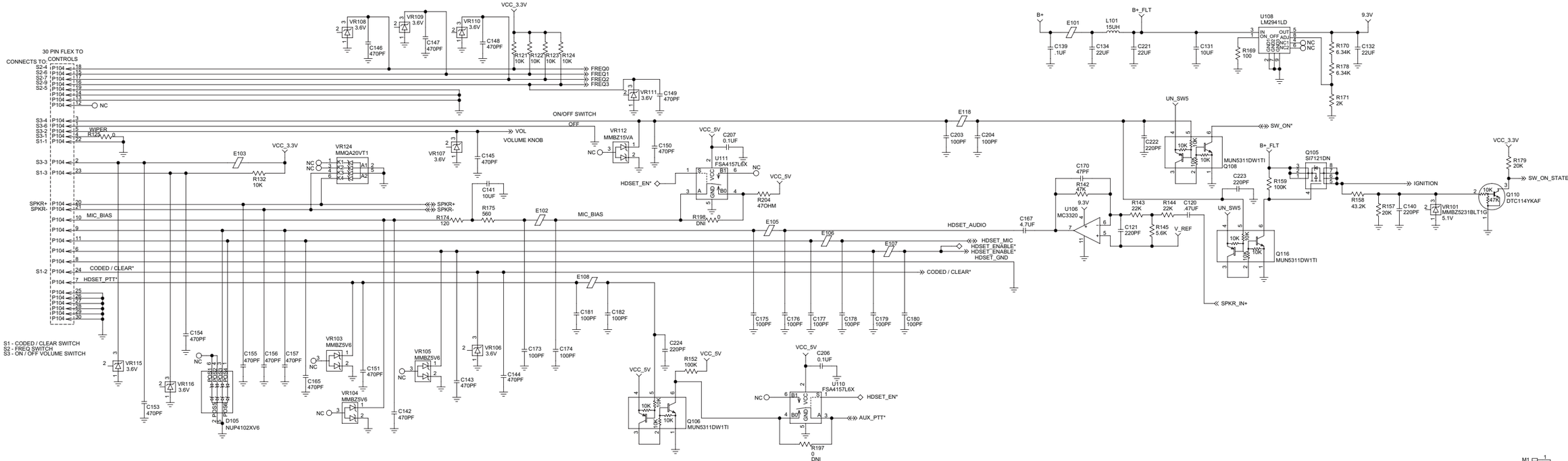


Figure 8-2. 84009544001 Control Board Schematic - B

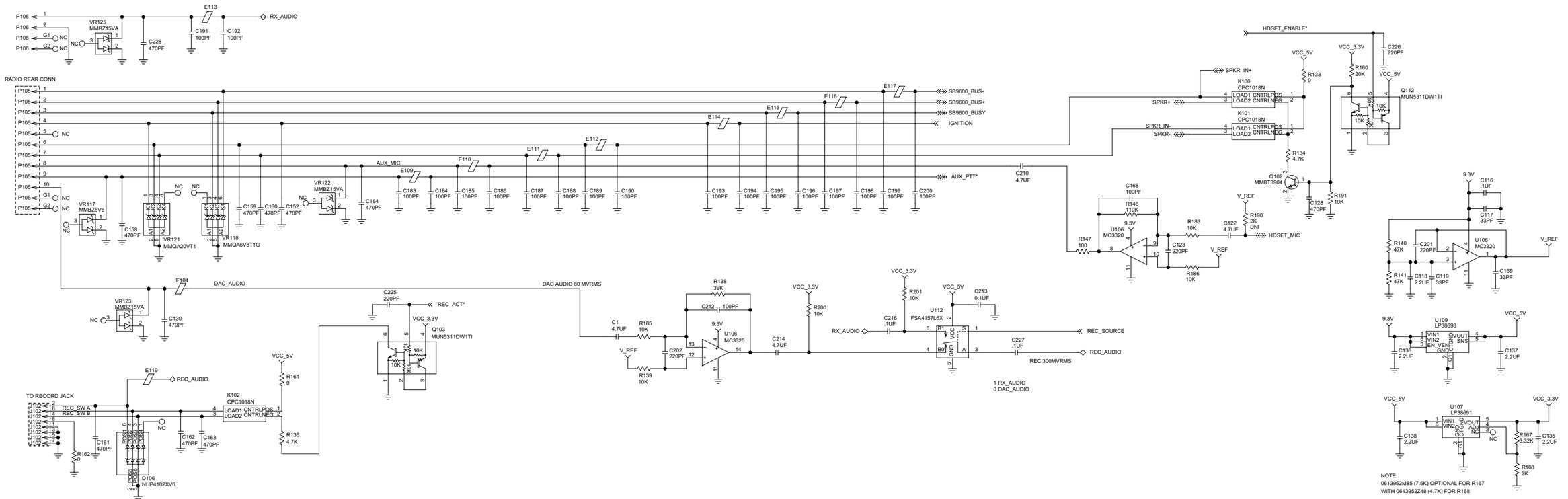


Figure 8-3. 84009544001 Control Board Schematic - C

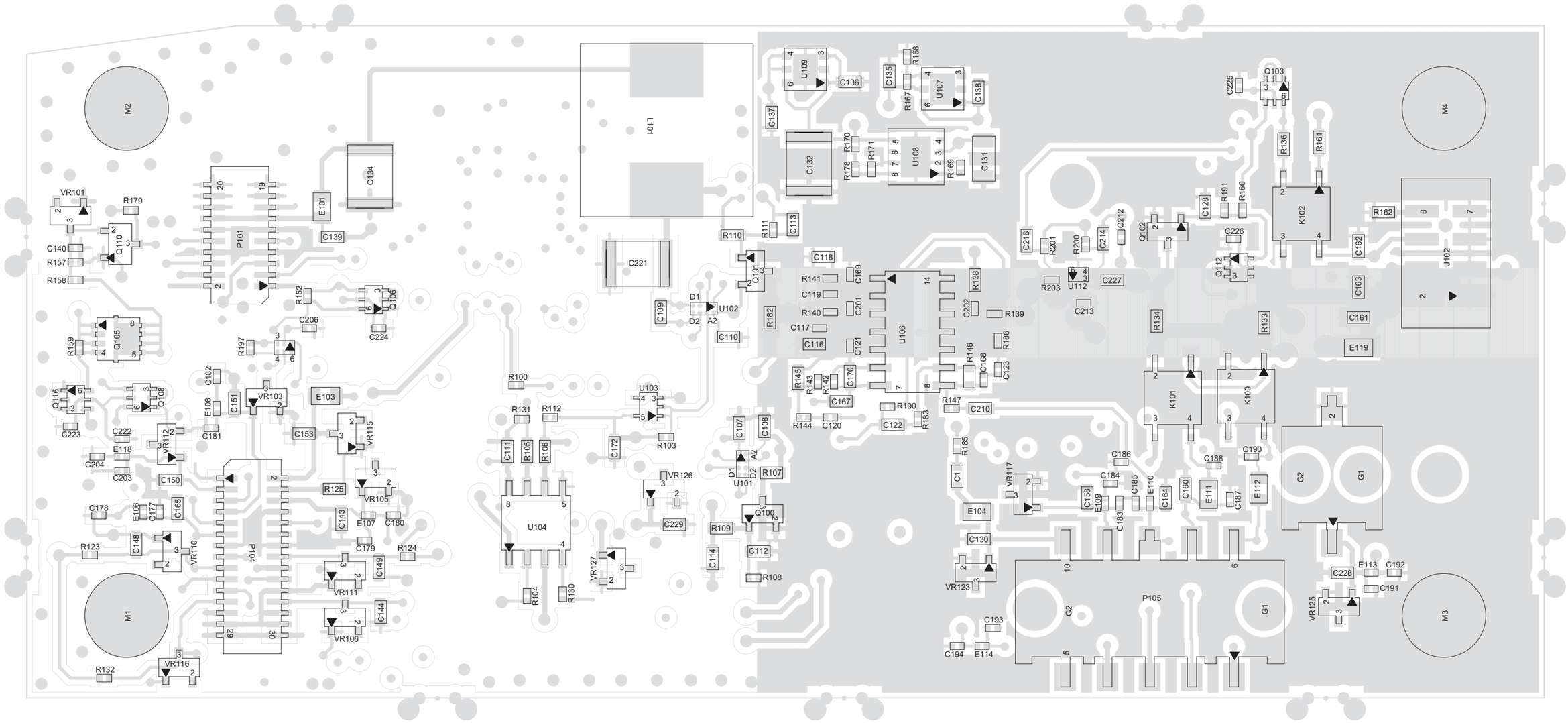


Figure 8-4. 84009544001 Control Board Layout - Top

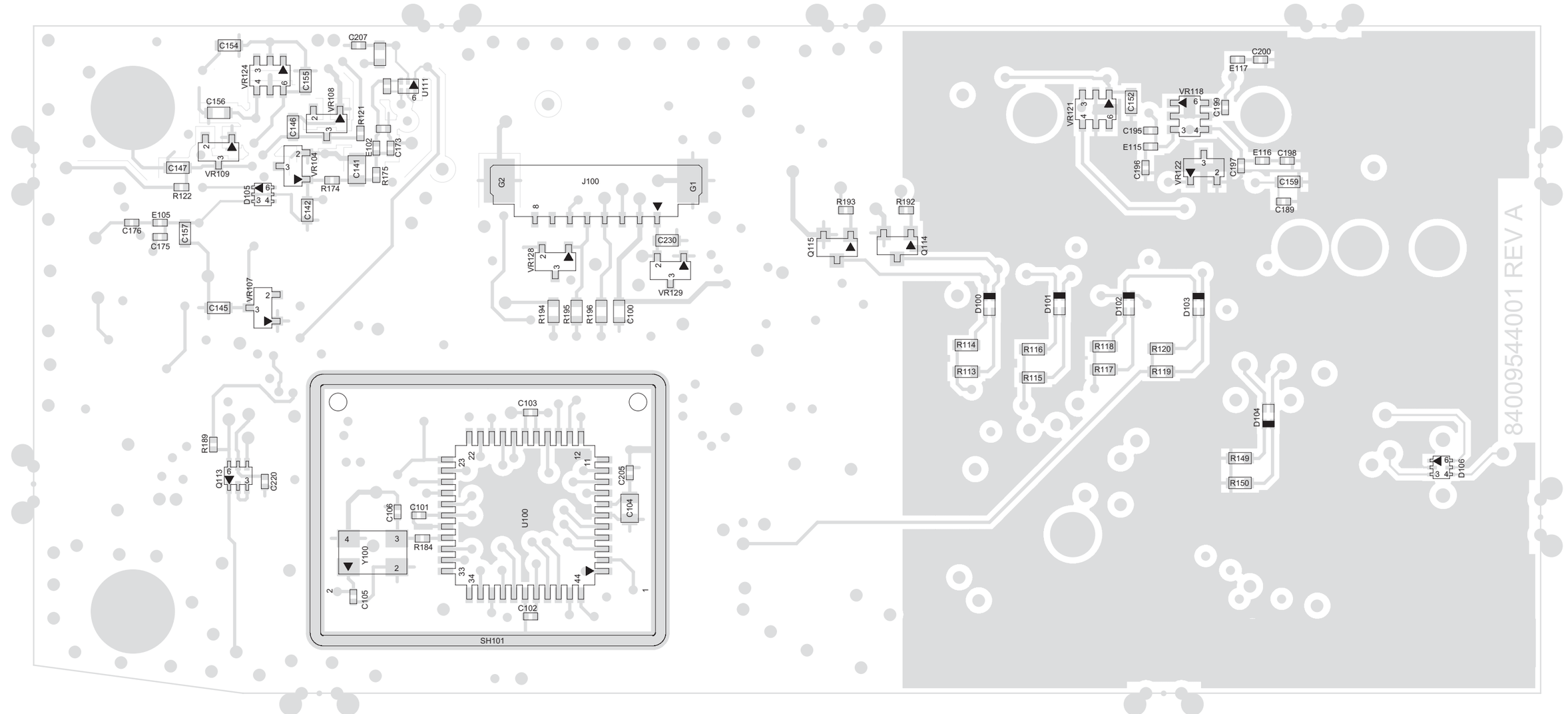


Figure 8-5. 84009544001 Control Board Layout - Bottom

NNTN8413_ Control Board Part List

Ref. Des	Part Number	Description
C100	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C101	2113946B04	CAP CER CHP 0.10UF 10V 10%
C102	2113946B04	CAP CER CHP 0.10UF 10V 10%
C103	2113946B04	CAP CER CHP 0.10UF 10V 10%
C104	2113946F05	"CAP,CHIP,10UF,+10%,-10%,6.3V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX"
C105	2113944A29	CAP CER CHP 22.0PF 50V 5%
C106	2113944A29	CAP CER CHP 22.0PF 50V 5%
C107	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C108	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C109	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C110	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C111	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C112	2113944C06	CAP CER CHP 470.0PF 50V 5%
C113	2113944C06	CAP CER CHP 470.0PF 50V 5%
C114	2113944C06	CAP CER CHP 470.0PF 50V 5%
C116	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C117	2113944A31	CAP CER CHP 33.0PF 50V 5%
C118	2113946N03	CAP CER CHP 2.2UF 16V
C119	2113944A31	CAP CER CHP 33.0PF 50V 5%
C120	2113946K05	"CAP,FXD,.47UF,+80%,-20%,16V-DC,0402,Y5V,-30DEG CMIN,85DEG CMAX"
C121	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C122	2113946D07	"CAP,CHIP,4.7UF,+10%,-10%,6.3V-DC,0603,X5R,-55DEG CMIN,85DEG CMA"
C123	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C128	2113944C06	CAP CER CHP 470.0PF 50V 5%
C130	2113944C06	CAP CER CHP 470.0PF 50V 5%
C131	2113956D27	"CAP,FXD,10UF,+10%,-10%,25V-DC,1206,X5R,-55DEG CMIN,85DEG CMAX,P"
C132	21009255001	"CAP, CERAMIC, FIXED, 22UF, 25 V."
C133	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C134	21009255001	"CAP, CERAMIC, FIXED, 22UF, 25 V."
C135	2113956B33	"CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX"
C136	2113956B33	"CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX"
C137	2113956B33	"CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX"
C138	2113956B33	"CAP,FXD,2.2UF,+10%,-10%,16V-DC,0603,X5R,-55DEG CMIN,85DEG CMAX"
C139	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C140	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C141	2113946F05	"CAP,CHIP,10UF,+10%,-10%,6.3V-DC,0805,X5R,-55DEG CMIN,85DEG CMAX"
C142	2113944C06	CAP CER CHP 470.0PF 50V 5%
C143	2113944C06	CAP CER CHP 470.0PF 50V 5%
C144	2113944C06	CAP CER CHP 470.0PF 50V 5%
C145	2113944C06	CAP CER CHP 470.0PF 50V 5%
C146	2113944C06	CAP CER CHP 470.0PF 50V 5%
C147	2113944C06	CAP CER CHP 470.0PF 50V 5%
C148	2113944C06	CAP CER CHP 470.0PF 50V 5%
C149	2113944C06	CAP CER CHP 470.0PF 50V 5%
C150	2113944C06	CAP CER CHP 470.0PF 50V 5%
C151	2113944C06	CAP CER CHP 470.0PF 50V 5%
C152	2113944C06	CAP CER CHP 470.0PF 50V 5%
C153	2113944C06	CAP CER CHP 470.0PF 50V 5%
C154	2113944C06	CAP CER CHP 470.0PF 50V 5%
C155	2113944C06	CAP CER CHP 470.0PF 50V 5%
C156	2113944C06	CAP CER CHP 470.0PF 50V 5%
C157	2113944C06	CAP CER CHP 470.0PF 50V 5%
C158	2113944C06	CAP CER CHP 470.0PF 50V 5%
C159	2113944C06	CAP CER CHP 470.0PF 50V 5%
C160	2113944C06	CAP CER CHP 470.0PF 50V 5%
C161	2113944C06	CAP CER CHP 470.0PF 50V 5%
C162	2113944C06	CAP CER CHP 470.0PF 50V 5%
C163	2113944C06	CAP CER CHP 470.0PF 50V 5%
C164	2113944C06	CAP CER CHP 470.0PF 50V 5%
C165	2113944C06	CAP CER CHP 470.0PF 50V 5%
C166	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C167	2113946K05	"CAP,FXD,.47UF,+80%,-20%,16V-DC,0402,Y5V,-30DEG CMIN,85DEG CMAX"
C168	2113944A40	CAP CER CHP 100.0PF 50V 5%
C169	2113944A31	CAP CER CHP 33.0PF 50V 5%
C170	2113944C38	CAP CER CHP 56.0PF 50V 5%CAP CER CHP 47.0PF 50V 5%

Ref. Des	Part Number	Description
C172	2113944C06	CAP CER CHP 470.0PF 50V 5%
C173	2113944A40	CAP CER CHP 100.0PF 50V 5%
C174	2113944A40	CAP CER CHP 100.0PF 50V 5%
C175	2113944A40	CAP CER CHP 100.0PF 50V 5%
C176	2113944A40	CAP CER CHP 100.0PF 50V 5%
C177	2113944A40	CAP CER CHP 100.0PF 50V 5%
C178	2113944A40	CAP CER CHP 100.0PF 50V 5%
C179	2113944A40	CAP CER CHP 100.0PF 50V 5%
C180	2113944A40	CAP CER CHP 100.0PF 50V 5%
C181	2113944A40	CAP CER CHP 100.0PF 50V 5%
C182	2113944A40	CAP CER CHP 100.0PF 50V 5%
C183	2113944A40	CAP CER CHP 100.0PF 50V 5%
C184	2113944A40	CAP CER CHP 100.0PF 50V 5%
C185	2113944A40	CAP CER CHP 100.0PF 50V 5%
C186	2113944A40	CAP CER CHP 100.0PF 50V 5%
C187	2113944A40	CAP CER CHP 100.0PF 50V 5%
C188	2113944A40	CAP CER CHP 100.0PF 50V 5%
C189	2113944A40	CAP CER CHP 100.0PF 50V 5%
C190	2113944A40	CAP CER CHP 100.0PF 50V 5%

Ref. Des	Part Number	Description
C191	2113944A40	CAP CER CHP 100.0PF 50V 5%
C192	2113944A40	CAP CER CHP 100.0PF 50V 5%
C193	2113944A40	CAP CER CHP 100.0PF 50V 5%
C194	2113944A40	CAP CER CHP 100.0PF 50V 5%
C195	2113944A40	CAP CER CHP 100.0PF 50V 5%
C196	2113944A40	CAP CER CHP 100.0PF 50V 5%
C197	2113944A40	CAP CER CHP 100.0PF 50V 5%
C198	2113944A40	CAP CER CHP 100.0PF 50V 5%
C199	2113944A40	CAP CER CHP 100.0PF 50V 5%
C200	2113944A40	CAP CER CHP 100.0PF 50V 5%
C201	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C202	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C203	2113944A40	CAP CER CHP 100.0PF 50V 5%
C204	2113944A40	CAP CER CHP 100.0PF 50V 5%
C205	2113946B04	CAP CER CHP 0.10UF 10V 10%
C206	2113946B04	CAP CER CHP 0.10UF 10V 10%
C207	2113946B04	CAP CER CHP 0.10UF 10V 10%
D100	4875690M01	"LED,CHIP,BICLR,RED-PQ/GRN-QR"
D101	4875690M01	"LED,CHIP,BICLR,RED-PQ/GRN-QR"

Ref. Des	Part Number	Description
D102	4875690M01	"LED,CHIP,BICLR,RED-PQ/GRN-QR"
D103	4875690M01	"LED,CHIP,BICLR,RED-PQ/GRN-QR"
D104	4875690M01	"LED,CHIP,BICLR,RED-PQ/GRN-QR"
D105	4813979B25	"DIODE ARRAY,SUPR,SOT-563,14V,100W,ZEN,8,PB-FREE"
D106	4813979B25	"DIODE ARRAY,SUPR,SOT-563,14V,100W,ZEN,8,PB-FREE"
E101	2480675U01	0805 CHIP-3AMP
E102	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E103	2480675U01	0805 CHIP-3AMP
E104	2480675U01	0805 CHIP-3AMP
E105	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E106	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E107	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E108	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E109	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"

Ref. Des	Part Number	Description
E110	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E111	7686949J14	"FLTR,FERRITE BEAD,2A,SM,0805,CHIP,220OHM"
E112	7686949J14	"FLTR,FERRITE BEAD,2A,SM,0805,CHIP,220OHM"
E113	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E114	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E115	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E116	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E117	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
E118	2471132D16	"IDCTR,FXD,25%,200MA,FERR,SM,0402,BEAD 1000OHMS W18 COMP"
J100	0915720H04	"CONN, 8PIN, 1.25MM PITCH, WTB"
J102	2888622D17	"CONN,PWR,HDR,2ROW,M,8CONT,STR,30AU"
K100	40009294001	4-PIN SOP OPTOMOS RELAY CPC1018N
K101	40009294001	4-PIN SOP OPTOMOS RELAY CPC1018N

Ref. Des	Part Number	Description
K102	40009294001	4-PIN SOP OPTOMOS RELAY CPC1018N
L101	2471120Y01	"IDCTR,PWR,15UH,20%,6.5A,.038OHM,SM,PB-FREE"
P101	0980423L10	"CONNECTOR, 20 PIN, RECEPTACLE"
P104	09012039001	"BTB 30PIN-CONNECTOR,0.8PITCH, SOCKE"
P105	09009310001	SMT 10 PIN CONNECTOR
PWB	84009544001	"PWB, CONTROLLER"
Q100	4813973M07	"XSTR,BIP GP SS,NPN,T3904,SM,SOT-23,SMT,40V,.225W,200MA,300MHZ"
Q101	4813973A13	"XSTR,GEN PURPOSE SMALL SIG,PNP,MMBT3906L,TO-236,4, PB-FREE"
Q102	4813973M07	"XSTR,BIP GP SS,NPN,T3904,SM,SOT-23,SMT,40V,.225W,200MA,300MHZ"
Q103	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q105	48009140001	P-CHANNEL 30-V (D-S) MOSFET
Q106	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q107	4815261H01	"TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN"
Q108	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q109	48009140001	P-CHANNEL 30-V (D-S) MOSFET
Q110	4815261H01	"TRANSISTOR,BIP GENERAL PURPOSE SMALL NPN"
Q111	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q112	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q113	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q114	4813972A17	"PB-FREE,NOT COMPLETELY ENRICHED"
Q115	4813972A17	"PB-FREE,NOT COMPLETELY ENRICHED"
R100	0613952J01	CER CHIP RES 10K OHM 5% 0603
R102	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R103	0613952J01	CER CHIP RES 10K OHM 5% 0603
R104	0613952J01	CER CHIP RES 10K OHM 5% 0603
R105	0613952H41	CER CHIP RES 47.0 OHM 5 0603
R106	0613952H41	CER CHIP RES 47.0 OHM 5 0603
R107	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R108	0613952H80	CER CHIP RES 2000 OHM 5 0603
R109	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R110	0613952H93	CER CHIP RES 6800 OHM 5% 0603
R111	0613952J25	CER CHIP RES 100K OHM 5% 0603
R112	0613952J01	CER CHIP RES 10K OHM 5% 0603
R113	0613952H65	CER CHIP RES 470 OHM 5% 0603
R114	0613952H65	CER CHIP RES 470 OHM 5% 0603
R115	0613952H65	CER CHIP RES 470 OHM 5% 0603
R116	0613952H65	CER CHIP RES 470 OHM 5% 0603
R117	0613952H65	CER CHIP RES 470 OHM 5% 0603
R118	0613952H65	CER CHIP RES 470 OHM 5% 0603
R119	0613952H65	CER CHIP RES 470 OHM 5% 0603
R120	0613952H65	CER CHIP RES 470 OHM 5% 0603
R121	0613952J01	CER CHIP RES 10K OHM 5% 0603
R122	0613952J01	CER CHIP RES 10K OHM 5% 0603
R123	0613952J01	CER CHIP RES 10K OHM 5% 0603
R124	0613952J01	CER CHIP RES 10K OHM 5% 0603
R125	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R130	0613952J01	CER CHIP RES 10K OHM 5% 0603
R131	0613952J01	CER CHIP RES 10K OHM 5% 0603
R132	0613952J01	CER CHIP RES 10K OHM 5% 0603
R133	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R134	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R136	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R138	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R139	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R140	0613952R17	CER CHIP RES 47K OHM 5% 0402
R141	0613952R17	CER CHIP RES 47K OHM 5% 0402
R142	0613952R17	CER CHIP RES 47K OHM 5% 0402
R143	0613952R09	CER CHIP RES 22K OHM 5% 0402
R144	0613952R09	CER CHIP RES 22K OHM 5% 0402
R145	0613952H67	CER CHIP RES 560 OHM 5 0603
R146	0613952R33	CER CHIP RES 220K OHM 5% 0402
R147	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R148	0613952Q73	CER CHIP RES 1000 OHM 5 0402
R149	0613952H65	CER CHIP RES 470 OHM 5% 0603
R150	0613952H65	CER CHIP RES 470 OHM 5% 0603

Ref. Des	Part Number	Description
R152	0613952R25	CER CHIP RES 100K OHM 5% 0402
R157	0613952N30	CER CHIP RES 20.0K OHM 1 0402
R158	0613952N62	CER CHIP RES 43.2K OHM 1 0402
R159	0613952R25	CER CHIP RES 100K OHM 5% 0402
R160	0613952N30	CER CHIP RES 20.0K OHM 1 0402
R161	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R162	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R163	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R165	0613952N62	CER CHIP RES 43.2K OHM 1 0402
R166	0613952N30	CER CHIP RES 20.0K OHM 1 0402
R167	0613952M51	CER CHIP RES 3320 OHM 1% 0402
R168	0613952M30	CER CHIP RES 2000 OHM 1 0402
R169	0613952Q49	CER CHIP RES 100 OHM 5 0402
R170	0613952M78	CER CHIP RES 6340 OHM 1 0402
R171	0613952M30	CER CHIP RES 2000 OHM 1 0402
R173	0613952R25	CER CHIP RES 100K OHM 5% 0402
R174	0613952Q51	CER CHIP RES 120 OHM 5 0402
R175	0613952Q67	CER CHIP RES 560 OHM 5 0402
R176	0613952H89	CER CHIP RES 4700 OHM 5% 0603

Ref. Des	Part Number	Description
R177	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R178	0613952M78	CER CHIP RES 6340 OHM 1 0402
R179	0613952N30	CER CHIP RES 20.0K OHM 1 0402
R182	0613952H41	CER CHIP RES 47.0 OHM 5 0603
R183	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R184	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R185	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R186	0613952N01	CER CHIP RES 10.0K OHM 1 0402
R187	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R188	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R189	0613952N30	CER CHIP RES 20.0K OHM 1 0402
R190	NOTPLACED	64AM DUMMY PART NUMBER
R191	0613952J01	CER CHIP RES 10K OHM 5% 0603
R192	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R193	0613952R66	CER CHIP RES 0.0 +/- 0.050 OHM
R194	0613952H27	CER CHIP RES 12.0 OHM 5 0603
R195	0613952H27	CER CHIP RES 12.0 OHM 5 0603
R196	0613952H27	CER CHIP RES 12.0 OHM 5 0603
R197	NOTPLACED	64AM DUMMY PART NUMBER

Ref. Des	Part Number	Description
R198	NOTPLACED	64AM DUMMY PART NUMBER
SH101	2671840L01	SHIELD
U100	51009829001	16-BIT FLASH MICROCNTRLLR IC
U101	5164852H16	IC TRANSCEIVER W/ LEVEL TRANSLATION
U102	5164852H16	IC TRANSCEIVER W/ LEVEL TRANSLATION
U103	5114000B34	"IC,NAND,1PER PKG,SM,SOT-353,PB-FREE"
U104	5171687H01	"IC, TRANSCEIVER, LOW POWER"
U106	5114016A12	"IC,OP AMP,4PER PKG,LVOLT,SM,SO-14,PB-FREE"
U107	5171734H01	"IC,VOLT.REG,LIN-EAR,CMOS,ADJ,500MA"
U108	5171774H01	ADJUSTABLE VOLT-AGE REGULATOR
U109	5171885H01	"IC,VOLT REG,CMOS,LIN-EAR,5.0V.,500MA"
U110	5102836C11	"IC,ANLG SW,FSA4157,SM,SPDT, PB FREE"
U111	5102836C11	"IC,ANLG SW,FSA4157,SM,SPDT, PB FREE"
VR101	4813977M10	"DIODE,ZEN,MBZ5231, SM,SOT-23,5.1V,10MA,.225W,ZEN,PB-FREE"
VR102	4813977M10	"DIODE,ZEN,MBZ5231, SM,SOT-23,5.1V,10MA,.225W,ZEN,PB-FREE"

Ref. Des	Part Number	Description
VR103	4813977A43	"PB-FREE, NOTCOM-PLETELYENRICHED"
VR104	4813977A43	"PB-FREE, NOTCOM-PLETELYENRICHED"
VR105	4813977A43	"PB-FREE, NOTCOM-PLETELYENRICHED"
VR106	48012095001	SMALL SIGNAL ZENER DIODE
VR107	48012095001	SMALL SIGNAL ZENER DIODE
VR108	48012095001	SMALL SIGNAL ZENER DIODE
VR109	48012095001	SMALL SIGNAL ZENER DIODE
VR110	48012095001	SMALL SIGNAL ZENER DIODE
VR111	48012095001	SMALL SIGNAL ZENER DIODE
VR112	4813977A44	"DIODE ARRAY,TRN-SNT PROT,MMBZ15V,SM,SOT-23,15V,.225W,ZEN,2,PB-FR"
VR115	48012095001	SMALL SIGNAL ZENER DIODE
VR116	48012095001	SMALL SIGNAL ZENER DIODE
VR117	4813977A43	"PB-FREE, NOTCOM-PLETELYENRICHED"
VR118	4813979P15	"DIODE,TRANSIENT SUPPRESSER,SOT-26/SC-74,ZEN, PB-FREE"
VR121	4813979C11	"DIODE,SUPR,QUAD 20 V ZEN, PB-FREE"

Ref. Des	Part Number	Description
VR122	4813977A44	"DIODE ARRAY,TRN-SNT PROT,MMBZ15V,SM,SOT-23,15V,.225W,ZEN,2,PB-FR"
VR123	4813977A44	"DIODE ARRAY,TRN-SNT PROT,MMBZ15V,SM,SOT-23,15V,.225W,ZEN,2,PB-FR"
VR124	4813979C11	"DIODE,SUPR,QUAD 20 V ZEN, PB-FREE"
Y100	4802582S85	"RESON,QRTZ,12MHZ,TOLERANCE10PPM,STABILITY15PPM,SM,FUND,LO"

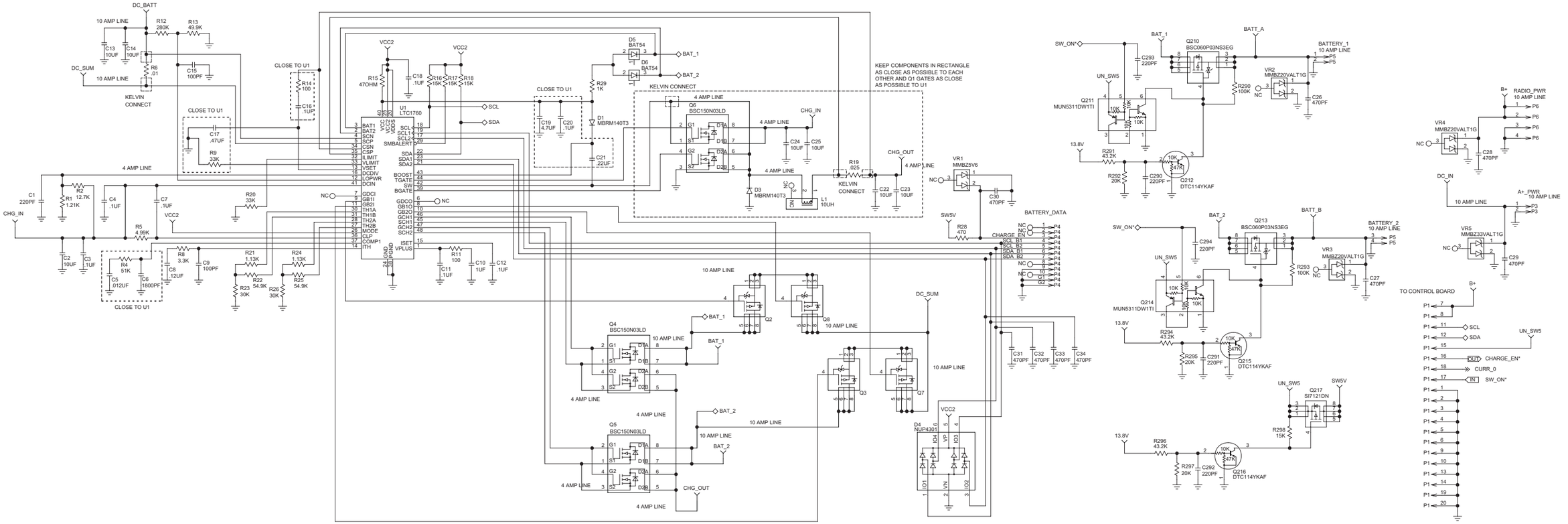


Figure 8-6. 84009542001 Charger Board Schematic - A

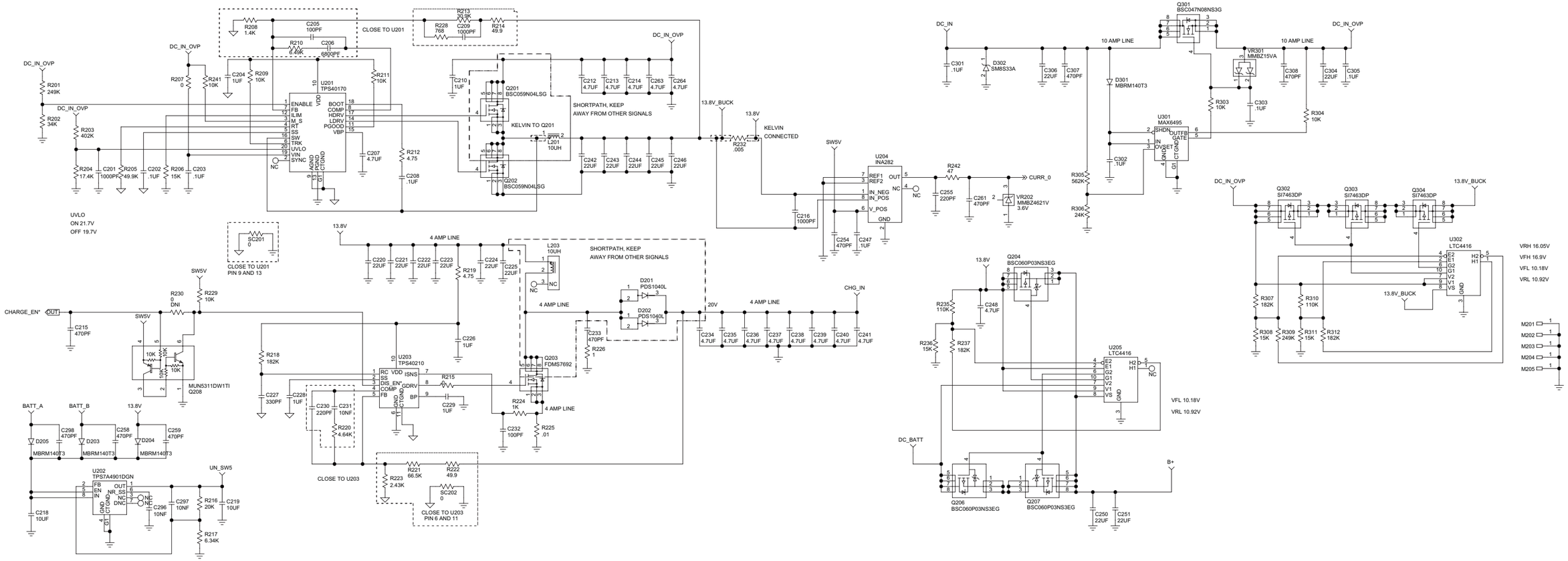


Figure 8-7. 84009542001 Charger Board Schematic - B

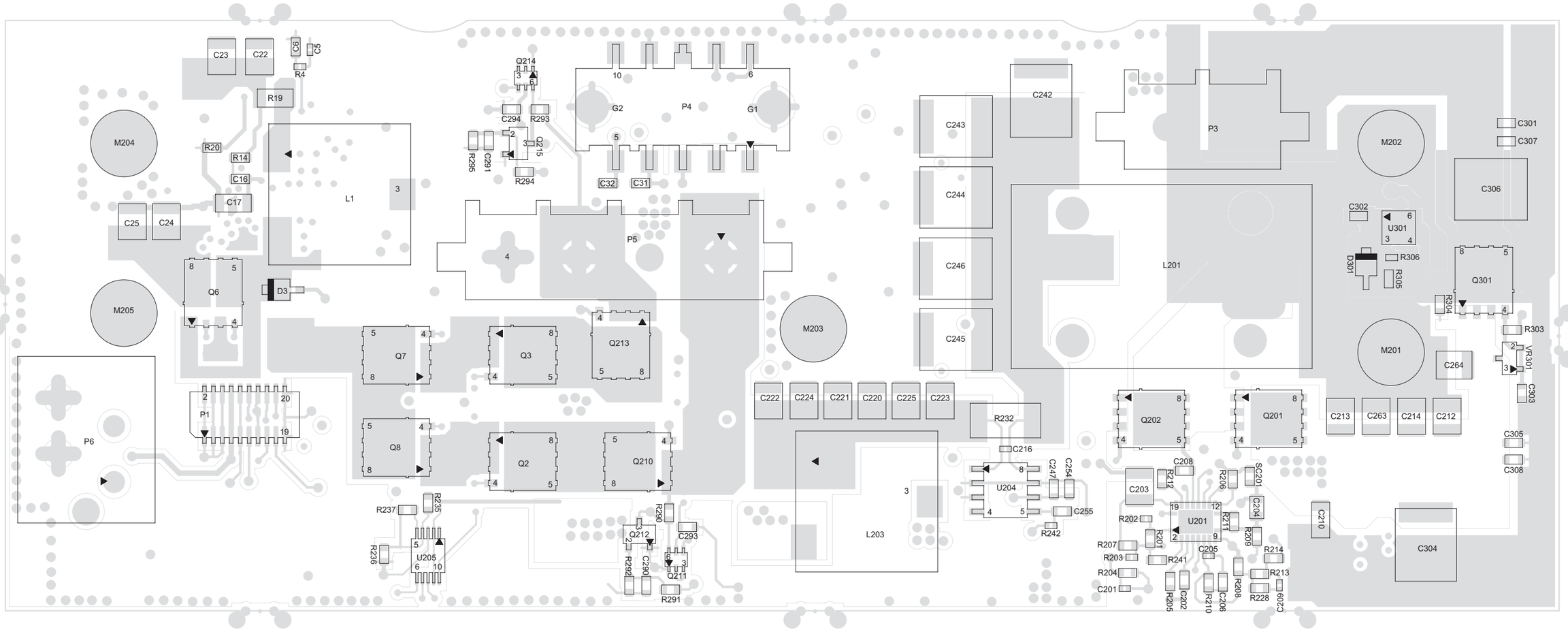


Figure 8-8. 84009542001 Charger Board Layout - Top

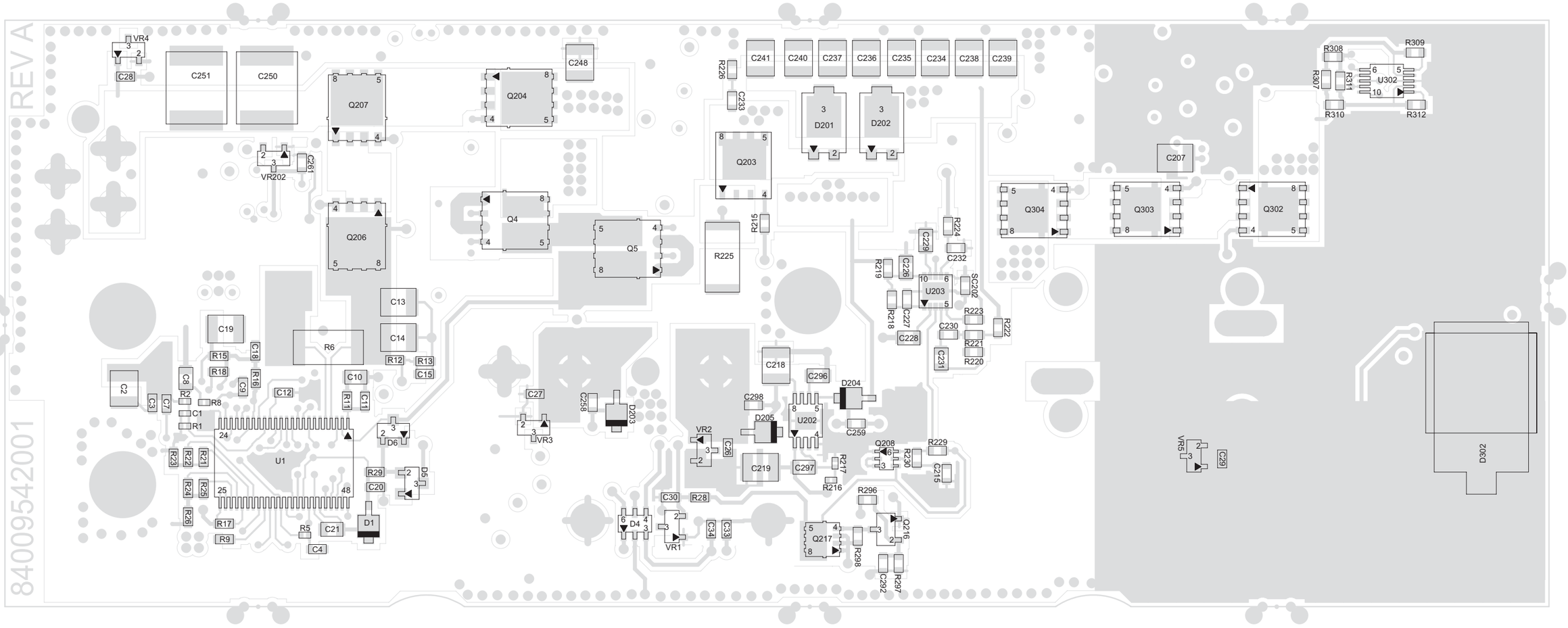


Figure 8-9. 84009542001 Charger Board Layout - Bottom

NPN6445_ Charger Board Part List

Ref Des.	Part Number	Description
C1	2113944A44	CAP CER CHP 220.0 PF 50V 5%
C10	2113955C21	"CAP,FXD,1UF,+10%,-10%,25V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX,P"
C11	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C12	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C13	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C14	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C15	2113944C45	CAP CER CHP 100.0PF 50V 5%
C16	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C17	21012039005	CAP CER SUPER LOW DIST 0.47UF
C18	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C19	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C2	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C20	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C201	2113945A09	CAP CER CHP 1000PF 50V 10%
C202	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C203	2113945V17	"CAP,FXD,.1UF,+10%,-10%,100V-DC,1210,X7R,-55DEG CMIN,125DEG CMAX"
C204	2113955C21	"CAP,FXD,1UF,+10%,-10%,25V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX,P"
C205	2113944A40	CAP CER CHP 100.0PF 50V 5%
C206	2113945C01	CAP CER CHP 6800PF 50V 10%
C207	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C208	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C209	2113945A09	CAP CER CHP 1000PF 50V 10%
C21	21012039003	CAP CER SUPER LOW DIST 0.22UF
C210	2113955D01	"CAP,FXD,1UF,+10%,-10%,100V-DC,1206,X7R,-55DEG CMIN,125DEG CMAX"
C211	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C212	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C213	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C214	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C215	2113944C06	CAP CER CHP 470.0PF 50V 5%
C216	2113944A52	CAP CER CHP 1000.0 PF 50V 5%
C218	2113945V17	"CAP,FXD,.1UF,+10%,-10%,100V-DC,1210,X7R,-55DEG CMIN,125DEG CMAX"
C219	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C22	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C220	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C221	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C222	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C223	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C224	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C225	2113956E28	"CAP,FXD,22UF,+10%,-10%,25V-DC,1210,X5R,-55DEG CMIN,85DEG CMAX,P"
C226	2113955C21	"CAP,FXD,1UF,+10%,-10%,25V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX,P"
C227	2113944C04	CAP CER CHP 330.0PF 50V 5%
C228	2113955C21	"CAP,FXD,1UF,+10%,-10%,25V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX,P"
C229	2113955C21	"CAP,FXD,1UF,+10%,-10%,25V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX,P"
C23	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C230	2113944C02	CAP CER CHP 220.0PF 50V 5%
C231	21012022001	"CAP, CERAMIC, 0805, 10000 PF, 5%"
C232	2113944C45	CAP CER CHP 100.0PF 50V 5%

Ref Des.	Part Number	Description
C233	2113944C06	CAP CER CHP 470.0PF 50V 5%
C234	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C235	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C236	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C237	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C238	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C239	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C24	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C240	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C241	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C242	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"

Ref Des.	Part Number	Description
C243	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C244	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C245	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C246	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C247	2113945D04	"CAP CER CHP 100,000PF 25V 10%"
C248	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C249	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C25	2171630Y01	"CAP,FXD,10UF,+10%,-10%,50V-DC,1210,X7S,-55DEG CMIN,125DEG CM"
C250	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C251	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C252	2113944A52	CAP CER CHP 1000.0 PF 50V 5%
C253	2113945D04	"CAP CER CHP 100,000PF 25V 10%"

Ref Des.	Part Number	Description
C254	2113944C06	CAP CER CHP 470.0PF 50V 5%
C255	2113944C02	CAP CER CHP 220.0PF 50V 5%
C256	2113944C06	CAP CER CHP 470.0PF 50V 5%
C257	2113944C02	CAP CER CHP 220.0PF 50V 5%
C258	2113944C06	CAP CER CHP 470.0PF 50V 5%
C259	2113944C06	CAP CER CHP 470.0PF 50V 5%
C26	2113944C06	CAP CER CHP 470.0PF 50V 5%
C260	2113944C06	CAP CER CHP 470.0PF 50V 5%
C261	2113944C06	CAP CER CHP 470.0PF 50V 5%
C262	2113944C06	CAP CER CHP 470.0PF 50V 5%
C263	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C264	2113955E15	"CAP,FXD,4.7UF,+10%,-10%,50V-DC,X7R,-55DEG CMIN,125DEG CMAX,PB-"
C27	2113944C06	CAP CER CHP 470.0PF 50V 5%
C28	2113944C06	CAP CER CHP 470.0PF 50V 5%
C29	2113944C06	CAP CER CHP 470.0PF 50V 5%
C3	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"

Ref Des.	Part Number	Description
C30	2113944C06	CAP CER CHP 470.0PF 50V 5%
C301	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C302	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C303	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C304	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C305	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C306	2189094V01	"CAP,CER,22UF,+20%,-20%,50V-DC,X5R,-40DEG CMIN,85DEG CMAX"
C307	2113944C06	CAP CER CHP 470.0PF 50V 5%
C308	2113944C06	CAP CER CHP 470.0PF 50V 5%
C31	2113944C06	CAP CER CHP 470.0PF 50V 5%
C32	2113944C06	CAP CER CHP 470.0PF 50V 5%
C33	2113944C06	CAP CER CHP 470.0PF 50V 5%
C34	2113944C06	CAP CER CHP 470.0PF 50V 5%

Ref Des.	Part Number	Description
C4	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C5	2113945B58	"CAP,FXD,.012UF,+10%,-10%,25V-DC,0402,X7R,-55DEG CMIN,125DEG CMA"
C6	2113944C54	CAP CER CHP 1800.OPF 50V 5%
C7	2113945C31	"CAP,FXD,.1UF,+10%,-10%,50V-DC,0603,X7R,-55DEG CMIN,125DEG CMAX"
C8	2113945G92	"CAP,FXD,.12UF,+10%,-10%,50V-DC,0805,X7R,-55DEG CMIN,125DEG CMAX"
C9	2113944C45	CAP CER CHP 100.0PF 50V 5%
D1	4813978M15	"DIODE,RECT,RM140,SM,1A,40V,SHTK,PB-FREE"
D201	48009400001	SCHOTTKY BARRIER RECTIFIER DIODE
D202	48009400001	SCHOTTKY BARRIER RECTIFIER DIODE
D203	4813978M15	"DIODE,RECT,RM140,SM,1A,40V,SHTK,PB-FREE"
D204	4813978M15	"DIODE,RECT,RM140,SM,1A,40V,SHTK,PB-FREE"
D3	4813978M15	"DIODE,RECT,RM140,SM,1A,40V,SHTK,PB-FREE"
D301	4813978M15	"DIODE,RECT,RM140,SM,1A,40V,SHTK,PB-FREE"
D302	48009402001	DIODE TRANSIENT SUPPRESSOR

Ref Des.	Part Number	Description
D4	4813979B23	"DIODE ARRAY,SUPR,SM,TSOP6,200MA,70V,8,PB-FREE"
D5	4805129M90	DIODE SOT PKGD
D6	4805129M90	DIODE SOT PKGD
J1	09009454001	"RECEPTACLE, FUSE"
J2	09009454001	"RECEPTACLE, FUSE"
L1	2471048Y03	"IDCTR,PWR,10UH,10%,6A,.015OHM,24MHZ SRF,SM,PB-FREE"
L201	24009338001	POWER-CHOKE WE-HCB (FERRITE)
L203	2471048Y03	"IDCTR,PWR,10UH,10%,6A,.015OHM,24MHZ SRF,SM,PB-FREE"
P1	0980423L10	"CONNECTOR, 20 PIN, RECEPTACLE"
P3	09009451001	"CONNECTOR, POWER 2 PIN"
P4	09009310001	SMT 10 PIN CONNEC-TOR
P5	09009450001	"CONNECTOR, POWER 4 PIN"
P6	09009453001	"CONNECTOR, 2 PIN FASTON"
PCB	84009542001	"PWB, POWER DISTRI-BUTION"
Q2	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q201	48009390001	N-CHANNEL MOSFET
Q202	48009390001	N-CHANNEL MOSFET
Q203	48009399001	N-CHANNEL POWER MOSFET TRANS
Q204	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G

Ref Des.	Part Number	Description
Q205	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q206	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q207	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q208	4813973A81	"XSTR,BIP GP SS,DIG,NPN AND PNP,SOT-363,50V,.25W,100MA,PB-FR"
Q3	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q301	48009378001	OPTIMOS 3 POWER-TRANSISTOR BSC047N08NS3 G
Q4	48012009001	DUAL N-CHANNEL POWER MOSFET
Q5	48012009001	DUAL N-CHANNEL POWER MOSFET
Q6	48012009001	DUAL N-CHANNEL POWER MOSFET
Q7	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
Q8	48009379001	OPTIMOS 3 POWER-TRANSISTOR BSC060P03NS3E G
R1	0613952M09	CER CHIP RES 1210 OHM 1% 0402
R10	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R11	0613952H49	CER CHIP RES 100 OHM 5% 0603
R12	0613952F44	CER CHIP RES 280K OHM 1 0603

Ref Des.	Part Number	Description
R13	0613952E68	CER CHIP RES 49.9K OHM 1 0603
R14	0613952H49	CER CHIP RES 100 OHM 5% 0603
R15	0613952H41	CER CHIP RES 47.0 OHM 5 0603
R16	0613952J05	CER CHIP RES 15K OHM 5% 0603
R17	0613952J05	CER CHIP RES 15K OHM 5% 0603
R18	0613952J05	CER CHIP RES 15K OHM 5% 0603
R19	0689610V01	"RES,MF,.025OHM,1%,.5W,SM,1206,PB-FREE"
R2	0613952N11	CER CHIP RES 12.7K OHM 1 0402
R20	0613952J86	"RES,MF,33KOHM,1%,.1W,SM,0603,200PPM/CEL,PB-FREE"
R201	0613952F39	CER CHIP RES 249K OHM 1 0603
R202	0613952N52	CER CHIP RES 34.0K OHM 1 0402
R203	0613952P59	CER CHIP RES 402K OHM 1 0402
R204	0613952N52	CER CHIP RES 34.0K OHM 1 0402
R205	0613952V67	CER CHIP RES 48.7K OHM 1 0201
R206	0613952J05	CER CHIP RES 15K OHM 5% 0603
R207	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R208	0613952D21	CER CHIP RES 1620 OHM 1% 0603
R209	0613952E01	CER CHIP RES 10.0K OHM 1% 0603

Ref Des.	Part Number	Description
R21	0613952D06	CER CHIP RES 1130 OHM 1 0603
R210	0613952D79	CER CHIP RES 6490 OHM 1 0603
R211	0613952E01	CER CHIP RES 10.0K OHM 1% 0603
R212	0613952A66	CER CHIP RES 4.75 OHM 1% 0603
R213	0613952E48	CER CHIP RES 30.9K OHM 1% 0603
R214	0613952B68	CER CHIP RES 49.9 OHM 1% 0603
R215	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R216	0613952Z48	"RES,MF,4.7KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE"
R217	0613952D21	CER CHIP RES 1620 OHM 1% 0603
R218	0613952F26	CER CHIP RES 182K OHM 1% 0603`
R219	0613952A66	CER CHIP RES 4.75 OHM 1% 0603
R22	0613952E72	CER CHIP RES 54.9K OHM 1 0603
R220	0613952D65	CER CHIP RES 4640 OHM 1 0603
R221	0613952E80	CER CHIP RES 66.5K OHM 1 0603
R222	0613952B68	CER CHIP RES 49.9 OHM 1% 0603
R223	0613952D38	CER CHIP RES 2430 OHM 1% 0603
R224	0613952D01	CER CHIP RES 1000 OHM 1% 0603
R225	0689877V11	"RES,MF,.01OHM,1%,2W,SM,2512,150PPM/CEL,PB-FREE"

Ref Des.	Part Number	Description
R226	0613952A01	CER CHIP RES 1.00 OHM 1% 0603
R227	0613952Q49	CER CHIP RES 100 OHM 5 0402
R228	0613952C86	CER CHIP RES 768 OHM 1 0603
R229	0613952E01	CER CHIP RES 10.0K OHM 1% 0603
R23	0613952J12	CER CHIP RES 30K OHM 5 0603
R232	0689877V09	"RES,MF,.007OHM,1%,SM,2512,75PPM/CEL,PB-FREE"
R233	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R234	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R235	0613952J25	CER CHIP RES 100K OHM 5% 0603
R236	0613952J05	CER CHIP RES 15K OHM 5% 0603
R237	0613952J19	CER CHIP RES 56K OHM 5% 0603
R238	0689877V09	"RES,MF,.007OHM,1%,SM,2512,75PPM/CEL,PB-FREE"
R239	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R24	0613952D06	CER CHIP RES 1130 OHM 1 0603
R240	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R241	0613952E01	CER CHIP RES 10.0K OHM 1% 0603
R242	0613952Q41	CER CHIP RES 47.0 OHM 5 0402
R243	0613952Q41	CER CHIP RES 47.0 OHM 5 0402

Ref Des.	Part Number	Description
R25	0613952E72	CER CHIP RES 54.9K OHM 1 0603
R26	0613952J12	CER CHIP RES 30K OHM 5 0603
R27	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R28	0613952H65	CER CHIP RES 470 OHM 5% 0603
R29	0613952D01	CER CHIP RES 1000 OHM 1% 0603
R301	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R302	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R303	0613952E01	CER CHIP RES 10.0K OHM 1% 0603
R304	0613952E01	CER CHIP RES 10.0K OHM 1% 0603
R305	0613952F73	CER CHIP RES 562K OHM 1 0603
R306	0613952Z59	"RES,MF,24KOHM,1%,.0625W,SM,0402,200PPM/CEL,PB-FREE"
R4	0613952R18	CER CHIP RES 51K OHM 5 0402
R5	0613952M68	CER CHIP RES 4990 OHM 1 0402
R6	0689877V11	"RES,MF,.01OHM,1%,2W,SM,2512,150PPM/CEL,PB-FREE"
R7	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
R8	0613952Q85	CER CHIP RES 3300 OHM 5 0402
R9	0613952J86	"RES,MF,33KOHM,1%,.1W,SM,0603,200PPM/CEL,PB-FREE"
SC201	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM

Ref Des.	Part Number	Description
SC202	0613952G67	CER CHIP RES 0.0 +/- 0.050 OHM
U1	51009828001	DUAL SMART BATTERY CONROLLER IC
U201	51009766001	4.5-V TO 60-V WIDE-INPUT SYNCHRONOUS PWM BUCK CONTROLLER
U202	5171774H01	ADJUSTABLE VOLTAGE REGULATOR
U203	51010228001	BOOST SWG VOLT REG CTRL 700MV
U205	51009765001	"36V, LOW LOSS DUAL POWERPATH CONTROLLERS FOR LARGE PFETS"
U301	5171775H01	OVERVOLTAGE PROTECTION SWITCH
VR1	4813977A43	"PB-FREE, NOTCOMPLETELYENRICHED"
VR2	4813977A48	"DIODE ARRAY,SUPR,SM,SOT-23,17V,.225W,ZEN,2,PB-FREE"
VR202	48012095001	SMALL SIGNAL ZENER DIODE
VR203	48012095001	SMALL SIGNAL ZENER DIODE
VR3	4813977A48	"DIODE ARRAY,SUPR,SM,SOT-23,17V,.225W,ZEN,2,PB-FREE"
VR301	4813977A44	"DIODE ARRAY,TRNSNT PROT,MMBZ15V,SM,SOT-23,15V,.225W,ZEN,2,PB-FR"

Ref Des.	Part Number	Description
VR4	4813977A48	"DIODE ARRAY,SUPR,SM,SOT-23,17V,.225W,ZEN,2,PB-FREE"
VR5	4813977A50	"DIODE ARRAY,TRN-SNT PROT,BZ33,SM,SOT-23,33V,.225W,ZEN,2,PB-FREE"

SECTION 9 SERVICING AND PARTS ORDERING

9.1 Motorola Service Centers

9.1.1 Servicing Information

If a unit requires further complete testing, knowledge and/or details of component level troubleshooting or service than is customarily performed at the basic level, please send the product to a Motorola Service Center as listed below.

9.1.2 Motorola Service Center

Motorola Repair
2214 Galvin Drive
Elgin, IL 60123
Tel: 1-800-221-7144

9.1.3 Motorola Federal Technical Center

10105 Senate Drive
Lanham, MD 20706
Tel: 1-800-969-6680
Fax: 1-800-784-4133

9.2 Replacement Parts Ordering

9.2.1 Basic Ordering Information

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.

9.2.2 Motorola Online

Motorola Online users can access our online catalog at
http://motorolasolutions.com/businessonline

To register for online access, please call 1-800-422-4210 (for U.S. and Canada Service Centers only). International customers can obtain assistance at **http://motorolasolutions.com/businessonline**

9.2.3 Mail Orders

Mail orders are only accepted by the US Federal Government Markets Division (USFGMD).

Motorola
7031 Columbia Gateway Drive
3rd Floor - Order Processing
Columbia, MD 21046
U.S.A.

9.2.4 Telephone Orders

Radio Products and Solutions Organization*
(United States and Canada)
7:00 AM to 7:00 PM (Central Standard Time)
Monday through Friday (Chicago, U.S.A.)
1-800-422-4210
1-847-538-8023 (United States and Canada)

U.S. Federal Government Markets Division (USFGMD)
1-877-873-4668
8:30 AM to 5:00 PM (Eastern Standard Time)

9.2.5 Fax Orders

Radio Products and Solutions Organization*
(United States and Canada)
1-800-622-6210
1-847-576-3023 (United States and Canada)

USFGMD
(Federal Government Orders)
1-800-526-8641 (For Parts and Equipment Purchase Orders)

9.2.6 Parts Identification

Radio Products and Solutions Organization*
(United States and Canada)
1-800-422-4210

9.2.7 Product Customer Service

Radio Products and Solutions Organization (United States and Canada)
1-800-927-2744

* The Radio Products and Solutions Organization (RPSO) was formerly known as the Radio Products Services Division (RPSD) and/or the Accessories and Aftermarket Division (AAD).

APPENDIX A FNE-Hub Cables

A.1 Cable 1: Astrotac (External Clock) to HSAA Cable

NOTE: Sync RJ45 to RJ45 cable.

Astrotac V.24 Board SW 101 & 102:

1-On, 2-Off, 3-Off, 4-Off

Link Type:

V.24 External Clock

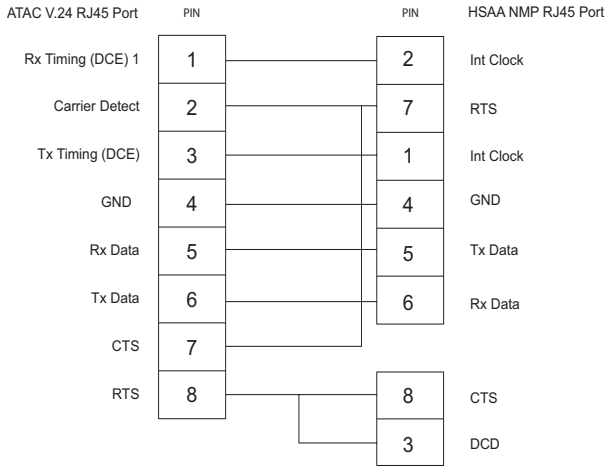


Figure A-1 Astrotac (External Clock) to HSAA Cable Diagram

A.2 Cable 2: HSAA to 326x Modem Cable

NOTE: Async RJ45 to DB25.

For this cable, connect modem signal GND (7) to chasis, to ensure it's grounded, as HSAA requires its GND (4) pin to be grounded properly, in order for it to transmit data.

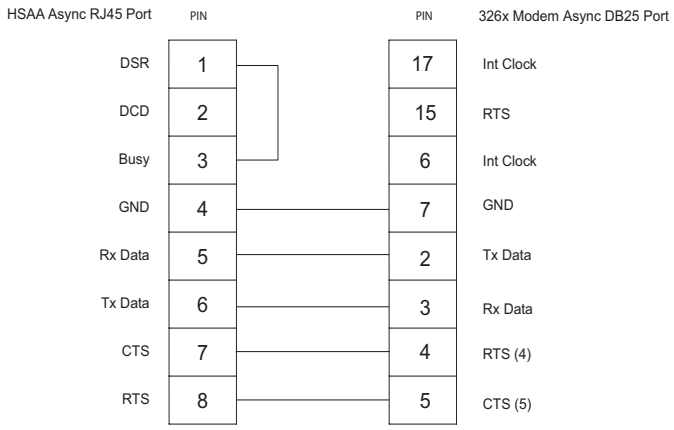


Figure A-2 HSAA To 326x Modem Cable Diagram

A.3 Cable 3: HSAA to TXM 2000

NOTE: Async RJ45 to DB25.
This is applicable, when TXM 2000 bypasses a modem, and connects directly to HSAA.

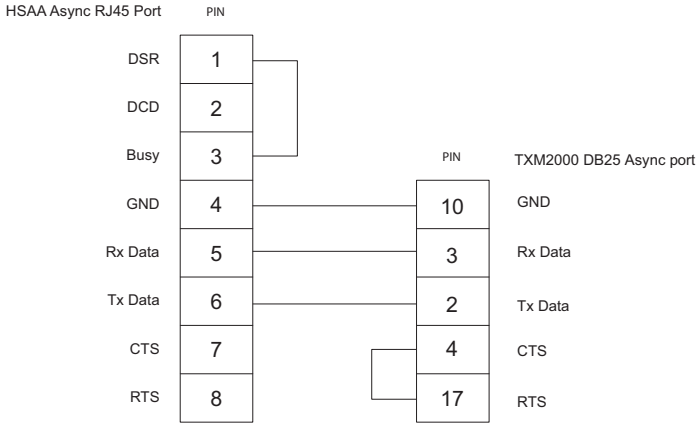


Figure A-3 HSAA to TXM 2000 Cable Diagram

APPENDIX B HIDEX Modem Setup Instructions

1. Connect modem to its power supply, and ensure it powers up.
2. Connect a DB25 to DB9 RS232 cable between a PC and the Hidex modem, to configure the Hidex modem.
3. Using a terminal emulator program such as hyperterminal, configure the PC baud rate to **19200 bps**.

NOTE: This is an important step. If a different baud rate is used, then the modem will perform an auto-baud detect and configure its DTE to DCE rate to that value. This would cause problem establishing a V.24 link with TXM 2000.

4. Send the following AT commands to configure the Hidex modem for Answer mode. The &W command is to save the settings.
5. Remove the modem programming cable.
6. When the TXM 2000 unit is powered off, and not connected to its power supply, connect the modem to TXM 2000 unit using the DB25-DB25 cable supplied with the modem. Be sure to connect the correct end of the cable to radio vs. the modem per marking on cable.

NOTE: The side with several pins removed, goes to the radio end.

Caution

Failure to follow this caution, may result in equipment damage or improper operation.
Prior to connecting the modem, ensure the TXM 2000 unit is powered off, by rotating the power knob until it is turned off, and disconnecting the AC to DC adaptor. Once power is turned off, connect the modem. Power can then be supplied to the unit.

7. Power on the TXM 2000 radio. The Hidex modem should be ready to receive a call from the remote modem.
8. Once a modem connection with the Astrotac on the infrastructure end is established, the v24 icon on TXM 2000 Control Head should go solid, and the Link Status LED on TXM 2000 chassis will also display solid green, indicating a v24 link has been established between TXM 2000 and Astrotac.

B.1 Modem AT command configuration (ANSWER mode)

Table B.1 Modem AT command configuration

Modem AT command configuration (ANSWER mode)	
AT&F&W	Set factory defaults
AT+MS=V34,0,0,19200,0,19200	Set modem mode and dialup line baud rates
AT&W	Save settings to modem
AT&D0	Set modem to Ignore DTR signal. A call will continue regardless of the DTR line
AT+IPR=19200	Set DTE to DCE baud rate
AT$SB19200	Set serial baud rate
ATS0=1	Answer in one ring
AT%DC1&W	Disable AT command modem and save settings

APPENDIX C HSAA (Internal Clock) HDLC Converter Box Configuration, For Use With Astrotac (External Clock)

NOTE: In this configuration, we setup HSAA for Internal Clock, and Astrotac for External Clock.

1. Power on the HSAA.
2. Press the SETUP button, and ensure "PORT1 SETUP LED" is active. This configures HSAA for Internal Clock.
3. Connect the Green Ethernet cable to (PC Direct) RJ45, and then to DB9 serial adapter. This is the configuration cable.
4. Connect RJ45 end to the **SYNC port** on HSAA. When the SETUP button is pressed on HSAA (PORT 1 SETUP LED active), the NMP and SYNC ports are reversed. Thus, the HSAA configuration has to occur through the SYNC port.
5. Connect the other end to DB9 Serial COM port to PC.
6. Use a terminal emulator tool such as Hyperterminal on PC, to open the serial port, where the HSAA is connected. For example, COM1. Set the baud rate on PC port to 9600 bps, to communicate with HSAA SYNC port for configuration.
7. Please refer to the commands on HSAA manual, that can be used to configure the HSAA. Type "Help", and hit “Enter” can also display the supported commands.
8. Input "**CP**" command, and hit enter to change the configuration port.
9. At the "**New ASYNC RATE**" prompt, input "**19200**", and hit Enter.
10. At the "**New Encoding**" prompt, hit **Enter**, and it will keep the default of NRZ for SYNC Encoding.
11. At the "**New SYNC Clock**" prompt, input "**9600**", and hit Enter.
12. Finally when the configuration is complete, the configuration cable can be disconnected.

NOTE: During setup, when it is ready to connect HSAA with the FNE/HUB equipment, please ensure:

- The modem is connected to HSAA ASYNC RJ45 port.
- The Astrotac is connected to HSAA NMP RJ45 port.

Notes

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