



**MOTOROLA**

**MTM800  
with Enhanced Control Head**

**TETRA Mobile Terminal  
450-470 MHz (MT512M)**

Part Number: 6866539D31-A



# COPYRIGHT

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# DOCUMENT HISTORY

The following major changes have been implemented in this manual since the previous edition:

<b>Edition</b>	<b>Description</b>	<b>Date</b>
6866539D31_A	Initial edition	Mar. 2007

## Notes

# PRODUCT SAFETY and RF Energy Exposure for Mobile Two-Way Radios installed in Vehicles or as Fixed Site Control Stations



Caution

**THIS CHAPTER IS AN EXTRACT OF THE MULTI LINGUAL MOBILE SAFETY BOOKLET PUBLICATION No. 6866537D37\_.**  
**FOR THE LATEST SAFETY INFORMATION REFER TO THE SEPARATE SAFETY BOOKLET DELIVERED WITH YOUR RADIO.**

**BEFORE USING THIS RADIO READ THIS INFORMATION WHICH CONTAINS IMPORTANT OPERATING INSTRUCTIONS FOR SAFE USAGE AND RF ENERGY AWARENESS AND CONTROL INFORMATION FOR COMPLIANCE WITH RF ENERGY EXPOSURE LIMITS IN APPLICABLE NATIONAL AND INTERNATIONAL STANDARDS.**

The information provided in this document supersedes information contained in user guides, manuals and other documentation published prior to **February 2002**.

## RF Energy Exposure Awareness and Control Information, and Operational Instructions for FCC Occupational Use Requirements.

**Note:** This radio is intended for use in occupational / controlled conditions, where users have full knowledge of their exposure and can exercise control over their exposure to meet FCC/ICNIRP limits. This radio device is NOT authorized for general population, consumer or any other use.

This 2-way radio uses electromagnetic energy in the radio frequency (RF) spectrum to provide communications between two or more users over a distance. It uses radio frequency (RF) energy or radio waves to send and receive calls. RF energy is one form of electromagnetic energy. Other forms include, but are not limited to, sunlight and x-rays. RF energy, however, should not be confused with these other forms of electromagnetic energy, which when used improperly, can cause biological damage. Very high levels of x-rays, for example, can damage tissues and genetic material.

Experts in science, engineering, medicine, health and industry work with organizations to develop standards for safe exposure to RF energy. These standards provide recommended levels of RF exposure for both workers and the general public. These recommended RF exposure levels include substantial margins of protection.

All Motorola 2-way radios are designed, manufactured and tested to ensure they meet government-established RF exposure levels. In addition, manufacturers also recommend specific operating instructions to users of 2-way radios. These instructions are important because they inform users about RF energy exposure and provide simple procedures on how to control it.

Please refer to the following Web sites for more information on what RF energy exposure is and how to control your exposure to assure compliance with established RF exposure limits.

<http://www.fcc.gov/oet/rfsafety/rf-faqs.html>

<http://www.osha.gov/SLTC/radiofrequencyradiation/index.html>

## Federal Communications Commission Regulations (US markets only)

The FCC rules require manufacturers to comply with the FCC RF energy exposure limits for mobile 2-way radios before they can be marketed in the U.S. When 2-way radios are used as a consequence of employment, the FCC requires users to be fully aware of and able to control their exposure to meet occupational requirements. Exposure awareness can be facilitated by the use of a label directing users to specific user awareness information. Your Motorola 2-way radio has an RF exposure product label. Do not remove this RF exposure label from the device. Also, your Motorola user manual, or separate safety booklet, includes information and operating instructions required to control your RF exposure and to satisfy compliance requirements.

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## Compliance with RF Exposure Standard

Your Motorola radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. **This radio complies with IEEE and ICNIRP exposure limits for occupational/controlled RF** exposure environments at duty factors of up to 50% talk–50% listen and is authorized by the IEEE/ICNIRP for occupational use. In terms of measuring RF energy for compliance with these exposure guidelines, your radio antenna radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode.

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## Your Motorola two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47 CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 2003
- ANATEL, Brasil Regulatory Authority, Resolution 256 (April 11, 2001) “additional requirements for SMR, cellular and PCS product certification.”

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## RF Exposure Compliance and Control Guidelines and Operating Instructions

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

**Guidelines:**

- User awareness instructions should accompany device when transferred to other users.
- Do not use this device if the operational requirements described herein are not met.

**Instructions:**

- **Transmit no more than the rated duty factor of 50% of the time.** To transmit (talk), push the Push-To-Talk (PTT) button. To receive calls, release the PTT button. 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 standards compliance).
- **Transmit only when people outside the vehicle are at least the recommended minimum lateral distance away, as shown in Table 1, from the body of a vehicle with a properly installed antenna.** This separation distance will ensure that there is sufficient distance from a properly installed (according to installation instructions) externally-mounted antenna to satisfy the RF exposure requirements in the standards listed above.

**Note:** Table 1 lists the recommended lateral distance for bystanders in an uncontrolled environment from the body of a vehicle with an approved, properly installed transmitting antenna (i.e. monopoles over a ground plane, or dipoles) at several different ranges of rated radio power for mobile radios installed in a vehicle.

**Table 1**

<b>Mobile Radio Rated Power (see Note below)</b>	<b>Minimum Lateral Distance From Vehicle Body</b>
Less than 7 Watts	20 cm (8 Inches)
7 to 15 Watts	30 cm (1 Ft)
16 to 39 Watts	60 cm (2 Ft)
40 to 110 Watts	90 cm (3 Ft)

**Note:** If you are not sure of the rated power of your radio, contact your Motorola representative or dealer and supply the radio model number found on the radio model label. If you cannot determine the rated power out, then assure 90cms (3 feet) separation from the body of the vehicle.

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## Mobile Antenna Installation Guidelines

- These mobile antenna installation guidelines are limited to metal body motor vehicles or vehicles with appropriate ground planes.
- Antennas should be installed in the centre area of the roof or the trunk lid taking into account the bystander exposure conditions of backseat passengers and according to the specific instructions and restrictions in the Radio. Installation Manual along with the requirements of the antenna supplier.
- Trunk lid installations are limited to vehicles with clearly defined flat trunk lids, and in some cases, to specific radio models and antennas. See the Radio Installation Manual for specific information on how and where to install specific types of approved antennas to facilitate recommended operating distances to all potentially exposed persons.

- **Use only Motorola-approved supplied antenna or a Motorola approved replacement antenna.** Unauthorized antennas, modifications, or attachments could damage the radio and may result in non-compliance with RF Safety Standards.

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## Approved Accessories

- This radio has been tested and meets the RF Safety Standards when used with the Motorola accessories supplied or designated for this product. Use of other accessories may result in non-compliance with RF Safety Standards.
- For a list of Motorola approved antennas, please see your dealer or local Motorola contact. Your nearest dealer can be found at the following web site:

<http://www.motorola.com/businessandgovernment/wemea/en-gb/public/functions/dealerlocator/dealerlocator.aspx>

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## Additional Information

- For additional information on exposure requirements or other training information, visit

<http://www.motorola.com/rfhealth>

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## Compliance and Control Guidelines and Operating Instructions for Mobile Two-Way Radios Installed as Fixed Site Control Stations

If mobile radio equipment is installed at a fixed location and operated as a control station or as a fixed unit, the antenna installation must comply with the following requirements in order to ensure optimal performance and compliance with the RF energy exposure limits in the standards and guidelines listed on previous page:

- The antenna should be mounted outside the building on the roof or a tower if at all possible.
- As with all fixed site antenna installations, it is the responsibility of the licensee to manage the site in accordance with applicable regulatory requirements and may require additional compliance actions such as site survey measurements, signage, and site access restrictions in order to insure that exposure limits are not exceeded.

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## Electromagnetic Interference/Compatibility

**Note:** Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed or otherwise configured for electromagnetic compatibility. It may be necessary to conduct compatibility testing to determine if any electronic equipment used in or around vehicles or near fixed site antenna is sensitive to external RF energy or if any procedures need to be followed to eliminate or mitigate the potential for interaction between the radio transmitter and the equipment or device.



## Facilities

To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

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## Vehicles

To avoid possible interaction between the radio transmitter and any vehicle electronic control modules, such as, ABS, engine, or transmission controls, the radio should be installed only by an experienced installer and that the following precautions be used when installing the radio:

1. Refer to the manufacturer's instructions or other technical bulletins for recommendations on radio installation.
  2. Before installing the radio, determine the location of the electronic control modules and their harnesses in the vehicle.
  3. Route all radio wiring, including the antenna transmission line, as far away as possible from the electronic control units and associated wiring.
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## Driver Safety

Check the laws and regulations on the use of radios in the area where you drive. Always obey them. **When using your radio while driving, please:**

- Give full attention to driving and to the road.
- Pull off the road and park before making or answering a call if driving conditions so require.



## OPERATIONAL WARNINGS

### WARNING

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#### For Vehicles With Air Bags

Do not mount or place a mobile radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.

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#### Potentially Explosive Atmospheres

Turn off your radio prior to entering any area with a potentially explosive atmosphere. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

The areas with potentially explosive atmospheres referred to above include fuelling areas such as below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles, such as grain, dust or metal powders. Areas with potentially explosive atmospheres are often but not always posted.

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#### Blasting Caps And Blasting Areas

To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted:

"Turn off two-way radio". Obey all signs and instructions.

For radios installed in vehicles fueled by liquefied petroleum gas, refer to the (U.S.) National Fire Protection Association standard, NFPA 58, for storage, handling, and/or container information. For a copy of the LP-gas standard, NFPA 58, contact the National Fire Protection Association, One Battery Park, Quincy, MA.

**Caution****ADDITIONAL IMPORTANT INFORMATION  
FOR SERVICING AND INSTALLING THE RADIO**

Only specialized workshops should be contacted for installation, maintenance and repair work.

This unit is equipped with protection fuses in the Power and Ignition Sense Cable.  
Replace these fuses only with the original ratings!

**Caution: Failure to use correct manufactures approved parts  
may result in physical damage to this unit.**

Fuse for Power Cable GKN6270/GKN6274: 10A (Motorola Part Number: 65C80283E05)  
Fuse for Ignition Sense Cable HKN9327: 4A (Motorola Part Number: 65C80283E02)

**Achtung****ZUSÄTZLICHE SICHERHEITS INFORMATIONEN  
FÜR SERVICE UND INSTALLATION DES FUNKGERÄTES**

Installations, Wartungs- und Reparaturarbeiten dürfen ausschließlich von autorisiertem und geschultem Personal ausgeführt werden.

Dieses Gerät ist mit einer Schutzsicherung im Stromversorgungskabel ausgestattet.  
Bei Austausch ausschließlich den Originalwert verwenden

**WARNUNG: Bei Einsetzen von nicht vom Hersteller freigegebenen Ersatzteilen  
kann das Gerät zerstört werden.**

Sicherung für Stromversorgungskabel GKN6270/GKN6274: 10A (Motorola Best.-Nr.:65C80283E05)  
Sicherung für Zündungserkennungskabel HKN9327: 4A (Motorola Best.-Nr.:65C80283E02)

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## Notes

# CHAPTER 1

## SCOPE & WARRANTY INFORMATION

### SCOPE OF THIS MANUAL

This manual is intended for use by trained service technicians familiar with similar types of equipment only. It contains information required for the installation of the equipment described and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete Manual revision or alternatively as additions.

**NOTE** Before planning or starting the installation, please read the Safety Information Section in the front of this manual.

This manual is divided into the following sections:

- Copyright
- Document History
- User Safety, Training and General Information
- CHAPTER 1 Scope & Warranty Information
- CHAPTER 2 Model Information & Accessories
- CHAPTER 3 Overview
- CHAPTER 4 Theory of Operation
- CHAPTER 5 Programming
- CHAPTER 6 Test Setup & Testing
- CHAPTER 7 Maintenance
- CHAPTER 8 Schematic Diagrams, PCBs and Parts Lists
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- Appendix B Replacement Parts and Kits
- Appendix C Retrofitting the GPS and UCM board
- Appendix D Product Specific Information

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## EMEA Manuals & User Guides

### Product Information Manual

6866537D87 MTM800/MTM800 ENH Product Information (and programming) Manual

### Installation Instructions

6866539D30 MTM800 With Enhanced Control Head Installation Manual (English)

### Service Manuals

6866539D29 MTM800 With Enhanced Control Head 380-430MHz Detailed Service Manual (English)

6866539D31 MTM800 With Enhanced Control Head 410-470MHz Detailed Service Manual (English)

6866539D32 MTM800 With Enhanced Control Head 806-870MHz Detailed Service Manual (English)

6866539D28 MTM800 With Enhanced Control Head Basic Service Manual (English)

### User Guides

6866539D24 MTM800 With Enhanced Control Head Basic User Guide (EN / DE / FR / ES / NL / AR)

6866539D34 MTM800 With Enhanced Control Head Basic User Guide (EN / RU / IT / PL)

6866539D35 MTM800 With Enhanced Control Head Basic User Guide (EN / SV / PT Braz / NO / DK)

6866539D25 MTM800 With Enhanced Control Head Feature User Guide (English) only available on MOL: (<https://emeaonline.motorola.com>)

### Safety Leaflets

6864117B25 Mobile Safety Leaflet (EMEA) or

6866537D37 Mobile Safety Leaflet (EMEA) especially for TETRA Mobiles

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## LACR Manuals & User Guides

### Product Information Manual

6866537D87 MTM800/MTM800 ENH Product Information (and programming) Manual

### Installation Instructions

6866539D30 MTM800 With Enhanced Control Head Installation Manual (English)

### Service Manuals

6866539D29 MTM800 With Enhanced Control Head 380-430MHz Detailed Service Manual (English)

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6866539D35 MTM800 With Enhanced Control Head Basic User Guide (EN / SV / PT Braz / NO / DK)

6866539D25 MTM800 With Enhanced Control Head Feature User Guide (English) only available on MOL: (<https://emeaonline.motorola.com>)

### CPS Start Up Manual

6802974C10 MTM800 CPS Start Up Manual (English, Spanish, Portuguese)

### CD ROM

9964416H09 MTM800 Documentation CD  
(includes 6881097C65, 6881097C66, 6881097C67 and 6881097C68)

### Safety Leaflets

6804112J96 Mobile Safety Leaflet (APAC & LACR) or

6804113J25 Mobile Safety Leaflet (APAC & LACR) especially for TETRA Mobiles

## Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/ repair or spare parts support out of warranty. **Warranty Period and Return Instructions**

The terms and conditions of warranty are defined fully in the Motorola Dealer or Distributor or Reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only. In instances where the product is covered under a "return for replacement" or "return for repair" warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any terminal back to the appropriate Motorola warranty depot, please contact Customer Resources or your Motorola dealer, distributor or reseller. All returns must be accompanied by a Warranty Claim Form, available from your Customer Service representative or Motorola Online Extranet (MOL) or your Motorola dealer, distributor or reseller (refer to list in Appendix A). Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

### After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways.

- Motorola's Regional Radio Support Centres offer a repair service to both end users and dealers at competitive prices.
- AAD supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.



# CHAPTER 2

## MODEL INFORMATION & ACCESSORIES

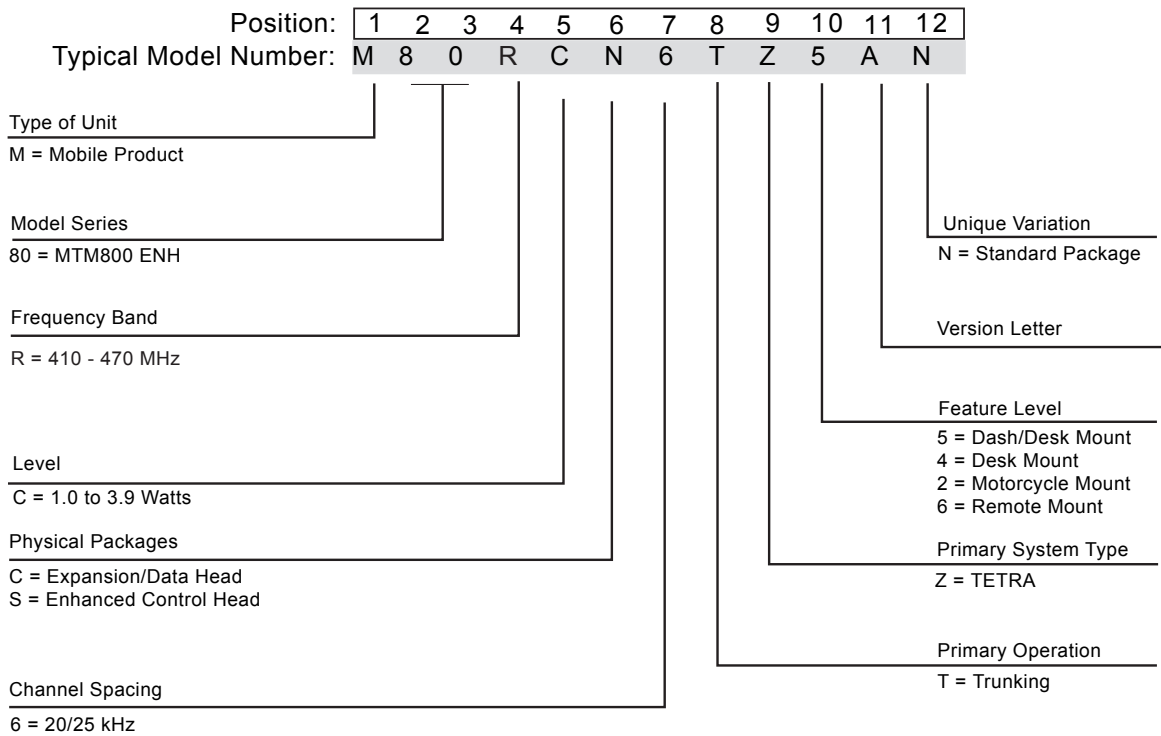
### MTM800 Mobile Terminal Model Information

This manual applies to the following Mobile Terminal Models

Type No.	Sales Model No.	Short Description	Model
MT512M	M80RCS6TZ5AN	MTM800 ENH 410-470 Dash	M1
MT512M	M80RCS6TZ4AN	MTM800 ENH 410-470 Desk	M2
MT512M	M80RCS6TZ6AN	MTM800 ENH 410-470 Remote	M3
MT512M	M80RCS6TZ2AN	MTM800 ENH 410-470 M'cycle	M4
MT512M	M80RCC6TZ5AN	MTM800 ENH 410-470 Exp/ Data	M5

Note: For identification of service tanapa numbers please refer to appendix B "REPLACEMENT PARTS & KITS".

### Sales Model Nomenclature



## Model Specifications\*

GENERAL		RECEIVER		TRANSMITTER	
<b>ETSI:</b>	ETS 300 394-1	<b>Receiver Type:</b>	Superheterodyne	<b>Modulation Type:</b>	$\pi/4$ DQPSK
<b>Type Number:</b>		<b>Frequency Range:</b>		<b>RF Power:</b>	
MTM800 ENH 410-470 MHz	MT512M	MTM800 ENH	410-470 MHz	TMO	3,16 W / 35 dBm
				DMO	3,16 W / 35 dBm
<b>Temperature Range for Transceiver:</b>		<b>Channel Spacing:</b>	25 kHz	<b>Frequency Range TMO:</b>	
Operating	-30°C to +60°C	<b>Sensitivity (3.5%) BER:</b>	-112 dBm	MTM800 ENH	410-470 MHz
Storage:	-40°C to +85°C	<b>Intermodulation:</b>	-47 dBm	<b>Frequency Range DMO:</b>	
<b>Power Supply:</b>		<b>Blocking (50-100 kHz):</b>	-40 dBm	MTM800 ENH	410-470 MHz
Minimum:	10.8 Vdc	<b>Spurious Rejection:</b>	-45 dBm	<b>Frequency Stability:</b>	
Nominal:	13.2 Vdc	Adjacent Channel		Locked to Base	+/-100 Hz
Maximum:	15.6 Vdc	Interference Ratio:	-45 dB	Not Locked to Base	+/- 1 kHz
Max. Current	Approx. 3.5 A	<b>Frequency Stability:</b>		<b>Spurious Emissions:</b>	
<b>Dimensions (HxWxD) in mm:</b>		Locked to Base	+/-100 Hz	Conducted/Radiated	- 36 dBm <=1GHz
Transceiver with		Unlocked to Base	+/- 1 kHz		- 30 dBm > 1GHz
Enhanced Control Head,	60 x 185 x 175	<b>Audio Rated (@4 Ohms):</b>		<b>Adjacent Channel Power Ratio (@ ±</b>	
Dash Mount		For External Speaker:	10 W	25kHz)	
<b>Weight in grams:</b>		Distortion at Rated Audio:	5% Max.	350-390 MHz	- 60 dBc
Transceiver with					
Enhanced Control Head,	1430				
Dash Mount					

\*) Technical information may be subject to change without further notice.

## Model Descriptions\*\*

Model	Description
M1	Dash Mount with Mobile Terminal with Direct Mount Enhanced Control Head, Speaker, Microphone or Handset, Standard User Guide, and Installation Accessories.
M2	Desk Mount with Mobile Terminal with Direct Mount Enhanced Control Head, Speaker, Microphone or Handset, Standard User Guide, and Installation Accessories and tray including with power supply
M3	Remote Mount with Mobile Terminal with Remote Mount Enhanced Control head, optional Remote Head Enhanced or Data Expansion Head Enhanced, Speaker, Microphone or Handset, Remote Mount cables, Standard User Guide, and Installation Accessories.
M4	Motorcycle Mount with Mobile Terminal with Motorcycle Mount Enhanced Control head, optional Remote Head Enhanced or Data Expansion Head Enhanced, Speaker, Microphone or Handset, Motorcycle cables, Standard User Guide, and Installation Accessories.
M5	Mobile Terminal with Data Expansion Head Enhanced, and Installation Accessories.

\*\*) Other combinations are not recommend or not possible.

## Accessories-to-Model Chart

ACCESSORIES						
Control Heads	Part Number	M1	M2	M3	M4	M5
Enhanced Control Head, English Keypad	GMWN4298_	X	X			
Enhanced Control Head, Chinese Keypad	GMWN4299_	X	X			
Enhanced Control Head, Korean Keypad	GMWN4300_	X	X			
Enhanced Control Head, Arabic Keypad	GMWN4301_	X	X			
Enhanced Control Head Bopomofu Keypad	GMWN4302_	X	X			
Enhanced Control Head Cyrillic Keypad	GMWN4303_	X	X			
Remote Mount Enhanced Control Head, English Keypad	GMWN4304_			X		
Remote Mount Enhanced Control Head, Chinese Keypad	GMWN4305_			X		
Remote Mount Enhanced Control Head, Korean Keypad	GMWN4306_			X		
Remote Mount Enhanced Control Head, Arabic Keypad	GMWN4307_			X		
Remote Mount Enhanced Control Head, Bopomofu Keypad	GMWN4308_			X		
Remote Mount Enhanced Control Head, Cyrillic Keypad	GMWN4309_			X		
Motorcycle Mount Enhanced Control Head, English Keypad	GMWN4600_				X	
Motorcycle Mount Enhanced Control Head, Chinese Keypad	GMWN4601_				X	
Motorcycle Mount Enhanced Control Head, Korean Keypad	GMWN4602_				X	
Motorcycle Mount Enhanced Control Head, Arabic Keypad	GMWN4603_				X	
Motorcycle Mount Enhanced Control Head, Bopomofu Keypad	GMWN4604_				X	
Motorcycle Mount Enhanced Control Head, Cyrillic Keypad	GMWN4605_				X	
Remote Mount Enhanced Control Head, English Keypad - Hungarian	GMWN4606_			X		
Motorcycle Mount Enhanced Control Head, English Keypad - Hungarian	GMWN4607_				X	
Enhanced Control Head, English Keypad - Hungarian	GMWN4608_	X	X			
Expansion & Remote Head Kits	Part Number	M1	M2	M3	M4	M5
Data Expansion Head Enhanced	PMLN4908_			X	X	
Data Expansion Head	GMCE4053_					X
Remote Head Enhanced	PMLN4904_			X	X	
Microphones	Part Number	M1	M2	M3	M4	M5
Desktop Microphone, Mobile Microphone Port	RMN5106_	X	X	X	X	

ACCESSORIES						
Compact Fist, Mobile Microphone Port	RMN5052_	X	X	X	X	
Heavy Duty Fist Microphone, Mobile Microphone Port	RMN5053_	X	X	X	X	
Fist Microphone, Water Resistant	HMN1089_	X	X	X	X	
Keypad Microphone (Future Release)	HMN4079_	X	X	X	X	
Visor Microphone	GMMN4065_	X	X	X	X	X
<b>Loudspeakers</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Loudspeaker, 13W	GMSN4066_	X	X	X	X	X
Small Loudspeaker, 5W	GMSN4078_	X	X	X	X	X
Loudspeaker Extension Cable	GMKN4084_	X	X	X	X	X
<b>Handset</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Telephone-Style Handset <sup>1</sup>	GMUN1006_	X	X	X	X	
<b>PTT Switches</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
External PTT with Emergency Footswitch	RLN4836_	X	X	X	X	X
Footswitch with Remote PTT	RLN4856_	X	X	X	X	X
Pushbutton with Remote PTT	RLN4857_	X	X	X	X	X
<b>Desktop Mount</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Power Cable (For Supply to Desktop Mobile)	GKN6266_		X			
Desktop Tray without Loudspeaker	GLN7318_		X			
Desktop Tray with Loudspeaker	GLN7326_		X			
Desktop Power Supply	GPN6145_		X			
<b>Power Cable (For Desktop Power Supply GPN6145)</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
US Linecord (3060665A04) Packed	NTN7373_R		X			X
Euro Linecord (3060665A05) Packed	NTN7374_R		X			X
UK Linecord (3002120F02) Packed	NTN7375_R		X			X
Argentina Linecord	NTN9246_		X			X
<b>Cables</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Remote Mount Cable (Terminal to C/H), 3m	RKN4077_			X		
Remote Mount Cable (Terminal to C/H), 5m	RKN4078_			X		
Remote Mount Cable (Terminal to C/H), 7m	RKN4079_			X		
Remote Mount Cable (Terminal to C/H), 10m	PMKN4020_			X		
Accessories Expansion Cable	PMKN4029_			X	X	
Motorcycle Mount TELCO Cable, 2.3m	PMKN4030_				X	
Ferrite Clamp	PMLN5148_			X	X	
<b>Junction Box</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Junction Box	GMLN3002_	X	X	X	X	X
Cable 6m Transceiver to Junction Box	GMKN4192_	X	X	X	X	X

ACCESSORIES						
Cable 4m Transceiver to Junction Box	GMKN4193_	X	X	X	X	X
Cable 2m Transceiver to Junction Box	GMKN4194_	X	X	X	X	X
<b>Power Cables (to Mobile Terminal)</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
12V Power Cable to Battery, 3m with Fuse (10A)	GKN6270_	X		X	X	X
12V Power Cable to Battery, 6m with Fuse (10A)	GKN6274_	X		X	X	X
Ignition Sense Cable, 3m with Fuse (4A)	HKN9327_	X		X	X	X
<b>Installation</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
External Alarm Relay	GKN6272_	X	X	X	X	X
Accessory Connector Kit	GMBN1021_	X	X	X	X	X
Buzzer Kit	GLN7282_	X	X	X	X	X
<b>Mounting (Transceiver)</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Key Lock Mount	RLN4779_	X	X	X	X	X
High Profile Mounting Bracket	GLN7317_	X	X	X	X	X
Low Profile Mounting Bracket	GLN7324_	X	X	X	X	X
Mounting Frame to Install Transceiver in DIN-A Slot	PMLN5094_	X	X	X	X	X
<b>Mounting (Control Head)</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Remote Mount Trunnion Kit	PMLN4912_			X		
Motorcycle Mount Trunnion Kit	PMLN5092_				X	
DIN Mount Bracket	PMLN5093_			X		
<b>Programming/Data</b>	<b>Part Number</b>	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
Programming Cable	GMKN4067_	X	X	X	X	X
Active Data Cable	GMKN1022_	X	X <sup>2</sup>	X	X	X
USB Programming Cable (Mobile Microphone Port)	HKN6184_	X	X	X	X	

1) Requires Junction Box, GMLN3002.

2) The cable, GMKN1022, is only compatible when a Data Expansion Head Enhanced is not fitted as part of a remote mount configuration. In this configuration access to the Tetra PEI for IP Packet Data and SDS services is available on the Data Expansion Head Enhanced and the Active Data Cable GMKN1022 is not required.

## Notes

## CHAPTER 3 OVERVIEW

---

### General

The MTM800 ENH is Motorola's latest and most advanced digital mobile TETRA radio. This radio generation is based on a new digital platform technology which takes care of the linear modulation type of radios to support the TETRA needs. It covers Trunk Mode Operation (TMO) as well as Direct Mode Operation (DMO) and among other new features it is supplied with extended code and operating memory capacity to support all new market requirements. The MTM800 ENH TETRA radio ensures a high audio quality.

To achieve high spectrum efficiency, the MTM800 ENH uses digital modulation technology and sophisticated voice-compression algorithm. The voice of the person speaking into the microphone is converted into a digital bit stream consisting of zeros (0) and ones (1). This stream is then modulated into a radio-frequency (RF) signal, which is transmitted over the air to another MTM800 ENH. The process is called digital modulation.

---

### Digital Modulation Technique

The MTM800 ENH Mobile Terminal can be operated in dispatch mode. It uses two digital technologies:  $\pi/4$  DQPSK and Time Division Multiple Access (TDMA).

$\pi/4$  DQPSK is a modulation technique that transmits information by altering the phase of the radio frequency (RF) signal. Data is converted into complex symbols, which alter the RF signal and transmit the information. When the signal is received, the change in phase is converted back into symbols and then into the original data.

The Tetra system can accommodate 4-voice channels in the standard 25 KHz channel as used in the two-way radio.

Time Division Multiple Access (TDMA) is used to allocate portions of the RF signal by dividing time into four slots, one for each unit.

Time allocation enables each unit to transmit its voice information without interference from other transmitting units. Transmission from a unit or base station is accommodated in time-slot lengths of 15 milliseconds and frame lengths of 60 milliseconds. The TDMA technique requires sophisticated algorithms and a digital signal processor (DSP) to perform voice compression/decompression and RF modulation/demodulation.

### Voice Compression Technology

Voice is converted into a digital bit stream by sampling the voice at high rate and converting the samples into numbers, which are represented by bits.

Voice compression reduces the number of bits per second while maintaining the voice at an acceptable quality level. The Tetra system uses a coding technique called ACELP (Algebraic Code Excited Linear Prediction). The compressed voice-data bits modulate the RF signal.

# Notes



## CHAPTER 4

## THEORY OF OPERATION

---

## Section Introduction

This section provides a block diagram overview of the main Digital/RF Board. This is supplemented by the detailed block diagram and detailed circuit description.

This Chapter contains the following sections:

- 4.1 Transceiver 450-470MHz**
- 4.2 Enhanced Control Heads**

## Notes

## CHAPTER 4.1

## THEORY OF OPERATION (TRANSCEIVER)

## Block Diagram and Overview

The main Digital/RF block contains the following five sections:

- Receiver Section
- Transmitter Section
- Frequency Generating Section (Synthesizer)
- Controller Section
- GPS sub module

An overview and a detailed description of these sections is provided in the following paragraphs.

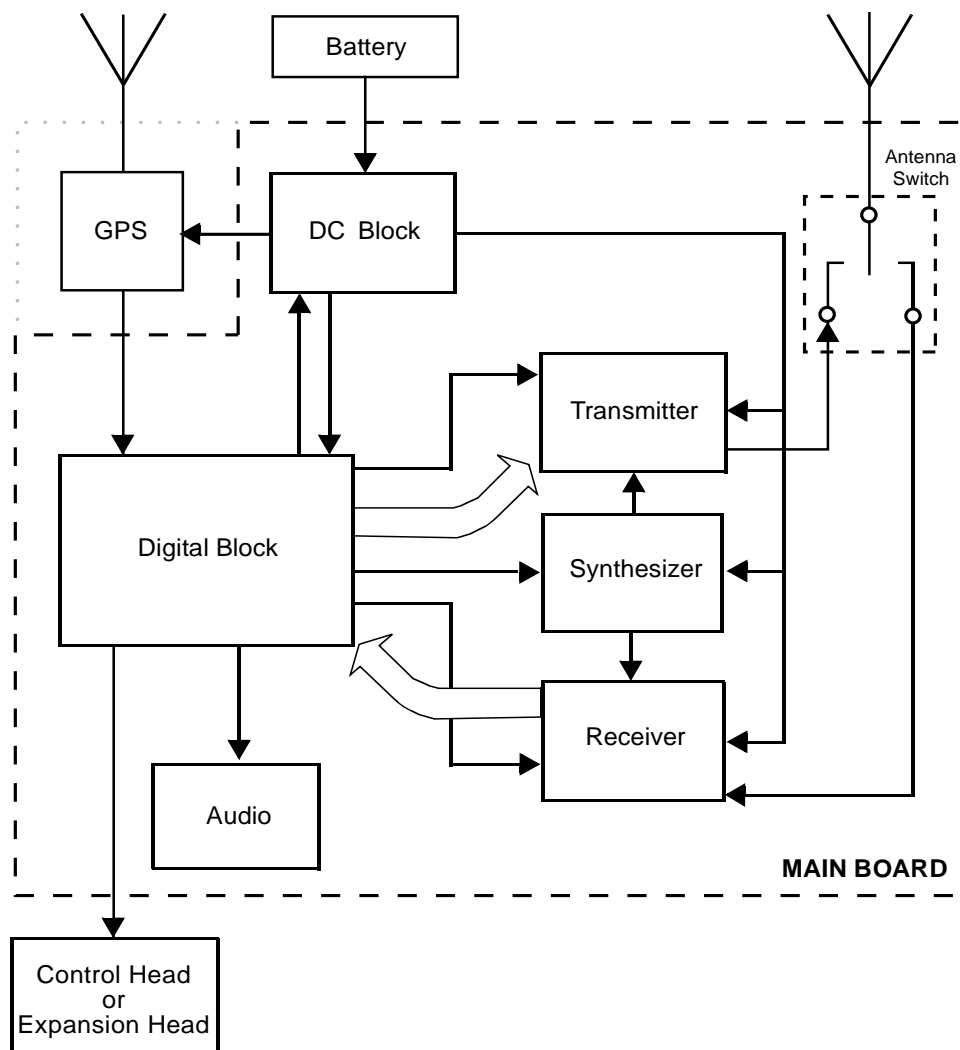


Figure 4.1-1 General Block Diagram

## Receiver Section

The receiver section includes the following main components:

- Antenna Switch
- AGC\_0 Attenuator
- Front End Pre-selector Filter
- Low Noise Amplifier (LNA)
- AGC\_1 Attenuator
- Second Pre-selector Filter
- Mixer
- IF Filter
- IF Amplifier
- AGC\_2 Attenuator and Buffer
- IF Digitizing Subsystem

The Receiver Path implements an Automatic Gain Control (AGC), which is required to maintain good receiver linearity over a wide range of incoming signal levels and prevents clipping of high level signals.

The IF Digitizing Subsystem performs the following functions:

- Carries out amplification and down conversion of the signal into the second IF.
- Performs IF AGC.
- Converts the second IF analog signal into baseband digital I & Q format.
- Transmits the I & Q baseband data to the DSP for further processing.
- Synthesizes the second LO frequency.
- Synthesizes the Sigma-Delta clock
- Calculates the received signal strength.

---

## Transmitter Section

The transmitter incorporates cartesian feedback circuitry to enhance transmitter linearity to reduce power splatter into adjacent channels. The transmitter circuitry comprises the following components:

- Modulation digital to analog conversion, performed by:  
Analog-to-Digital / Digital-to-Analog IC (ADDAG),
- Modulation up-converter, performed by:  
Low Noise Offset Direct Conversion Transmitter integrated circuit (JAVELIN),
- Balun and Attenuator,
- Linear class AB Power Amplifier (PA),
- Directional coupler,
- Isolator (depends on terminal model)
- Antenna switch, and
- Harmonic filter.

The transmitter linearization feedback signal is taken from the forward power port of the directional coupler, attenuated, and passed to the RF feedback port of the JAVELIN integrated circuit.

---

## Controller Section

This section includes the Patriot Bravo, which controls the transmit, receive and synthesize operations of the integrated circuits located in the RF section. Within the Patriot Bravo are the DSP and the serial interfaces.

The controller section contains the following:

- Voltage regulators
- Power On/Off circuitry
- Patriot Bravo
- Host memories (FLASH and SRAM)
- Serial peripheral interface (SPI)
- RS232, USB, SB9600, SBEP serial interfaces
- RX and TX path multiplexer
- Programmable potentiometer
- CODEC
- Audio power amplifier (PA)

## Frequency Generating Section

The frequency generating section comprises the following components:

- Reference Oscillator - TCXO
- Main Synthesizer - consists of the Main Voltage Controlled Oscillator (VCO) and Low Voltage Fractional-N integrated circuit (LVFracN). In receive mode, the main synthesizer provides the local oscillator injection to the receiver first mixer. In transmit mode, this synthesizer provides the frequency reference for the transmit frequency translation loop.
- Transmit frequency translation loop. Consists of the transmit Voltage Controlled Oscillator (VCO) and ESCORT Near Unity Divider (NUD) Phase Locked Loop IC.

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## GPS Section

The GPS Sub module includes the following main components:

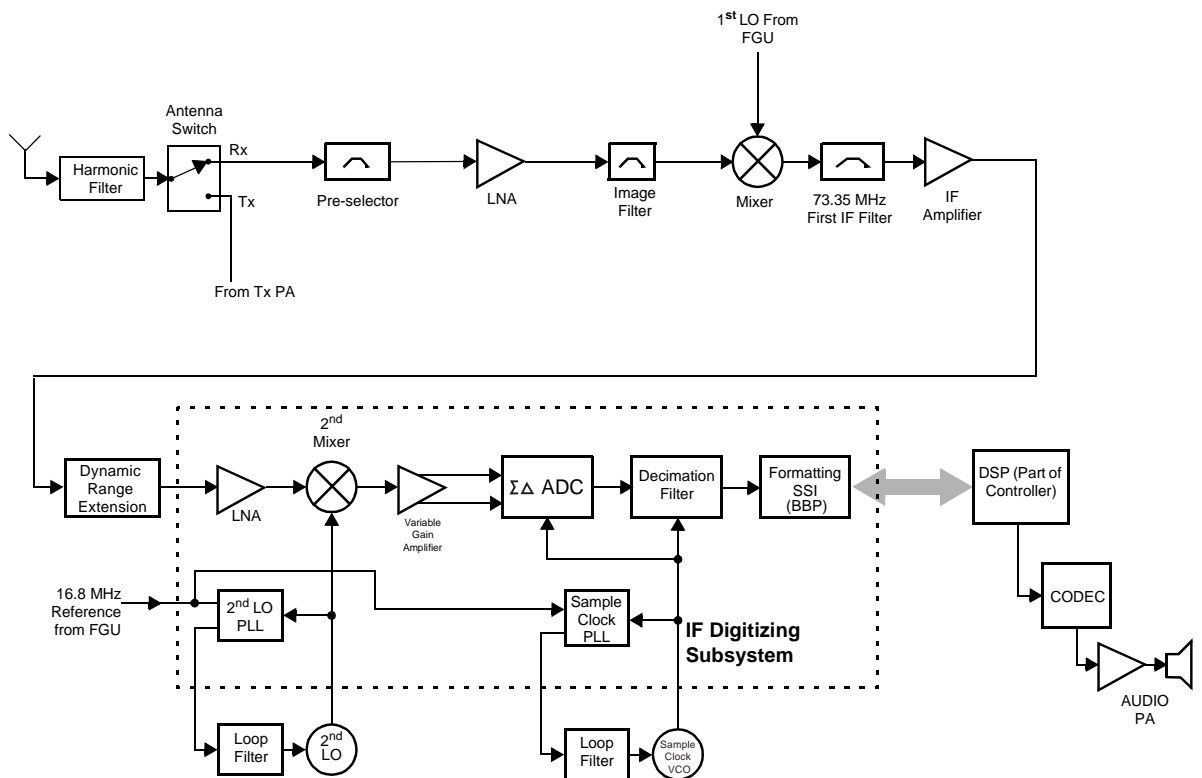
- Front End Filter
- LNA matching network
- The Phoenix GPS Acquisition Module (PGAM)
- 26MHz Reference TCXO
- Power supply for PGAM IC
- 5V (20mA) Phantom Power Supply for external LNA

## Block Diagrams Descriptions

The block diagrams descriptions cover Receiver Path, Transmitter Path, Frequency Generation Section, and Controller Section.

### Receiver Path

The received signal (see figure below) from the antenna is directed by the Antenna Switch to the Front End Pre-selector Filter.



**Figure 4.1-2** Receive Path Block Diagram

The receive pre-selector filter performs the following functions:

- passes frequencies in the 851 – 870 MHz receive frequency range, and
- blocks unwanted spurious frequencies like half IF and image frequencies.

The signal is mixed with the low side injection local oscillator signal to create the first IF at 73.35 MHz. The IF signal is filtered by the crystal filter, amplified by the IF amplifier, and sent to the IF Digitizing IC.

The IF Digitizing Subsystem performs the following functions:

- down conversion to the second IF at 2.25 MHz,
- perform a bandpass sigma-delta analog-to-digital conversion of the second IF signal into in-phase (I) and quadrature (Q) digital signals.

- Formats the I and Q data streams into a serial bit stream, which is sent for further processing to the Digital Signal Processor (DSP) (part of the micro controller) over the Synchronous Serial Interface (SSI) data link.

The DSP performs the following functions:

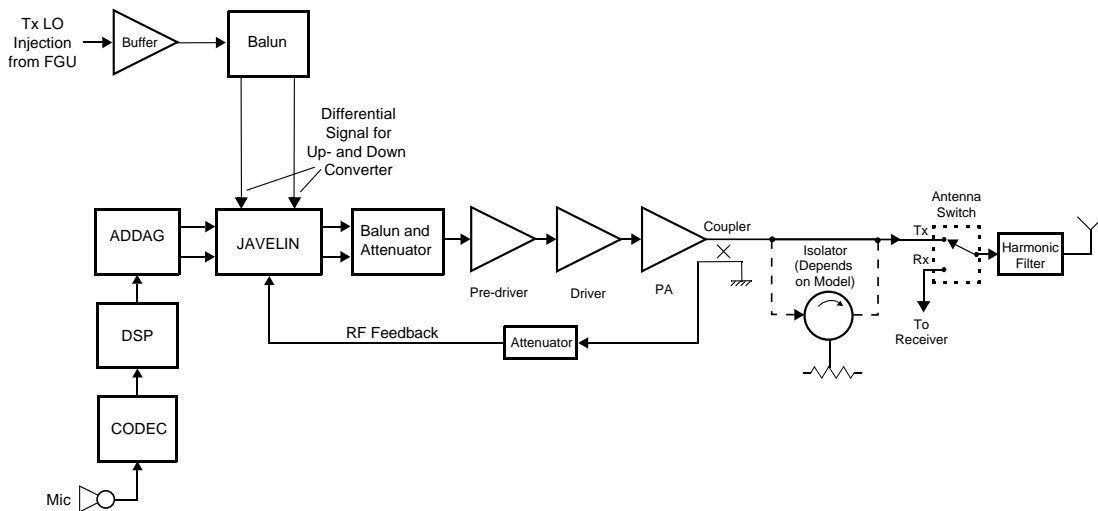
- Base band filtering,
- Synchronisation
- Demodulation
- Forward Error Correction (FEC)
- other correction algorithms for overcoming channel errors, and
- the decoder procedure for digital speech data decompression.

## Transmitter Path

When the terminal is transmitting (see figure below), microphone audio is sent to the CODEC, which performs analog-to-digital conversion and routes the digital signal to the DSP. The DSP performs the following functions:

- coding,
- error correction, and
- generation of the baseband modulation waveform.

From the DSP, baseband digital 'I' and 'Q' modulation waveform samples are sent to the ADDAG IC, where the digital data is converted into baseband analog 'I' and 'Q' waveforms and filtered.



**Figure 4.1-3** Transmit Path Block Diagram

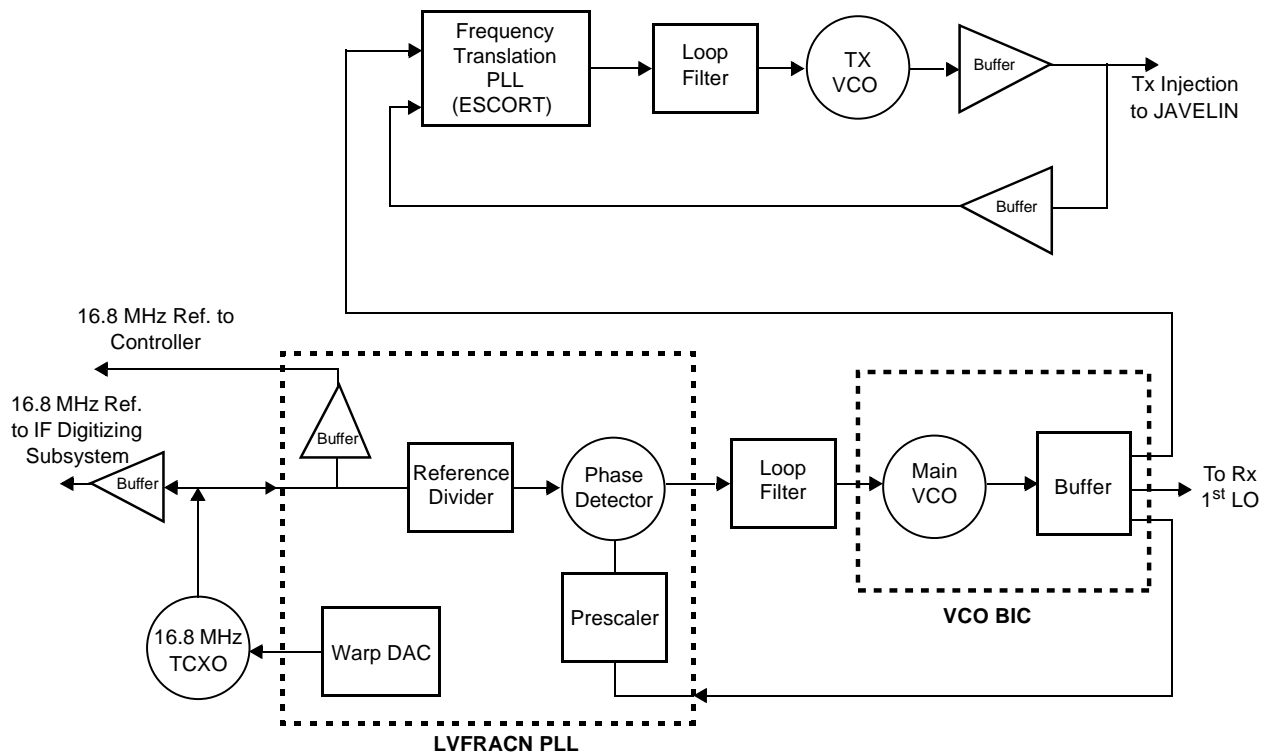
The analog modulation signal is passed on to the JAVELIN where it is up-converted to the transmitter operating frequency. The modulated RF output signal from the JAVELIN is converted from differential to single-ended by a balun, and passed to the attenuator, pre-driver IC, driver transistor, power amplifier transistor, directional coupler, and isolator (depends on terminal model), from where it is routed to the antenna via the antenna switch and harmonic filter. An RF feedback signal is taken from the directional coupler and fed back to the JAVELIN for transmitter power control and linearization.



## Frequency Generating Section

The frequency generating section comprises the following components (see figure below):

- 16.8 MHz TCXO Reference Oscillator.
- Main Synthesizer - consists of the Main Voltage Controlled Oscillator (VCO) and Low Voltage Fractional-N (LVFRACN) integrated circuit PLL. In receive mode, the main synthesizer provides the local oscillator injection to the receiver first mixer. In transmit mode, this synthesizer provides the frequency reference for the transmit frequency translation loop.
- Transmit frequency translation loop - consists of the transmit Voltage Controlled Oscillator (VCO) and ESCORT Near Unity Divider (NUD) Phase Locked Loop IC.



**Figure 4.1-4** Frequency Generating - Block Diagram

The reference oscillator –TCXO is a temperature compensated crystal oscillator producing an accurate and stable 16.8 MHz master clock, from which all other clocks in the terminal are derived. It provides the reference frequency for the following components:

- the main frequency synthesizer,
- the IF Digitizing Subsystem,
- the ADDAG, and
- the micro controller

Its operating frequency is fine tuned by means of a warp voltage signal which is controlled by the controller and generated by the LVFRACN IC

## **Main Synthesizer**

The Main Synthesizer consists of the main VCO and LVFRACN PLL IC. The main synthesizer provides the LO signal to the first mixer for down-converting the received signal to the 73.35 MHz first IF frequency and in transmit mode provides the reference frequency for the ESCORT frequency translation loop.

## **Transmit Frequency Translation Loop**

The transmitter frequency translation loop consists of the transmit VCO and ESCORT near unity divider PLL IC. This subsystem generates the carrier frequency injection signal for the JAVELIN.

## Controller Section

The controller section contains the Patriot Bravo dual core (DSP / RISC) processor and its external memory, the TX and RX audio processing, the serial interfaces and I/O circuitry.

The Patriot Bravo controls the receive / transmit frequencies, power levels, Enhanced Control Head display and keypad, serial interfaces, accessories, MMI, and other terminal functions. This microprocessor can be operated through the RS232 interface by a personal computer to program the FLASH.

The TX audio circuitry selects between the different microphone inputs, controls the TX audio level and converts the analog audio signal to a digital format.

The RX audio circuitry converts the received signal from digital format to an analog audio signal, performs volume control and amplifies the signal to speaker level.

The DSP performs signalling, and voice encoding and decoding.

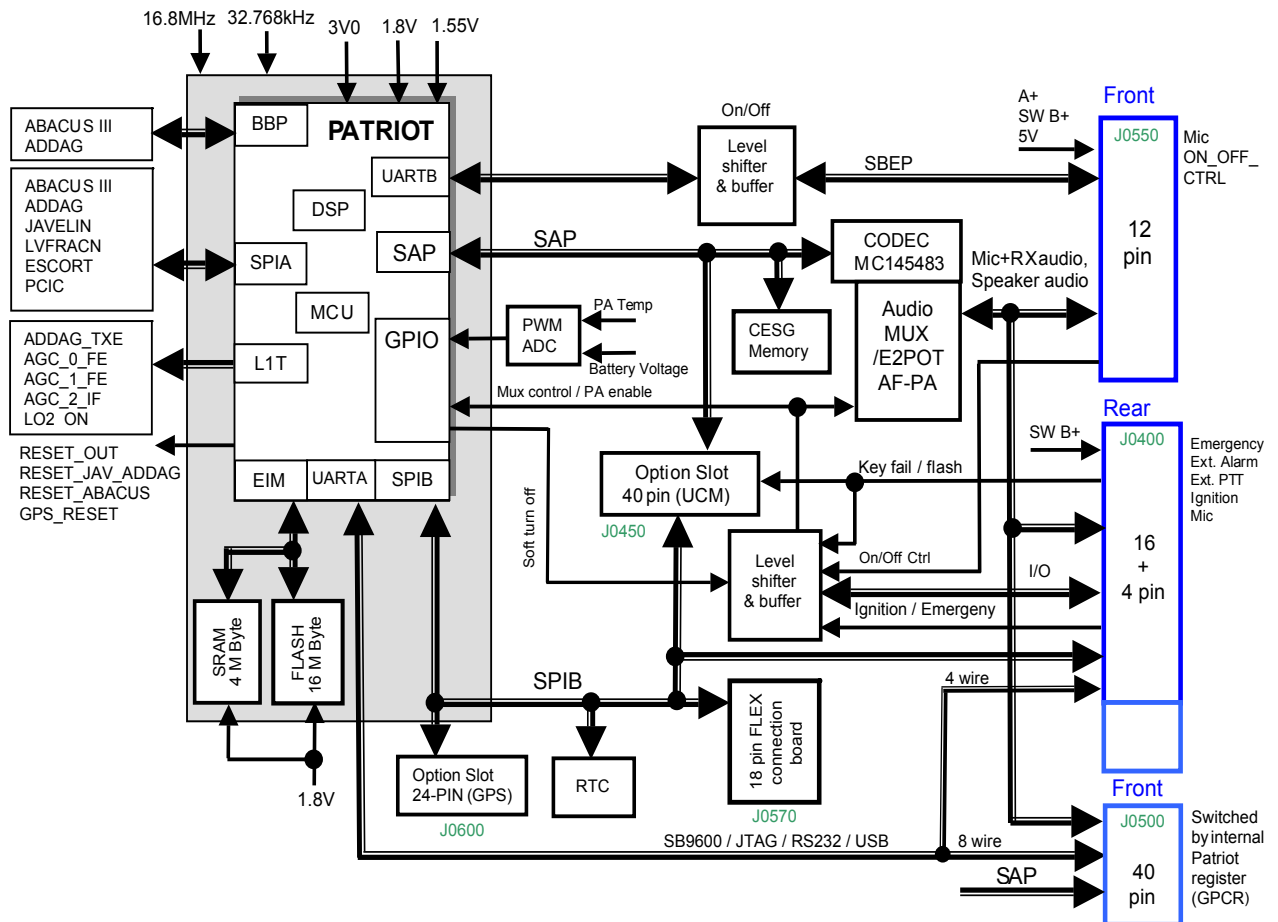


Figure 4.1-5 Controller Block Diagram

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## Detailed Circuit Description

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### Receiver Path, Detailed Circuit Description

For the Receive Path Block Diagram see Figure 4.1-2 on page 4.1-5.

#### Antenna Switch

The signal coming from the antenna is routed to the receiver section via the harmonic filter, which is comprised of L5461, L5462, C5461, C5462, C5464 and C5466. The signal continues to flow through quarter wave transformer L5452 and C5555 to the RX section toward pre-selector filter. The limiter (D5002) function is to prevent entrance of signals with power higher than 30dBm, which may damage the receiver front-end.

#### Pre Selector Filter

The signal is passed to the first pre-selector filter (FL5002) and from there routed to Low Noise Amplifier (LNA) (U5003). The first pre-selector filter attenuates incoming spurious RF frequencies, especially the image frequency

#### LNA

The Low noise amplifier (LNA) U5003 amplifies the incoming received signal. It maintains a large gain and small Noise Figure. When LNA "enable" (pin 3, VPD) receives a supply of 1.9 V from DC switch (Q5002), the amplifier is enabled. From the LNA the signal passes to the second pre-selector filter (FL5001).

#### Second Pre-selector

The second pre-selector filter (FL5001) provides further attenuation of incoming image and half-IF spurious response signals, as well as noise at the image frequency that may be generated by the LNA. From the output of the second pre-selector filter the received signal is sent to the RF input port of the first mixer.

#### Mixer

Mixer U5002 down-converts the incoming RF signal to the 73.35 MHz first IF, utilizing a first local oscillator signal tuned 73.35 MHz below the desired receiver operating frequency. An impedance matching network (L5012, C5037, C5036, L5201, C5203, L5011, L5018) is placed between the mixer output and IF filter U5201.

## IF Filter, Amplifier, Dynamic Range Extension

The IF signal is routed via IF filter (FL5201) to IF amplifier Q5201. From there it is routed to the Dynamic Range Extension circuitry which comprises Q5101, its bias components, and D5121. This circuitry is required to maintain good receiver linearity over a wide range of incoming signal levels, and prevent clipping of high level signals. This circuit avoids the use of fixed switchable attenuators typically used in Automatic Gain Control (AGC) circuits.

## IF Digitizing Subsystem

The IF Digitizing Subsystem is comprised of U5101. Here the IF signal is amplified and then mixed with an internally generated 2nd LO signal to produce the second IF signal.

The 2nd IF signal is first processed by a variable gain amplifier and then converted to in-phase and quadrature (I and Q) digital data samples by means of a bandpass sigma-delta analog-to-digital converter.

The I and Q digital signals are formatted into a single serial bit stream and sent for further processing to the Digital Signal Processor (DSP) (part of micro-processor) over the Synchronous Serial Interface (SSI) data link.

An internal AGC circuit controls the gain of the variable gain amplifier (VGA) to ensure that the maximum signal level into the ADC does not exceed a fixed analog ADC clip level and the rms output level of the ADC is maintained at an established reference level.

An internal phase locked loop control circuit controls the frequency of voltage controlled oscillator Q5180 which generates the 71.1 MHz 2<sup>nd</sup> LO injection frequency.

An internal phase locked loop control circuit controls the frequency of voltage controlled oscillator Q5190 which generates the 18MHz sample clock frequency utilized by the ADC and decimation filters.

Both phase locked loops derive their frequency reference from the buffered 16.8 MHz TCXO master clock.

## Transmitter Path, Detailed Circuit Description

For the Transmit Path Block Diagram see Figure 4.1-3 on page 4.1-6.

### ADDAG

The Analog to Digital/Digital to Analog IC U5810 (ADDAG) receives the modulation waveform as serial data transmitted by the DSP at a 48 kbps rate to the SSI port (ball C7, STD). Data is transmitted as a 16-bit 'I' word followed by a 16-bit 'Q' word. The ADDAG provides a serial clock of 2.4MHz to the DSP (ball B6, SCK) and sends a frame sync signal (ball B7, SFS) at the beginning of every 'I' word transmission, to instruct the DSP to send data.

In the ADDAG, the received serial I & Q words are converted into parallel I & Q words, and transferred to an interpolation filter. The interpolation filter increases the sampling rate to reduce in-band quantization noise, as well as to reduce image at multiples of the input data. The interpolated samples are rounded to 8 bits, and run through 8-bit D/A converters.

The D/A converters take the digital I & Q words and convert them into analog signals, which are filtered and amplified. The output is comprised of two separate low-level differential signals, I & Q (ball E2, OUT1; ball E1, OUT1B; ball D1, OUTQ; ball C1, OUTQB). The output signals are routed to the JAVELIN IC for up conversion to the transmitter operating frequency. They are also available on R5841, R5842, R5843 and R5844. The ADDAG sends a 2.4MHz low-level differential reference clock signal (ball C2, TCLK; ball B1, TCLKB) to the JAVELIN.

It also sends a differential signal (ball A1, TSL0T; ball B2, TSL0TB) that marks the beginning and end of each transmission slot (whenever a TXE signal {ball B5 TXE} is received from the DSP). After receiving the TSL0T signal, the JAVELIN toggles the ASW line (ball F2, ASW) which signals the ADDAG to set VCNT0 signal LOW (ball F2, VCNT0) which enables the Antenna Switch during the transmit slot. The ADDAG starts to receive data from DSP after TXE signal (ball B5, TXE).

### Tx LO

The Tx LO signal path processes the signal generated by the Transmit Frequency Translation Loop (part of the FGU), which determines the operating frequency of the transmitter. The input signal is amplified by Q5801, and passed to the Balun T5801 which provides the differential signal to the JAVELIN LO input (balls H5, VCO1 and H6, VCO1B). Internally to the JAVELIN the signal is routed to the feedback down conversion circuitry and to a 90 degree phase shifter, that provides the I and Q vectors for up conversion.

### JAVELIN

The Low Noise Offset Direct Conversion Transmitter (JAVELIN) U5809 performs the following tasks:

- up converts the baseband I and Q modulation waveform to the transmitter operating frequency,
- controls power output, and
- cancels power amplifier distortion products created by non-linearities in the RF power amplifier output stage.

The differential base-band signals from the ADDAG are input into the JAVELIN on balls C1, B1, C3, B2 (BINQB, BINQ, BINIB and BINI). The baseband I and Q waveforms are passed through a

variable attenuator and then they are summed with the down-converted I & Q feedback signal. The base-band signal is then amplified and sent to the up-mixer. The up-mixer consists of two mixers, one for the I channel and the other for the Q channel.

The split I & Q LO signal is mixed with the base-band I & Q signals to produce an I and Q modulated signal at RF frequency. The signal is then output differentially on balls E8 and D8 (RFOUT2B, RFOUT2), where the differential RF signal is converted to a single-ended unbalanced output by means of BALUN T5802. The output signal from the BALUN is applied to the RF Power Amplifier.

## RF Power Amplifier

The RF Power Amplifier consists of attenuator R5413, R5414, R5415, pre-driver IC U5401, driver transistor Q5421, and output transistor Q5431. The overall RF gain of the power amplifier string is fine tuned by the BIAS1 voltage from the controller, which is applied to VCNTL pin 1 on pre-driver U5401. The BIAS1 signal is buffered by amplifier Q5501. The operating bias point of driver Q5421 and PA Q5431 is set by BIAS2 and BIAS3 respectively, buffered by Q5521 and Q5542.

## Directional Coupler and RF Feedback Path

A directional coupler exists at the RF PA output, and is used to pass the signal to the Antenna Switch via the isolator FL 5451 and to sample the signal thus providing the necessary feedback for the linearization and feedback correction. The sampled signal is routed via attenuator R5453, R5454, R5455 and the BALUN L5812 to the JAVELIN (ball D1, RFIN, ball E1, RFINB). Internally to the JAVELIN, the RF feedback signal is mixed down to base-band in a quadrature down mixer, and summed with the base-band input signal to provide cancellation of modulation distortion generated in the power amplifier.

## Antenna Switch

The RF signal from the Directional Coupler is applied to PIN diode D5451. This PIN diode is turned on during the transmission time slot, to route the transmitter output signal to the harmonic filter (C5455-C5457, C5461-C6467, L5461, and L5462), and from there on to the antenna connector. During the transmit time slot, pin diode D5551 is also turned on, preventing power from the transmitter from reaching the receiver LNA. During receive time slots, PIN diodes D5451 and D5551 are OFF, allowing receive signals to pass from the antenna connector through the harmonic filter, through L5452, and on to the receiver input preselector.

## Harmonic Filter

From the antenna switch the signal is routed to the harmonic filter, consisting of C5455-C5457, C5461-6467, L5461, and L5462. The filter is required to attenuate transmitter harmonics during transmit mode, and leakage of local oscillator harmonics during receive mode.

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## Frequency Generating Section Detailed Circuit Description

For the Frequency Generating Section Block Diagram see Figure 4.1-4 on page 4.1-7.

This section describes the generating circuits that supply all the required frequencies for the required transmitter and receiver functions. These circuits are described as follows:

- 16.8 MHz Reference Oscillator - TCXO.
- Main VCO and Main Synthesizer.
- Transmit frequency translation loop.

### Reference Oscillator - TCXO

16.8 MHz TCXO (Y5363) is a temperature compensated crystal oscillator producing an accurate and stable 16.8 MHz master clock to the terminal RF circuits. Its operating frequency is fine tuned by means of a warp voltage signal generated by the LVFRACN IC (U5331, pin 25). On terminal power-up, an initial warp voltage setting is programmed into the LVFRACN IC by the microprocessor via the SPI bus, using a stored value programmed into the terminal codeplug during factory tuning.

While the receiver is registered to the terminal system, an automatic frequency control algorithm is executed by the microprocessor, to fine tune the LVFRACN warp voltage to bring the TCXO frequency into alignment with the terminal system frequency standard.

The output signal at pin 3 of the TCXO is passed to LVFRACN IC U5331, where it is used as a reference for the main frequency synthesizer. The TCXO output is also buffered by Q5351, and passed to other terminal circuits via REF16\_8\_OSC. The LVFRACN IC buffers the 16.8 MHz reference, and provides it at FREFOUT (pin 41) for use by other terminal circuits.

### Main VCO and Main Synthesizer

The synthesizer components are LVFRACN, Loop Filter, VCO and VCO Buffer IC (VCO BIC). It produces the receiver first LO signal, as well as serving as the reference for the transmit frequency translation loop.

The operating frequency of Voltage Controlled Oscillator (VCO) with active element Q5712 is determined by resonator W5701, in conjunction with C5735, C5737, C5738, C5736, L5733, and varactors D5731-5734. The operating frequency of the oscillator is varied by means of varactor tuning voltage VCTRL, supplied by the LVFRACN U5331 IOOUT signal (pin 43), and filtered by loop filter components C5303, R5304, C5305, R5303, R5302, and C5301. The RF output of the VCO is buffered by U5701

U5701 pin 12 provides a sample of the VCO output to the LVFRACN prescaler input (pin 32), where the signal is divided down to a lower comparison frequency by means of a programmable frequency divider. The divided down VCO signal is compared to a signal derived from the 16.8 MHz reference clock to generate an error signal (IOOUT) which is filtered by the loop filter and tunes the VCO to the programmed operating frequency.

A LOCK\_FN signal is available at LVFRACN pin 4 to provide feedback to the microprocessor that the synthesizer has successfully locked to the programmed frequency. The "RX\_OUT" signal from buffer U5701 pin 8 is amplified by Q5701, and supplied to the first mixer LO port.

The "TX\_OUT" signal from buffer U5701 pin 10 provides the frequency reference for the Transmit Frequency Translation Loop.



## Transmit Frequency Translation Loop

The Transmit Frequency Translation Loop comprises the following components:

- transmit Voltage Controlled Oscillator (VCO) and
- the ESCORT Near Unity Divider (NUD) Phase Locked Loop IC.

The operating frequency of Voltage Controlled Oscillator with active element Q5601 is determined by resonator W5601 in conjunction with C5603, C5604, C5606, C5607, L5603, and varactors D5601-5604. The operating frequency of the oscillator is varied by means of a tuning voltage applied to the varactors.

The translation loop works as follows:

- A sample of the VCO operating frequency is buffered by Q5631 and applied to the FREQA input of the NUD IC U5702 pin 16, where it is divided by a programmable divider set to 1.0625, and phase compared to a reference frequency supplied to U5702 FREQB pin 9 from the main synthesizer
- The result of this comparison is a VCO tuning signal, buffered by charge pump transistors Q5604, Q5605, and Q5653, filtered by loop filter components C5653, R5652, C5654, C5655, and L5607 and applied to the VCO varactors.
- The action of the feedback loop is to maintain the operating frequency of the Transmit VCO at 1.0625 times the programmed operating frequency of the main synthesizer.
- The loop bandwidth of the transmit frequency translation loop is set to a high value in order for the corrective feedback action of the loop to suppress re-modulation of the VCO as a result of leakage of the modulated transmitter signal from the transmitter Power Amplifier output back into the VCO.

## Controller Section

For the Controller Section Block Diagram see Figure 4.1-5 on page 4.1-9.

This section describes the related circuits as follows:

- DC Power Distribution and RESET
- Microprocessor and Host Memories
- SPI
- RS232/USB
- Terminal Audio System
- RTC
- GPS
- SIM card connectivity
- GPIOs

## DC Power Distribution

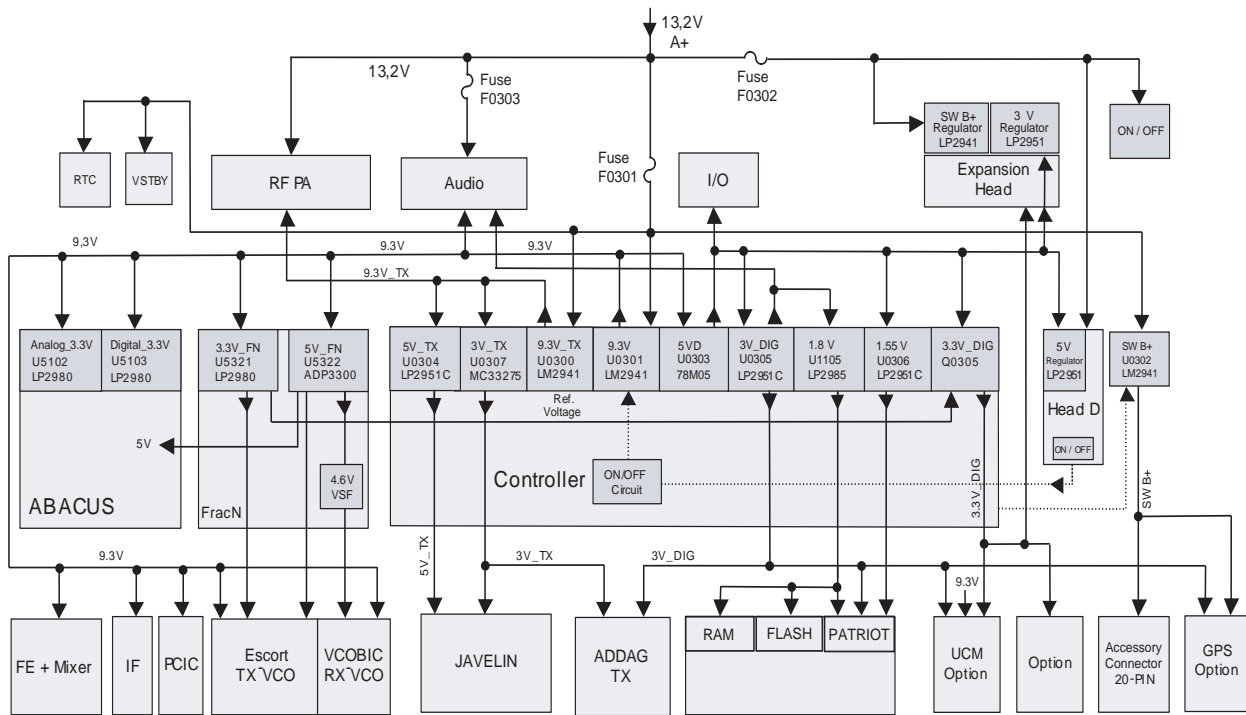


Figure 4.1-6 DC Power Distribution Diagram

## DC Power Input

The DC power of nominal 13.2 volts enters the terminal at connector J0301. Diode VR0300 acts as protection against transients and wrong polarity of the supply voltage. The supply voltage is fed directly to the RF PA, through the 3A fuse F0303 to the audio circuitry, through F0302 to the expansion head and Enhanced Control Head, and through the 4A PCB fuse (F0301) to regulators U0300, U0301, U0302, and the ON/OFF and VSTBY circuitry. The fuses protect the board from over current in case of a short on the connector pins or circuit failure.

### **9V3 Linear Regulator U0301**

Regulator U0301 is connected to the 13.2 volts supply voltage via PCB fuse. The output of this regulator is controlled by the ON/OFF circuitry. When any of the signals RTC\_ON\_SW, ON\_OFF\_CONTROL\_SV, SOFT\_TURN\_OFF, IGNITION is at high level or EMERGENCY is at low level the regulator is switched on via transistors Q0302, Q0301, Q0303. In addition, regulators U0300 and U0302 are also switched on by the same signal. The output voltage of U0301 is set to 9.3 volts with resistors R0307 and R0308.

### **9V3\_TX Linear Regulator U0300**

Regulator U0300 is connected to the 13.2 volts supply voltage via PCB fuse. The output of this regulator is controlled by the ON/OFF circuitry. When any of the signals RTC\_ON\_SW, ON\_OFF\_CONTROL\_SV, SOFT\_TURN\_OFF, IGNITION is at high level or EMERGENCY is at low level the regulator is switched on via transistors Q0302, Q0301, Q0303. The output voltage of U0300 is set to 9.3 volts with resistors R0305 and R0306.

### **SW B+ Current Limit Regulator U0302**

Regulator U0302 is connected to the 13.2 volts supply voltage via PCB fuse. The output of this regulator is controlled by the ON/OFF circuitry. When any of the signals RTC\_ON\_SW, ON\_OFF\_CONTROL\_SV, SOFT\_TURN\_OFF, IGNITION is at high level or EMERGENCY is at low level the regulator is switched on via transistors Q0302, Q0301, Q0303. The output voltage of U0302 is set far above the maximum possible input voltage with resistors R0303 and R0304 so that this regulator acts as a current limiter for the EXT\_SWB+ voltage on the 20 pin accessory connector.

### **5VD Linear Regulator U0303**

Regulator U0303 gets its input voltage from the 9.3 volt regulator U0301. The output voltage 5VD is fixed to 5 volts and is the input voltage for the regulators U0305 and U0306. The voltage 5VD is also fed to the Enhanced Control Head.

### **5V\_FN Linear Regulator U5322**

Regulator U5322 gets its input voltage from the 9.3 volt regulator U0301. The output voltage 5V\_FN is fixed to 5 volts and is mainly used in the frequency generating unit (FGU).

### **3V3\_FN Linear Regulator U5321**

Regulator U5321 gets its input voltage from the 9.3 volt regulator U0301. The output voltage 3V3\_FN is fixed to 3.3 volts and is mainly used in the frequency generating unit (FGU).

### **Analog\_3V3 Linear Regulator U5102**

Regulator U5102 gets its input voltage from the 9.3 volt regulator U0301. The output voltage ANALOG\_3V3 is fixed to 3.3 volts and is mainly used in the receiver section.

### **Digital\_3V3 Linear Regulator U5103**

Regulator U5103 gets its input voltage from the 9.3 volt regulator U0301. The output voltage DIGITAL\_3V3 is fixed to 3.3 volts and is mainly used in the receiver section.

### **3V\_TX Linear Regulator U0307**

Regulator U0307 gets its input voltage from the 9.3 volt regulator U0300. The output voltage 3V\_TX is fixed to 3 volts and is used in the transmitter TX\_LOW section to supply the ADDAG and JAVELIN IC.

### **5V\_TX Linear Regulator U0304**

Regulator U0304 gets its input voltage from the 9.3 volt regulator U0300. The output voltage 5V\_TX is fixed to 5 volts and is mainly used in the transmitter section.

### **3V3\_DIG Voltage Follower Q0305**

Transistor Q0305 is configured as voltage follower and gets its input voltage from the 5 volt regulator U0303. The output voltage 3V3\_DIG is set to 3.3 volts by the reference voltage 3V3\_FN from U5321. Diode D0303 compensates the base to emitter voltage drop of Q0305. The voltage is used as supply voltage for modules connected to J0570.

### **3V\_DIG Linear Regulator U0305**

Regulator U0305 gets its input voltage from the 5 volt regulator U0303. The output voltage is fixed to 3 volts and is mainly used in the controller section to supply the I/O voltage.

### **1.55 V Linear Regulator U0306**

Regulator U0306 gets its input voltage from the 5 volt regulator U0303. The output voltage is set to 1.55 volts with resistors R0318 and R0319 and is used in the controller section for supplying the Patriot Bravo core.

### **1.8 V Linear Regulator U1105**

Regulator U1105 gets its input voltage from the 3 volt regulator U0305. The output voltage is 1.8 volts and is used in the controller section for supplying the address and data bus voltage of the patriot Bravo and for supplying the Flash and RAM memory.

### **4.6V VSF Voltage**

The fractional N synthesizer U5331 creates the 4.6 volts super filter voltage (VSF). This voltage is used for the main VCO.

### **RESET**

The open drain Error outputs of the regulators U0304 (5V\_TX), U0305 (3V\_DIG), U0306 (1V55) as well as the 2.8V voltage sense IC U0308 are connected together to create the LV\_DETECT signal which is the RESET\_IN signal of Patriot Bravo. Furthermore the circuitry Q0341, Q0342, R0341, R0342, R0343 generates a reset when a programming cable is disconnected from the terminal. The reset sources share the pull up resistor R0344

### **Microprocessor**

The Patriot Bravo dual core (DSP / RISC) processor (U1100, block 1 to 5) controls the terminal hardware, communicates via various interfaces with external equipment or accessories and performs digital signal processing. Beside its internal memory the Patriot Bravo uses the FLASH Memory and the SRAM also located near to the controller. The Patriot Bravo exchanges digitized audio data with the CODEC via its Serial Audio Port (SAP). The Patriot Bravo sends digital baseband data to the ADDAG and receives digital baseband data from the ABACUS via its Baseband Port (BBP). To communicate with the RF IC's the Patriot Bravo uses one of its Queued Serial Peripheral Interfaces - the (QSPIA). A second interface, QSPIB, is used for communication with external equipment or accessories. The Patriot Bravo has 2 universal asynchronous receiver / transmitter ports (UARTA and UARTB) for communication with external equipment e.g. a Enhanced Control Head or a control terminal (PC). UARTA communicates via SB9600, RS232 or USB protocol and UARTB communicates via SBEP protocol.

## Host Memories

### Flash Memory

The 16MByte FLASH Memory (U1102) located near to the micro-controller contains the terminal's Application Software and the Terminal Code Plug. The Code Plug stores customer related information and terminal parameters. The Patriot Bravo accesses the data via a 24 bit wide address bus (A0-A23), a 16 bit wide data bus (DQ0-DQ15), and 8 control lines (EN\_CE, EN\_OE, EN\_WE, ADV, BURSTCLK, WP, VPP and RESET). When the FLASH Memory has been replaced or the software needs to be upgraded, the new Code Plug and application software must be programmed into the FLASH Memory.

### SRAM Memory

The 4MByte SRAM (U1103) located near to the micro controller stores data that can change very frequently, and which is generated and stored by the Application Software during its normal operation. The information is lost when the terminal is turned off. The Patriot Bravo accesses the data via a 21 bit wide address bus (A0-A20), a 16 bit wide data bus (IO1-IO16), and 6 control lines (CS1, CS2, EN\_OE, EN\_WE, LB, UB).

### EEPROM

On the terminal mainboard, an additional 128 kbit serial memory is connected to the SAP interface of the Patriot Bravo. This EEPROM holds encryption keys and is accessed by the DSP.

### Serial Peripheral Interface (SPI)

The Patriot Bravo features two SPI interfaces.

The SPI protocol is used to communicate with the RF IC's ABACUS, ADDAG, JAVELIN, LVFRACN, ESCORT and PCIC. All these IC's are connected to the Patriot Bravo's QSPIA module. The interface comprises the lines SPIA\_MOSI (TX), SPIA\_MISO (RX), SPIA\_CS's, and SPIA\_CLK. The SPI bus is a synchronous bus, the timing clock signal CLK is sent while SPI data is transferred. Therefore, whenever there is activity on either MOSI or MISO, there should be a uniform signal on CLK.

The Patriot Bravo uses its module QSPIB to communicate with the real time clock (RTC) U0100, the external UART in the expansion head via the 40 pin connector J0500 and the GPS module via the 24 pin connector J0600.

### RS232, USB, SB9600, SBEP Serial Interfaces

The Patriot Bravo uses four serial protocols to communicate with external devices: RS232, USB, SB9600 and SBEP. The interface lines are available on the rear or front connectors, dependent on the interface. Not all interfaces can be used at the same time.

### SBEP Serial Interface

The Patriot Bravo communicates with the Enhanced Control Head via the SBEP serial interface. This interface comprises line BUS+ and is available on the 12 pin front connector J0550. Op-amps U0102-1 and U0102-2 perform buffering and level shifting from 3 volts to 5 volts level. The Patriot Bravo uses its UARTB for the SBEP serial interface.

## RS232 and SB9600 Serial Interfaces

The configuration of the RS232 and SB9600 serial interfaces depends on the terminal setup. If no expansion head is connected to the terminal, Patriot Bravo module UARTA provides either a 4-wire RS232 or an SB9600 interface on the 20 pin accessory connector J0400.

If at power up pin BUSY\_OUT on the accessory connector J0400 is connected to pin BUSY\_IN, the Patriot Bravo assumes that SB9600 equipment is connected and configures UARTA for the SB9600 interface. If both pins are not connected to each other at power up, the UARTA will be configured for RS232 interface. The interface comprises lines RS232\_TX, RS232\_RX, RS232\_CTS, RS232\_RTS. These lines are not buffered and at 0 or 3 volts level.

## USB

The terminal is a 1.1 USB device with 12Mb/s. The interface comprises lines RS232\_TX, RS232\_RX and RS232\_RTS. When a USB cable is connected to the terminal via JB the USB supply voltage is detected on line RS232\_RTS and transferred to the controller via signal USB\_INT.

The controller chooses between RS232 and USB interface via the signal USB\_RS232 and switches the IC U0408. When the USB mode is used, the signal line RS232\_TX is switched to USB D+ and the RX signal to D-. The USB signals are driven by the driver IC U0405. The RS232 lines to expansion head are then disconnected to eliminate the influence of stub lines.

## Note

When an expansion head is connected to the terminal, the serial interfaces on the 20 pin accessory connector J0400 can not be used.

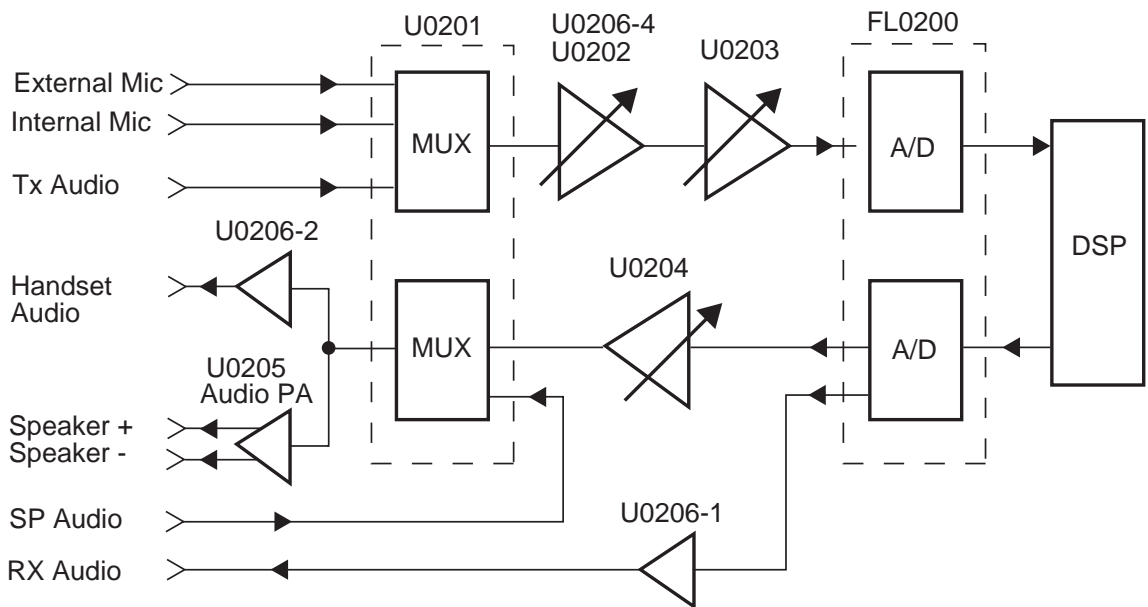
The UARTA is configured for an 8-wire RS232 interface, which is available on the 9 pin connector of the expansion head. This interface has standard RS232 levels and can be connected to an external data terminal.

In addition, the Patriot Bravo configures its QSPIB module to provide either a 4-wire RS232 or SB9600 interface with 5 volts level on the 25 pin expansion head connector. If line MUX\_CTRL\_1 is at 0 volt, the interface is switched to RS232 mode.

When the MUX\_CTRL\_1 line is at 3 volts, the interface is switched to SB9600 mode. The interface comprises lines BUSY\_IN, BUSY\_OUT, RESET\_OUT, and the QSPIB lines SPIB\_MOSI, SPIB\_MISO, SPIB\_CLK, SPIB\_CS1\_UART and is available on the 40 pin front connector J0500 with signals at 3 volts high level.

The Patriot Bravo uses the SB9600 interface to communicate with the motorcycle Enhanced Control Head. If no motorcycle Enhanced Control Head is connected, the interface can be used to control the terminal via the SB9600 protocol with an external control terminal.

## Terminal Audio System



**Figure 4.1-7** Audio Block Diagram

The Audio system consists of the following components:

- RX and TX path multiplexer
- RX and TX programmable potentiometer
- CODEC
- DSP
- Audio PA

### TX Path

The speech audio is fed to the internal microphone input (INT\_MIC), the external microphone input (EXT\_MIC) or the TX audio input (TX\_AUDIO). The internal and external microphone inputs have a DC bias prepared for connecting a microphone.

The TX audio input has a DC blocking capacitor. Multiplexer U0201 selects one of the possible inputs and feeds the signal to amplifier U206-4. The gain of this amplifier is switchable via gate U0202.

The programmable potentiometer U0203 attenuates the signal according to the terminal mode of operation. Finally, the CODEC FL0200 converts the analog signal into digital format and transfers it to the DSP via the serial audio port (SAP).

The DSP performs the functions of audio filtering, ACELP speech compression, digital modulation, and transfers the data to the RF section. When the terminal is operating in the telephone interconnect mode, the DSP performs the required tasks such as echo and noise reduction.

## RX Path

The receiver feeds the digital output signal via the baseband port (BBP) to the DSP which performs the functions of digital demodulation, ACELP speech de-compression, and audio filtering. After processing, the DSP feeds the signal via the serial audio port (SAP) to the CODEC FL0200.

The CODEC converts the digital audio format to an analog signal. One of the CODEC's analog output signals is amplified by U0206-1 and then fed to the RX\_AUDIO pin on the 20 pin accessory connector J0400.

The second output signal from the CODEC is fed to the programmable potentiometer U0204 which attenuates the analog signal according to the terminal mode of operation or the setting of the volume control.

The multiplexer U0201 selects between the signal from the potentiometer or the signal SP\_AUDIO from the 40 pin expansion head connector J500 and routes the audio to the audio power amplifier (PA) U0205 and the amplifier U0206-2.

The amplified audio from U0206-2 is available on the HANDSET\_AUDIO pins on the 20 pin accessory connector J0400 and the 40 pin expansion head connector J0500.

The audio PA has one inverted and one non-inverted output that produces the differential audio output signals SPEAKER+ and SPEAKER-.

Both signals are available on the 20 pin accessory connector J0400 and the 12 pin Enhanced Control Head connector J0550.

## RTC

The real time clock (RTC) IC U0100 supplies the controller with 32.768kHz clock. When the terminal is powered off, the RTC is supplied by a 5.1V supply URTC which derives from A+ via the zener diode VR0325.

After the terminal has been switched on, the IC is supplied from 3V\_DIG and URTC is internally disconnected from the IC supply. When the terminal is disconnected from FLT\_A+, the RTC continues to work for approx. 10 minutes.

## TEMP\_SENSE and BATTERY\_VOLTAGE MUX

The controller alternately senses the battery voltage and the temperature on a dedicated input. The temperature information TEMP\_SENSE is generated by the temperature sensor U5501 which is located close to the PA.

The battery voltage information derives from FLT\_A+ via R0312 and R0313. These signals are input to the analog multiplexer U0104. With the PWM\_ADC\_SEL line, the controller selects which signal is routed to the comparator U0103-1.

The comparator compares the voltage from the multiplexer and the filtered (R0115 and C0113) pulse width modulated signal PWM\_ADC\_REF from the controller.

This PWM signal is adjusted by the controller until the comparator output changes its state. Thus the voltage either battery or temp sense can be determined.

## GPS connector J0600

On this connector an optional GPS module electrically interfaces to the terminal. Two voltages, 3V\_DIG and a protected SWB+, are available to supply the GPS circuitry. The GPS module



communicates with the controller via the SPIB bus and the module is activated by SPIB\_CS0\_UART.

Furthermore a 32.768 kHz clock signal from the terminal is provided to the GPS module on J0600. The controller ports SIM UART0 and SIM UART1 are also routed to J0600 in order to provide the signals for a SIM card device.

### **SIM card connectivity**

All SIM card signals are also available on the connectors, J0450, J0570 and J0600.

### **EMERGENCY**

The signal EMERGENCY has an internal 4k7 pull up to FLT\_A+. When the EMERGENCY signal pulls to ground during the "OFF" state of the terminal, the regulators U0300, U0301 and U0302 are powered on by means of Q0301 and Q0303. INT\_SWB+ is supplied to the terminal through Q0301.

The controller reads the EMERGENCY information via Q0158 when it comes out of the POR and applies a high signal to SOFT\_TURN\_OFF and thus keeps the terminal powered on.

When EMERGENCY is applied during the "ON" state of the terminal, the controller also reads the EMERGENCY information via Q0158.

### **IGNITION**

The IGNITION line is accessible on the 20pin accessory connector J0400 on pin 10 and the 40 pin expansion board connector J0400 on pin 27.

They are routed to a common 4k7 pull down resistor R0404. When the IGNITION signal exceeds approx. 4V, the regulators U0300, U0301 and U0302 are powered on by means of Q0302, Q0301 and Q0303. INT\_SWB+ is supplied to the terminal through Q0301.

The controller reads the IGNITION information via Q0160 when it comes out of the POR.

## **General purpose inputs and outputs**

### **HOOK**

The HOOK GPIO is used as a digital input with a 2k2 pull up resistor R0154 to 5V. The HOOK function is detected if the signal is active low.

### **PA\_ENABLE**

The PA\_ENABLE GPIO is used as a digital input with a 2k2 pull up resistor R0155 to 5V. The PA\_ENABLE function is detected if the signal active low.

### **EXTERNAL\_PTT**

The EXTERNAL\_PTT GPIO is accessible on the 20 pin accessory connector J0400 on pin 3 and the 12 pin Enhanced Control Head connector J0550 pin 5. They are routed to a common 4k7 pull up resistor R0160 to 5V. EXTERNAL\_PTT is detected if the signal active low.

### **EXT\_ALARM**

The EXT\_ALARM GPIO is used as a digital output with a 4k7 pull up resistor to FLT\_A+. When EXT\_ALARM occurs, the transistor Q0159 switches to low.

## GPS Sub Module

The MTM800 ENH GPS is based on the Phoenix GAM IC (PGAM), which comprises a custom mixed mode RF-DSP IC in a single chip FBGA package.

It is a self contained GPS receiver capable of producing a final position including full tracking and data decode capability.

The GPS signal that applies to the RF cable connector is filtered by two SAW filters FL1 and FL2. It is amplified by a low noise amplifier (LNA).

The input of the GPS receiver at the RF FME connector is DC coupled.

A voltage regulator on board provides about 20mA at 5V DC voltage to an external antenna low noise amplifier (LNA).

This phantom voltage is applied to the input by the RF coil L1.

The supply voltages GPS\_2V and GPS\_3V of the PGAM-IC are derived from two on board voltage regulators U2 and U3.

A 26MHz TCXO provides the reference clock to the PGAM IC.

Data communication takes place via the serial SPI bus.

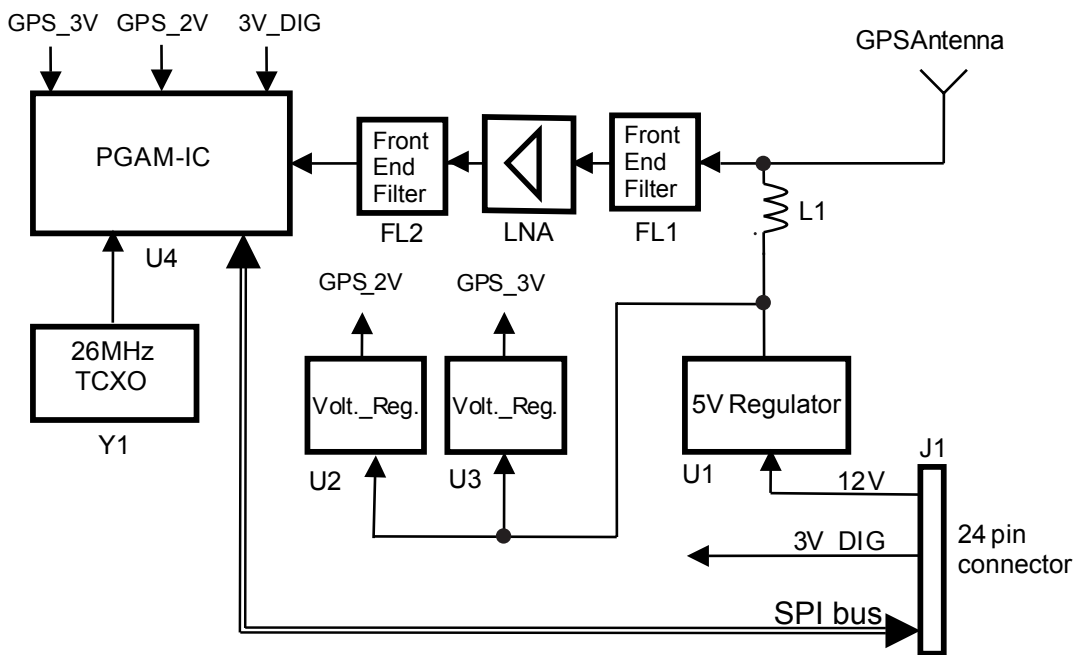


Figure 4.1-8 GPS Module Block Diagram

## CHAPTER 4.2

## THEORY OF OPERATION (ENHANCED CONTROL HEADS)

This chapter contains the descriptions of the different configurations of the Enhanced Control Head:

- Enhanced Control Head in Dash Mount configuration
- Enhanced Control Head in Remote Mount configuration
  - Remote Back Head
  - Data Expansion Head Enhanced
  - Remote Head Enhanced
- Enhanced Control Head in Motorcycle configuration

## Enhanced Control Head in Dash Mount configuration

The Enhanced Control Head in dash mount configuration consists of the main board, the liquid crystal display (LCD) module, the keypad board, the keypad, the rotary and push button, the EMERGENCY button, the GCAI accessory connector, the 3-colour status LED and the housing.

The display module contains a colour 2.8" VGA TFT display.

The 3 colour status LED informs the user about the radio status

The functions of the Enhanced Control Head are driven by the OMAP1621 microcontroller from Texas instruments.

### Power Supplies

The power supply to the Enhanced Control Head is taken from the host radio's FLT A+ voltage via connector J101 pin 3. It is used to power up the Enhanced Control Head.

The regulator U513 provides an unswitched stabilized 5V to constantly power some circuits.

The switching regulator U501 produces 5V when the system is switched ON. The output voltage of U501 feeds the following regulators U503, U504 and U505. Furthermore the VCC\_5 voltage is used to supply the keypad backlight.

The boost regulator U503 generates 23V for the display backlight.

The reset IC U502 enables the regulator U503 when the output voltage of U501 exceeds 2.8V. U503 produces the 1.5V core voltage for the OMAP microcontroller.

Only when the 1.5V is stable, the regulator U504 is enabled and generates 3.3V for USB and as input voltage for the two regulators U506 and U507. U507 provides 1.8V to the memory block of the OMAP and to the memories themselves.

U506 generates 2.8V for the I/O section of the OMAP.

The 2.8V also release the clear input of the D-Flip Flop U509. At the same time the crystal oscillator U515, Y501, R520 - R523 and C530 - C532 starts oscillating at 32.768 kHz and the binary counter

in U515 starts counting. When the output Q12 of U515 goes to HIGH, the output of the D-Flip Flop U509 goes to HIGH and the OMAP is coming out of RESET.

In case the error output of U506 goes to LOW, the Flip Flop is cleared and thus the OMAP goes into RESET. U515 is also held in RESET and the oscillator stops working.

## Power On / Off

The Enhanced Control Head in dash mount configuration can be switched ON either by the ON rotary push button, the ON button in the keypad, the EMERGENCY button or by the radio via the accessory connector of the radio.

If one of the three buttons on the Enhanced Control Head is pressed, the OR circuitry D510, D511 produces the signal ON\_OFF\_CONTROL, that switches the radio ON. When the radio powers ON it delivers a 5V level on the BUS+ and SCI\_TX lines. The transistor couple Q508 then sets the signal BUS\_ON to HIGH and the regulator U501 is enabled.

When all regulators are powered and the RESET signal has gone to HIGH, the OMAP controller starts operating.

The OMAP processor has to program the ON\_HOLD line to HIGH in order to maintain the enable signal for U501, when the BUS+ line is used for communication later on.

Before the first message can be transferred, the interface has to be activated by setting the RADIO\_COM\_EN signal to LOW and the BUS\_EN signal to HIGH.

RADIO\_COM\_EN enables the buffer U420-1 and supplies 5V to the operational amplifiers U421 and U422 via the transistors Q411 and Q412.

The BUS\_EN signal connects the SCI\_TX to the BUS+ line via Q410.

The other possibility to switch ON is when the radio is switched ON from its accessory connector either by IGNITION or by EMERGENCY. The regulator U501 is also enabled by the BUS+ signal in this case.

The system can be switched OFF by either the ON/OFF button in the keypad or by the radio via the IGNITION signal on the accessory connector.

If it is switched OFF by the ON / OFF button, the Enhanced Control Head communicates this to the radio. After the radio has shut down the OMAP releases the ON\_HOLD signal. If it is switched OFF by the radio it is told by a message from the radio to switch OFF. It has then also to release ON\_HOLD.

## Microprocessor Circuit

The Enhanced Control Head uses the TI microcontroller OMAP1621 (U201) to control the functions of the Enhanced Control Head. The firmware is contained in a flash memory of 16Mbytes (U204). When the firmware is executed it runs in the SRAM U205. Flash and RAM have a separate data, address and control bus and operate at a 1.8V level.

The internal clock oscillator with the Xtal Y201 and the components R221 and C204/C205 generate the system clock of 12MHz.

The 32.768 kHz clock mentioned above is also fed into the OMAP controller.

The power supply design assures that the core is powered first and then the I/O and USB voltages are supplied to the controller. After this the system comes out of RESET.

The internal display controller in the OMAP loads the images into the display.

The display module is connected to the main board by the 40 pin connector J201

## Keypad

The keypad interface of the OMAP can read the keypad matrix (COL5 - COL0 / ROW4 - ROW0) and discover which key has been pressed. The reading of the matrix is initiated by an interrupt.

The keypad PCB is connected to the main board by the 24 pin connector J401.

## One Wire interface

The One Wire signal from the OMAP is connected via a level shifter Q305, D301 and R309/R310 to a switch U301. The switch routes the One Wire interface either to the front GCAI connector or to the rear of the remote back housing connector if present.

The direction of the switch is chosen by the OMAP GPO signal ONE\_WIRE\_SEL.

## GCAI GPIOs and USB

The general purpose I/Os from the GCAI connector GPIO\_0\_PWR, GPIO\_3\_PTT and GPIO\_4\_HOOK are shifted from a 3.3V level to the OMAP I/O level of 2.8V by the bi-directional level shifters U302, U303 and U304. The direction of the signal is chosen by the OMAP GPOs GPIO\_0\_DIR, GPIO\_3\_DIR and GPIO\_4\_DIR.

The general purpose I/Os from the GCAI GPIO\_1 and GPIO\_2 are also level shifted by U323 and U325. As the USB signals D+ and D- share the same physical pin of the GCAI connector with the two GPIOs GPIO\_1 and GPIO\_2, the two switches U321 and U322 route the respective signals from the OMAP to the GCAI connector.

With the switches U326 and U327 the signals can be switched between the front GCAI connector and the rear GCAI connector when a remote back head is present. The two switches are controlled by the logical signal USB1\_GPIO and USB\_FRONT\_REAR.

The digital signal USB\_MODE\_SEL switches the resistors R327 and R328 to GROUND when the Enhanced Control Head USB is required to be host. If the Enhanced Control Head is an USB device USB1\_PUEN activates the pull up resistor R326.

When the Enhanced Control Head is USB host the signal USB\_VBUS\_ENA enables the power supply switch U324.

U324 provides 5V for USB to the FET switch and to the remote back head if present. The signal VBUS\_FET\_EN activates the FET Q326, which then switches the 5V to the GCAI connector. U324 has an internal over current detection, which will switch OFF the 5V if too much current is drawn. At the same time the signal VBUS\_OC\_DET goes to LOW and indicates the over current to the OMAP.

The comparator U328 compares the USB\_VBUS signal with 3.3V and delivers a HIGH on USB1\_DET when the VBUS voltage exceeds 3.3V. If the Enhanced Control Head is USB master it will detect its own voltage. When the Enhanced Control Head is USB device it will detect when a master is applied.

## Backlights

The PWM output LCD\_BL controls the current source Q201 and related circuitry. By this signal the current through the backlight diodes on the display module is determined. The supply voltage for the backlight diodes is the 23V source provided at J201 pin 32.

The PWM signal KPD\_BL controls the brightness of the 3 colour LED. It is routed via Q324 to the emitters of the two red/green switches Q404 and Q405. The digital signals LED\_GREEN and LED\_RED enable the colour by applying a HIGH to the basis of the respective transistor. Q504/Q505. When both switches are ON the light will be amber.

The digital signal KPD\_BL\_ON\_OFF switches the keypad backlight ON or OFF by means of the FET Q401.

The PWM signal LED\_EMERG is low pass filtered by R414/C410 and controls the brightness of the EMERGENCY key backlight.

## Rotary and push button

The push button S401 connects the LOCK\_ON signal to the FILT\_A+. LOCK\_ON is wired into the keypad matrix. The rotary S401 produces pulses on the two outputs PULSE\_A and PULSE\_B of a different phase when the knob is turned. These pulses are low passed R403 Expansion Head Enhanced Enhanced - R404 and C405/C406.

The B output is then applied to the D inputs of the two D-Flip Flops U401 and U402. The signal integrity of output A output is ensured by the two invert Schmitt triggers U403 and U404. The output pulse of U403 is the clock input for D-Flip Flop U401 and latches the status of the B signal with the rising edge. The second Schmitt trigger inverts the A signal another time and latches the B output into the D-Flip Flop U402 with its rising edge. Furthermore it serves as an interrupt RSW\_1 for the OMAP, which is the required to read the outputs of the two D-Flop Flops RSW\_2 and RSW\_INT. From the polarity of these two signals the OMAP can determine whether the rotary was turned clockwise or counter clockwise. The Flip Flops get a reset from the general board-reset POR

## Communication interface

In direct mount the radio and the Enhanced Control Head communicate with each other via a two wire communication interface BUS+ and SCI\_TX. This interface needs to be enabled by setting the RADIO\_COM\_EN signal to LOW and the BUS\_EN signal to HIGH.

RADIO\_COM\_EN enables the buffer U420-1 and supplies 5V to the operational amplifiers U421 and U422 via the transistors Q411 and Q412.

The BUS\_EN signal connects the SCI\_TX to the BUS+ line via Q410.

The speed of this interface is 115kBaud/sec.

The physical interface to the radio is J102 with the following signals: GROUND, ON\_OFF CONTROL, FILT\_A+, BUS+, HANDSET\_AUDIO, 5VD and SCI\_TX.

## Accessory Connector

The accessory connector J101 complies to the GCAI standard and provides the following signals: FRONT\_ONE\_WIRE, GPIO\_3\_PTT, HANDSET\_AUDIO, USB\_D-, GROUND, USB\_VBUS, INT\_MIC, USB\_D+, GPIO\_4\_HOOK and GPIO\_0\_PWR. For further information please refer to the GCAI specification.

## Enhanced Control Head in Remote Mount configuration

In remote configuration a remote mount back housing is attached to the back of the Enhanced Control Head.

It is connected to the Enhanced Control Head main board through J603.

A 10 pin Remote Mount cable on P101 connects the Remote Mount Back Housing Board to the radio transceiver with either Expansion Head Enhanced or remote head.

A 25 pin connector J105 gives access to the GCAI GPIOs, second USB, 4-wire RS232, Rear GCAI Pins and Audio.

The remote mount back head is detected by the OMAP by sending an I2C Bus request by means of the I2C clock and data lines I2C\_SCL and I2C\_SDA.

The routing of the GCAI GPIOs and the first USB is described already in the dash mount chapter. The 4-wire RS232 is connected to the UART 3 of the OMAP microcontroller. The signals for realizing the second USB port are directly provided by the OMAP and connected through the 40 pin connector J601 to the remote mount back housing board. The ON\_OFF\_CONTROL, BUS+, SCI\_TX as well as the HANDSET\_AUDIO and MIC lines are also routed via J602 to the rear of the remote mount back head.

The remote mount back head itself is controlled by I2C messages and the remote mount back head creates an interrupt to the OMAP when it has an I2C Bus message to deliver.

When the device was switched ON from the rear IGNITION line, the signal RM\_ON turns to HIGH and switches the signal GCAI to HIGH by means of D350 and Q353. Then the same ON procedure starts as in dash mount configuration. After the device is in ON\_HOLD and the OMAP has detected the ON source on the remote mount back housing it sent a LOW on RM\_GCAI\_PWR\_ON\_CLR to clear the RM\_ON.

### Remote Mount Back Head

#### Power supply

The remote mount back head is supplied from the Enhanced Control Head main board with the FILT\_A+ and unswitched 5 V when the device is switched OFF. When the device is switched ON by either the Enhanced Control Head front panel or from the radio accessory connector, VCC\_2.8V, VCC\_3.3V and the switched 5V will be also provided by the Enhanced Control Head main board.

When the device is switched ON from the rear IGNITION on the 25 pin rear connector by pulling J105 pin 25, to the battery voltage, the Transistor Q401 provides a rising edge to the D-Flip Flop U401 clock input. This latches the HIGH level on the D-input of U401 and creates an HIGH on RM\_ON. This turns ON the Enhanced Control Head main board as described above. At the same time a HIGH on IGN\_SENSE is applied to the I2C port expander U501 and generates an interrupt to the OMAP. When the main board has powered ON as described above it clears the Flip Flop by pulling RM\_GCAI\_PWR\_ON\_CLR to LOW.

An optional 5V can be turned ON supplying the rear GCAI (U304) even when NGCH is turned OFF.

#### RS232

The MAX3232E U303 transceiver provides level translation to RS232 levels of the 4 wire RS232 interface connected to UART3 of the OMAP that is internally routed to the camera interface.

## USB

There are 2 USB connections on the Remote Mount Back Housing Board. The first USB is shared with the front GCAI USB and the D- and D+ lines are switched ON the main board. The second USB is provided by the ISP1105 USB transceiver U302. It is interfaced to the OMAP's USB1 port. USB power supply is separately switched for both USBs via Q306 and Q307. Detection and switching is controlled by the I2C port expanders U501 and U502.

## Audio

Audio is on 2 wires for both directions and balanced and is routed from and to the Milan transceiver via the Gabel Hybrid U201. The Gabel Hybrid serves to transform the audio from unbalanced to balanced in order to reduce noise susceptibility on the remote cable. Receive or Handset Audio is routed to the main board and via 10uF to the 25 pin connector J105. Transmit or MIC audio is multiplexed by U203 and U204. Depending on PTT, these switches determine where the transmit audio is coming from. There are 3 sources: Front GCAI, Rear GCAI ON 25 pin connector and Rear MIC, also from the 25 pin connector J105.

## 1-Wire

The 1-Wire bus is routed from the 25 pin connector to the main board. It is shared between front and back GCAI and switched ON the main board.

## Bus+/SCI\_TX

Both BUS+ and SCI-TX serial communication lines have Pull-Ups to 5V. These 5 Volt needs to be turned ON/OFF by the OMAP in order to detect the ON/OFF status of the radio transceiver. This is done via the I2C port expander and Q503.

## Analogue 4-level Input:

An analogue 4-level input pin is available on the 25 pin connector (U503). The 4 levels are preset by resistor dividers R540 - R551 and detected by comparators U503. The 4 states can be read by I2C expander 501.

## I2C Port Expander settings and In/Output Matrix:

The heart of the Remote Mount Back Housing Board is the two PCA9535BS port expanders U501 and U502. The GPIOs and most detection and switching circuitry on the Back Housing Board are provided by these Port Expanders. The PCA9535BS provides 16 general purpose In/Output pins. It is interfaced to the OMAP's I2C bus via SDA (data) and SCL (clock) line. Both expanders are sharing the same interrupt, provided by an extra line GPIO\_REQ.

Under normal operating condition, the second port expander U502 has only outputs and static inputs (HW ID) connected to it, so no interrupt is generated by U502. All Inputs that generate an interrupt are connected to U501.

## Data Expansion Head Enhanced

### Overview

The Data Expansion Head Enhanced (PMLN4908\_) is a hardware interface to the MTM800 TETRA mobile radio. It gives access to the radio via three front side connectors. The following interfaces and protocols are provided:

- 8-wire RS232 Interface (9-pin D-type connector)



- 4-wire RS232 Interface (25-pin D-type connector)
- SB9600 Interface (25-pin D-type connector)
- SBEP Interface (10-pin Telco connector)
- 14 pin JTAG port

## General

The 25-pin D-type, the 9-pin D-type connector and the 10-pin Telco connector are mounted on the Connector Board that is screwed into the Data Expansion Head Enhanced housing. The Milan Expansion Board is installed at expansion board position. The interconnection between the Connector Board and the Milan Expansion Board is accomplished by a 40-pin flex connector.

A 12-pin flex and a 40-pin flex achieve the connection between the Expansion Board to the main radio chassis. A remote mount Enhanced Control Head can be connected in a remote mount configuration via the 10-pin Telco connector. External DCE(s) can be connected via the 25 pin and /or 9 pin D type connectors.

## Circuit Description

The Data Expansion Head Enhanced Interface consists of several circuits to provide interfaces for the MTM800 TETRA mobile radio and the "outside world".

The Expansion board has an onboard 3-Volt Regulator U501 that is driven by 5-Volt supply from the main radio via the 12-pin flex on J1001. The supply voltage FLT\_A+ is over current protected by the 2A fuse F101.

A second regulator U503 provides VAG\_1 of 9.3V for the Gabel Hybrids U201. This regulator will be shut down through Q501 when the 5V are detached

The Gabel Hybrid U201 serves to transform the audio from unbalanced to balanced in order to reduce noise susceptibility on the remote cable.

There are several interfaces on the board but not all of them are available at the same time

The 8 wire RS232 interface consists of the MAX3238 true RS-232 transceiver (U101) that provides the EIA/TIA-232 and V.28/V.24 communications interface. This interface can be fully accessed through the 9-pin D-connector.

The circuit comprising ICs U401, U403 and U404 interfaces the MTM800 SPIB bus to an asynchronous serial-data communication port RS232 that is the 4-wire RS232 interface (pins 2, 3, 4, 5).

U401 is a MAX3100 universal asynchronous receiver transmitter (UART) with a baud rate generator driven by a 3.6864 MHz crystal U402.

U404 is a MAX3232 RS232 transceiver, translating the 3V logic levels to the RS232 levels.

The next interface is an SB9600 interface on the 25-pin connector (pins 8, 13, 15, 17) (SB9600\_INTERFACE). The UART chip U401 also generates the transmit/receive signals of this interface.

The SBEP interface is provided on the 10-pin Telco remote connector. All signals necessary to connect a remote mount Enhanced Control Head are routed through this connector. Those signals are fed from the radio via the 12-pin flex (J1001). The SBEP interface is always available on the Telco connector.

The Expansion PTT signal on the Telco connector is routed through the Expansion Board via Q102 and Q103. This line signals the radio that PTT is coming from the Data Expansion Head Enhanced and the audio paths are routed through the Data Expansion Head Enhanced.

The JTAG port is provided on the back of the Expansion board. The pin layout of the connector is setup in a way that the JTAG connector used for software debugging can be directly connected to this port. A 14-pin m/m 90° adapter is needed to connect to the test equipment.

To select a specific configuration, pin 23 (SB9600\_SW) on the 25 pin D-type connector can be used.

Also the ACC3 pin on the 12-pin flex and pin 19 on the JTAG connector influence which interface is active in the Data Expansion Head Enhanced at a specific time. Default if nothing is connected to the radio is that the 8-wire RS232 interface and 4-wire RS232 interface are active.

A high voltage (12V) on pin 23 enables the 8-wire RS232 interface on the 9-pin D-type connector. At the same time the SB9600 interface on the 25-pin connector is enabled. A low voltage (0V = default) on pin 23 enables the 8 wire RS232 interface on the 9-pin connector and the 4 wire RS232 interface on the 25-pin connector.

If a device is connected to the accessory connector of the radio, the 8-wire RS232 interface in the Data Expansion Head Enhanced is disabled. Also, if the JTAG port is used, a 3-Volt level is applied to pin 19 of the JTAG, the 8-wire RS232 interface is disabled.

## Remote Head Enhanced

### General

The Remote Head Enhanced (PMLN4904\_) and the radio are connected via 10-pin TELCO connectors. A 12-pin flex connects the radio to one remote mount PCB.

### Description

The remote mount board basically routes the signals necessary to drive a Enhanced Control Head from the radio to the remote mount cable and to the Remote Mount Enhanced Control Head. The signals (ON\_OFF\_CONTROL, BUS+, SCI\_TX and the supply voltage) are directly routed from the flex connector J301 to the TELCO connector J302. Microphone and speaker audio are transformed from unbalanced to balanced by the Gabel Hybrid U202 in order to reduce noise susceptibility on the remote cable.

The regulator U201 provides VAG\_1 of 9.3V for the Gabel Hybrids U202. This regulator will be shut down through Q101 when the 5V are detached. The supply voltage FLT\_A+ is over current protected by the 2A fuse F101.

VR301 - VR304 protects the board against electrostatic discharge

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## Enhanced Control Head in Motorcycle configuration

When the Enhanced Control Head is used on a motor cycle, it is electrically same as remote mount configuration. The housing of the remote mount back head and the TELCO connector are mechanically modified to meet the IP67 requirement.

## Notes

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## CHAPTER 5

# PROGRAMMING THE TERMINAL

**Note:** For programming the terminal, refer to TETRA Customer Programming Software (CPS) Start-up User Guide, Publication No. 6802974C10\_

## Notes

## CHAPTER 6 TEST SETUP & TESTING

 <b>WARNING</b>	<p>Any level 3 repairs can deeply affect the performance of the MTM800 ENH terminal and may cause a new tuning procedure. This tuning procedure can only be applied by certain authorized Motorola depots where the appropriate TEST&amp;TUNE EQUIPMENT is available. The appropriate TEST&amp;TUNE EQUIPMENT is a special automated test equipment which is only available at some Motorola factories and Motorola repair centers.</p>
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### Typical Test Setup

#### Before Testing

Carry out the following instructions before testing:

- Connect the DC cable to the DC connector on the terminal.
- Connect the other side of the DC cable to the DC output connector on the power supply
- Connect an RF cable to the N-type RF Connector of the IFR.
- Connect the other side of the RF cable to the antenna connector on the terminal.
- Set the DC voltage on the power supply to 13.2 Volts.
- Switch on the terminal.

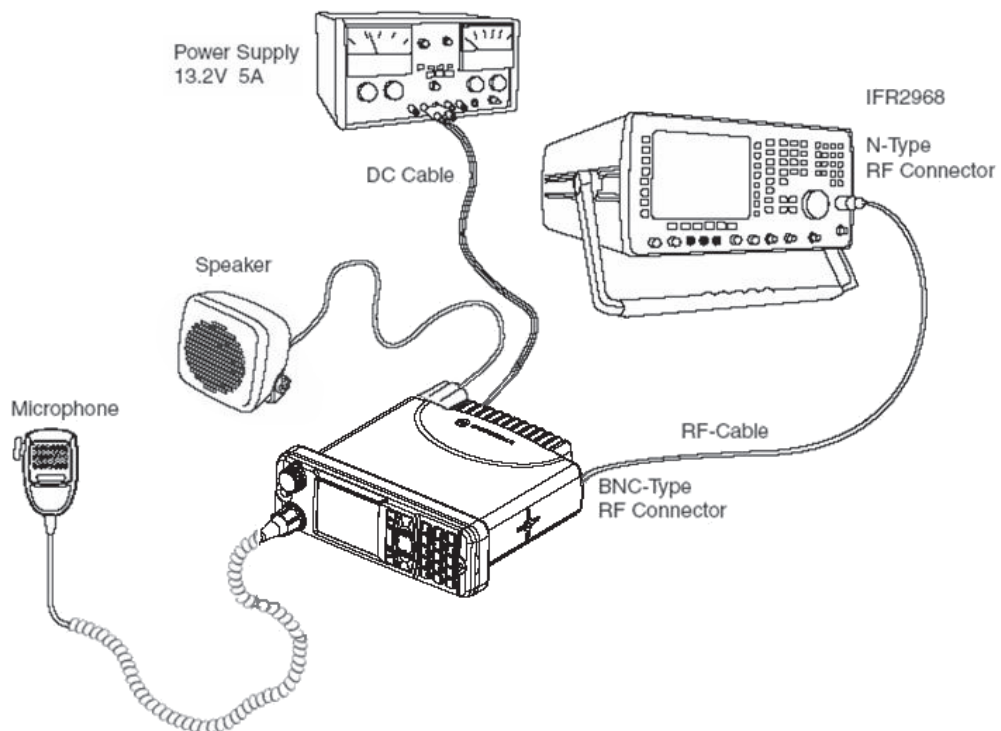


Figure 6-1 Typical Test Setup

## Test Equipment

The table below lists the special test equipment required for servicing TETRA mobile terminals.

**Table 6-1** Test Equipment

Name	Part Number
Digital Multimeter	R1072_
220V Power Supply	R1011_/220V
TETRA SVC MON. MOBILES ONLY	WADN4161A
TETRA SVC MON. MOB.+ DIR.MODE	WADN4163A
TETRA SVC MON. MOB.+ BASE ST.	WADN4164A
TETRA SVC MON. MOB.+ BASE ST. + DIRECT MODE	WADN4173A
TETRA SVC MON. MOB.+ DIR.MODE + MPT1327/1343	WADN4233A



## Test Check List

The following table summarises the required test setups.

**Table 6-2** Test setup

No.	Test Name	Test Setup	Terminal Setup	Test Conditions	Limits	
1.	IFR System Setup and Manual Test Screen	Control Channel		For 450--470MHz terminal: 2440		
		Traffic Channel		For 450--470MHz terminal: 2440		
		Time Slot		3		
		Country Code		262		
		Network Code		75		
		Base Colour		1		
		Location Area		224		
		Min Rx Level			-110dBm	
		Max Tx Level			35dBm (3.2W)	
		Access Parameter			-33dBm	
		Mobile Power	35dBm (3.2W)			
Burst Type			Normal			
2.	Base Station Registration	RF Gen Level	For 450--470MHz terminal: 461.0125MHz	-90dBm		
3.	Receiver RSSI	RF Gen Level	4 Cells Info RSSI TRACE	-90dBm		
4.	Transmitter Tests	RF Gen Level	Range 1 Talk Group 1	-90dBm		
		Burst Power			33-37dBm	
		Timing Error			<=0.25 Symbols	
		Frequency Error			-/+ 100Hz	
		Vector Error			Max 10% RMS, Max 30% Peak, Max 5% Residual	
5.	Call Processing Talk Back	1KHz Test Signal Group Mode	Range 1 Talk Group 1	-90dBm		
6.	Call Processing Call to Mobile	Private Mode Private Call	Private Mode			
		RF Gen Level Burst Power		-90dBm	33-37dBm	
		Timing Error			<=0.25 Symbols	

**Table 6-2** Test setup

No.	Test Name	Test Setup	Terminal Setup	Test Conditions	Limits
		Frequency Error			-/+ 100Hz
		Vector Error			Max 10% RMS, Max 30% Peak, Max 5% Residual
7.	Digital Duplex Test (Tx)	RF Gen Level	Private Mode	-50dBm	
		Burst Power			10-22dBm
		Timing Error			<=0.25 Symbols
		Frequency Error			-/+ 100Hz
		Vector Error			Max 10% RMS, Max 30% Peak, Max 5% Residual

## Receiver Tests

1. Simulate Base Station (registration)
2. RSSI Test

## Transmitter Tests

1. Power Profile
2. Power Burst (Control Range)
3. Tx Burst Timing Error
4. Tx Frequency Error
5. Vector Error RMS, Peak and Residual

## Call Processing Tests

1. Talk Back
2. Call to Mobile

## Duplex Test

1. Digital Duplex Test (Tx)

Measurement Capabilities:

Bar chart display for Tx Power, Frequency Error, Vector Error RMS, Power Analyzer, Spectrum Analyzer, Vector Analyzer, Vector Diagrams.

## Configuration of the IFR 2968 System Setup

The setup depends on the firmware version of the IFR 2968, the firmware version of the terminal and the customer programming of the terminal.

>>The following table should be taken only as an example of how to proceed for setup.<<  
Perform the following steps to configure the IFR 2968 System Setup with the terminal settings.:

1. Turn ON the IFR.
2. Press the "Systems" Mode Key (wait until the digital system is initialised).
3. Press the "Tetra Mobile" soft key.
4. Press the "Setup" soft key and enter the System Parameters Screen.
5. Press the "Channel Plan" or "System Type" soft key.
6. Press the "Tetra 450MS" soft key for 450-470.
7. Press the "More" soft key if the Type cannot be seen.

**Note:** If the required Mobile soft key in step 6 and step 7 is not displayed, the system needs to be set up manually as in step 8. If the MS type was chosen in step 6 and step 7 continue with step 9.

8.
  - a. Press the "More" soft key until the "User defined" soft key is displayed.
  - b. Press the "User Defined" soft key in the next menu again.
  - c. Press the "User Defined" soft key once more.
  - d. Press the "Frequency Band" soft key and press the "4 (450-470MHz)" soft key. Press the "More" soft key if the band is not displayed.
  - e. Press the "Offset" soft key and press the "3 (12.5kHz)" soft key.
  - f. Press the "Duplex Spacing" soft key and press the "0 (10MHz)" for 450-470MHz soft key
  - g. Press the "Reverse Operation" soft key and press the "0 (Normal)" soft key.
  - h. Press the "Channel Block 1" soft key.
  - i. Press the "Channel Block" soft key and press the "Include" soft key.
  - j. Press the "Lowest Channel" soft key and enter "2440" for 450-470MHz using the data keys followed by the "Lowest Channel" soft key.
  - k. Press the "Highest Channel" soft key and enter "2799" for 450-470MHz using the data keys followed by the "Highest Channel" soft key.
  - l. Press the "Lowest Tx Freq" soft key and enter "461.0125" for 450-470MHz using the data keys followed by the "MHz" key.
  - m. Press the "Duplex Offset" soft key and enter "10" for 450-470MHz using the data keys followed by the "MHz" key.
  - n. Press the "Channel Spacing" soft key and enter "25" using the data keys followed by the "kHz" key.

- o. Press the "Return" soft key.
  - p. Verify that channel block 2 to 8 are excluded.
  - q. Press the "Return" soft key.
9. Press the "Control Channel" soft key and enter "2440" for 450-470MHz using the data keys followed by the "Control Channel" soft key.
  10. Press the "Traffic Channel" soft key and enter "2440" for 450-470MHz using the data keys. Press the "Traffic Channel" soft key again and check that the marker goes to Timeslot. Press data key "3" followed by the "Traffic Channel" soft key, to change to Timeslot "3".
  11. Press the "Country Code" soft key.  
Enter "262" and press the "Country Code" soft key.
  12. Press the "Network Code" soft key.  
Thereafter, enter "75" and press the "Network Code" soft key.
  13. Press the "Base Color" soft key.  
Thereafter, enter "1" and press the "Base Color" soft key.
  14. Press the "Location Area" soft key.  
Thereafter, enter "224" and press the "Location Area" soft key.
  15. Press the "Min Rx Level" soft key.  
Thereafter, enter "-110dBm" and press the "Min Rx Level" soft key.
  16. Press the "Max Tx Level" soft key.  
Thereafter, enter "35dBm (3.2W)" and press the "Max Tx Level" soft key.
  17. Press the "Access Parameter" soft key.  
Thereafter, enter "-33dBm" and press the "Access Parameter" soft key.
  18. Press the "Test Mode" soft key. Press the "Enable" soft key.
  19. Press the "Base Service" soft key.
  20. Press the "Support" soft key if it is displayed  
or verify that the following values are displayed:

<b>POWER ON REGISTRATION:</b>	<b>REQUIRED</b>
<b>POWER OFF DE-REGISTRATION:</b>	<b>REQUIRED</b>
<b>PRIORITY CELL:</b>	<b>YES</b>
<b>MINIMUM MODE SERVICE:</b>	<b>NEVER USED</b>
<b>MIGRATION:</b>	<b>SUPPORTED</b>
<b>SYSTEM WIDE SERVICE:</b>	<b>NORMAL MODE</b>
<b>TETRA VOICE SERVICE:</b>	<b>SUPPORTED</b>
<b>CIRCUIT MODE DATA SERVICE:</b>	<b>SUPPORTED</b>
<b>(RESERVED):</b>	<b>NOT AVAILABLE</b>
<b>SND CP SERVICE:</b>	<b>NOT AVAILABLE</b>
<b>AIR INTERFACE ENCRYPTION:</b>	<b>NOT AVAILABLE</b>
<b>ADVANCED LINK:</b>	<b>NOT SUPPORTED</b>

**Note:** The displayed values are factory defaults and should not be changed.

21. Press the "Return" soft key.
22. Press the "Neighbr Cell" soft key.
23. Verify that the following values are displayed:

<b>NEIGHBOUR CELL BROADCAST:</b>	<b>NOT REQUIRED</b>
<b>BROADCAST INTERVAL:</b>	<b>10s</b>
<b>NEIGHBOUR CELL CHANNEL:</b>	<b>0000</b>
<b>NEIGHBOUR CELL LOCATION AREA:</b>	<b>00001</b>
<b>NEIGHBOUR CELL IDENTIFIER:</b>	<b>01</b>
<b>SLOW RE-SELECT THRESHOLD:</b>	<b>10dB</b>
<b>SLOW RE-SELECT HYSTERESIS:</b>	<b>10dB</b>
<b>FAST RE-SELECT THRESHOLD:</b>	<b>10dB</b>
<b>FAST RE-SELECT HYSTERESIS:</b>	<b>10dB</b>

**Note:** The displayed values are factory defaults and should not be changed.

24. Press the "Return" soft key.
25. Verify that "Trunking Type" is set to "Message".
26. Press the "Call Type" soft key to enter the "Call Type" screen.
27. Press the "Private Call" soft key.
28. Press the "Simplex Duplex" soft key and "Simplex Call" soft key.
29. Press the "Signal Type" soft key and "Direct set –up" soft key.
30. Press the "Priority" soft key. Thereafter, enter "00" and press the "Priority" soft key.
31. Leave "Calling Party SSI" setting to default value.
32. Press the "Return" soft key.
33. This completes the System Setup configuration.

---

## Configuration of the IFR 2968 Manual Test Screen

The setup depends on the firmware version of the IFR 2968, the firmware version of the terminal and the customer programming of the terminal. The following procedure is only an example.

1. To enter "Manual test" screen, press the "Manual" soft key.
2. Press the "Control Channel" soft key. Thereafter, enter the control channel Number and press the "Control Channel" soft key. The control channel Number is "2440" = Rx 461.0125MHz.
3. Press the "Traffic Channel" soft key. Enter "2440" for 450-470MHz and press the "Traffic Channel" soft key. The marker goes to Timeslot. Enter "3" and press the "Traffic Channel" soft key. (Note that the Traffic Channel number changes automatically after entering the Control Channel number).
4. Press the "RF Gen Level" soft key. Thereafter, enter "-90" and press "dBm" data keys followed by "RF Gen Level" soft key.
5. Press the "Mobile Power" soft key, enter "35 dBm/3.2W", using soft key.
6. Press the "Burst Type" soft key and "Normal" soft key.
7. This completes the Manual test equipment configuration setup.

**Note:** The System Setup Configuration Data is saved even after the power is turned off. However, the Manual Test Setup is not saved.

---

## RF Tests

---

### Receiver Tests

#### Simulate Base Station (registration)

1. Turn the terminal ON  
When the terminal is in Trunked Mode, continue with step 2. Otherwise perform steps a through c.
  - a. Press "Options" using the Lower (soft) key
  - b. Press the "Down" navigation key to scroll to "Trunked Mode".
  - c. Press "Select" using the Lower (soft) key
2. Check that registration and "ITSI: ---/---/01490199" (as example only) is displayed on the IFR "Manual Test" screen.

**Note:** The number "01490199" is the terminal ID (ISSI) which is displayed when the terminal is switched on.

### RSSI Test

**Note:** To perform procedure below the Test Page field must be enabled using the CPS

**Before carrying out the following steps, record the Insertion loss (dB) of the cable loss value - (X) dB.**

1. In the IFR Manual Test Mode, press the "RF Gen Level" Soft Key and enter -90 dBm.
2. Before testing, the terminal should be configured to RSSI mode using the following sequence. When performing steps 3 through 6, make sure that you press the Enhanced Control Head keys sequentially (less than a second between every consecutive press).
3. Press the "\*" key.
4. Press the "#" key.
5. Press the "Menu" key.
6. Press the "Right Navigation" key.

**Hereafter, there is no need for quick sequence of pressing the Enhanced Control Head keys.**

7. Press the "Down" navigation key to scroll to "Cells Info".
8. Press "Select" using the Lower (soft) key.
9. Press the "Right" navigation key to scroll to the RSSI monitoring screen.
10. Press "Trace" using the Lower (soft) key.

**Note:** RSSI results will flash on the screen every few seconds.

The display shows: **SERV: 0/34348**

**RSSI: -90**

**CX: 20**

**CHQ: 99/E0**

Disregard the "SERV", "CX" and "CHQ" results.

**Actual RSSI measured**

=IFR RF Gen Level - Cable insertion loss +/- other stray losses.

**Range of Actual RSSI measured**

= -90dBm - XdB (cable) +/- 1 dB.

**Terminal RSSI result should be within the range of Actual RSSI.**

**To stop the "Trace" process, perform the following. When performing steps 11 through 14, make sure that you press the Enhanced Control Head keys sequentially (less than a second between every consecutive press):**

11. Press the "\*" navigation key.
12. Press the "#" key.
13. Press the "Menu" key.
14. Press the "Right Navigation" key.

**Hereafter, there is no need for quick sequence of pressing the Enhanced Control Head keys.**

15. Press "Select" using the Lower (soft) key.
16. Press "Stop" using the Lower (soft) key.
17. Press "Back" using the Upper (soft) key twice.

---

## Transmitter Tests

**Before you start these tests, make sure that the terminal is in Trunked Mode.**

1. Press "Options" using the Lower (soft) key.
2. Press the "Down" navigation key to scroll to "TG by abc".
3. Press "Select" using the Lower (soft) key.
4. Scroll to one of the available groups and press select using the Lower (soft) key.
5. In the IFR Manual Test Mode press the "RF Gen Level" soft key. Enter "-90dBm" by pressing the data keys and "RF Gen Level" key.
6. Press the "PTT" of the terminal and monitor the IFR "Manual Test" screen which displays the Power Profile, Burst Power, Timing Error, Frequency Error and Vector Error.

**Note:** You have to hold the PTT in the pressed position long enough to enable you to read the results.

**- Power Profile:**

**Passed.**



- Burst Power Required Results:	<b>33-37dBm.</b>
- Timing Error:	<b>≤ 0.25 symbols.</b>
- Vector Error:	<b>Max 10% RMS, Max 30% Peak, Max 5% Residual.</b>
- Frequency Error:	<b>+/- 100Hz.</b>

7. Press the "Clear Down" soft key, to proceed with other tests.

---

## Call Processing Test

**Before you start these tests, make sure that terminal and test equipment are configured the same as given in the Transmitter Test.**

### Talk Back

1. Press "Options" using the Lower (soft) key on the terminal and change to one of the available groups.
2. In the IFR Manual Test Mode press the "RF Gen Level" soft key. Enter "-90dBm" by pressing the data keys and "RF Gen Level" key.
3. Press the "PTT", press the "Talk Back" soft key on the IFR and speak into the mic of the terminal for at least 3sec, then release "PTT". You will hear from the terminal speaker the last three seconds of the speech frames before the "PTT" has been released.
4. Press the "Test Sound" soft key to provide the 1kHz signal to the terminal speaker.
5. Press the "Silence" soft key to mute the 1KHz audio signal of the speaker.
6. Press the "Clear Down" soft key and check that the "Cleardown Complete" status appears on the IFR "Manual Test" screen.

### Call to Mobile

1. In the IFR Manual Test Mode press the "RF Gen Level" soft key. Enter "-90dBm" by pressing the data keys and "RF Gen Level" key.
2. Press the "Call Mobile" soft key and select "Private Call" on the IFR. Verify that two beeps are heard from the terminal speaker.
3. Press the "Abort Call" soft key.

### Duplex Test (Phone/Private Mode)

#### Digital Duplex Test (Tx)

1. In the IFR Manual Test Mode press the "RF Gen Level" soft key. Enter "-50dBm" by pressing the data keys and "RF Gen Level" key.

2. Dial a random 4 digit number (eg "9359") using the alphanumeric keys of the terminal, press "Calltype" using the Lower (soft) key until "Phone #" is displayed and press

the "Send" Key



The following results are displayed on the IFR "Manual Test" Screen

- Power Profile: **Passed**
- Burst Power Required Results: **10-22dBm**
- Timing Error: **≤ 0.25 Symbols.**
- Frequency Error: **-/+ 100Hz**
- Vector Error: **Max 10% RMS,  
Max 30% Peak.  
Max 5% Residual.**

3. Press the "Talk Back" soft key.
4. Speak into the terminal microphone and hear your speech (after a short delay) from the terminal loudspeaker.  
**Note:** If you need more details, press the "Duplex Test" mode key.
5. Press the "duplex test (Tx)" soft key. The "Digital Duplex test" results will be displayed on the IFR screen providing you with either one of the following:
  - **bar charts measurement capabilities showing Tx Power, Frequency Error and Vector RMS in one screen**
  - **Tx Power (more details in Power Analyser)**
  - **Frequency Error (more details in Spectrum Analyser)**
  - **Vector RMS (more details in Vector Analyser)**

**For Power Analyser Graph:**

6. Press "power ana" soft key.
7. Check that the power frame falls within the limits.

**For Spectrum Analyser Graph:**

8. Press "spec ana" soft key.
9. Monitor the Tx frequency.

**For Vector Analyser Diagram:**

10. Press the "vector ana" soft key.
11. Monitor the diagram for the following:
  - **press "vector error" soft key for vector error.**
  - **press "mag error" soft key for magnitude error.**
  - **press "phase error" soft key for phase error.**
  - **Vector Error**
  - **Magnitude Error**
  - **Phase Error**

**For Vector Diagram:**

12. Press the "vector diagram" soft key.
13. View the following:
  - press "symbol constel" soft key for graphical symbol constellation.
  - press "rotated vector" soft key to zoom in on the constellation.
  - press "phase traject" soft key to view trajectory of the constellation.

14. Press the terminal "End" key.



## Manual Mode Testing

### Preparation for Testing

Verify that the radio is turned off.

Press the "1", "2" and "3" keys together and then, press the On/Off key or the Rotary Push Button to turn the radio on. Keep the "1", "2" and "3" keys pressed until the display turns on.

The display shows "User test mode, Press any key to start, Press SoftKeys to scroll".

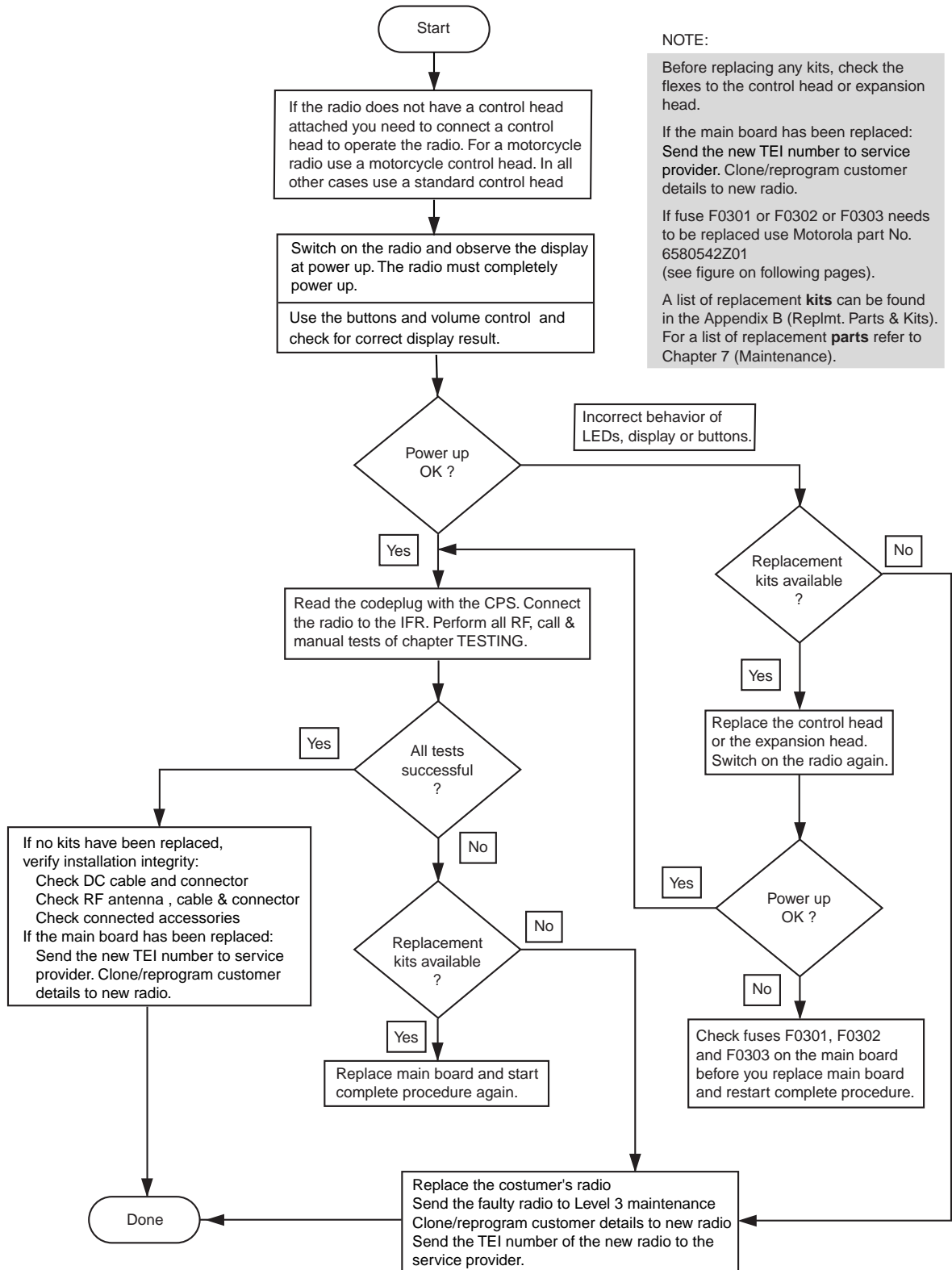
### Tests

**Note:** Any key that will be pressed will cause the test to advance from one step to the next. You can use the soft keys to go to the next or back to the previous test. After a test has started you can press the upper soft key to go back to the start of the current test. At any time you can switch off the radio by pressing the On/Off key for 2 seconds.

1. Press any key to start the first test. The display shows "LCD Red-Green-Blue test".
2. Press any key consecutively. First the display shows horizontal red lines that become thicker with every key press, until it becomes fully red. Then the display shows vertical green lines that become thicker with every key press, until it becomes fully green. After that the display shows horizontal blue lines that become thicker with every key press, until it becomes fully blue.
3. Press any key to start the next test. The display shows "LCD Color brightness test"
4. Press any key consecutively. The display shows the color brightness levels "min", "low", "med" and "max". Verify the color brightness of the display.
5. Press any key to start the next test. The display shows "Display backlight test"
6. Press any key consecutively. The display shows the backlight brightness levels "min", "low", "med" and "max". Verify the brightness of the display.  
**Note:** At level "min" the display contents is not visible.
7. Press any key to start the next test. The display shows "Keypad backlight test"
8. Press any key again. The display shows "Keypad backlight is off". Verify that the keypad backlight is off.

9. Press any key again. The display shows "Keypad backlight is on". Verify that the keypad backlight is on.
10. Press any key to start the next test. The display shows "Emergency backlight test"
11. Press any key consecutively. The display shows the emergency button brightness levels "min", "low", "med" and "max". Verify the brightness of the emergency button.
12. Press any key to start the next test. The display shows "Status LED test"
13. Press any key again. The display shows "Red LED is on" and the Red LED at the right side of the radio is lit.
14. Press any key again. The display shows "Green LED is on" and the Green LED at the right side of the radio is lit.
15. Press any key. The display shows "Orange LED is on" and the orange LED at the right side of the radio lit.
16. Press any key consecutively. The display shows the LED brightness levels "min", "low", "med" and "max". Verify the brightness of the orange LED at the right side of the radio.
17. Press any key to start the next test. The display shows "Keypad test"
18. Press any key again. The display shows all the radio keys.
19. Press every key, one by one. Each key you press causes its respective display to be highlighted. If you press a highlighted key again, the highlighting is removed. To exit this test before all keys are highlighted press the rotary push button.
20. Press any key to start the next test. The display shows "Rotary test"
21. Turn the rotary switch clockwise and counter clockwise. Each step causes the respective displayed arrow sign to be highlighted. Turn the rotary switch until the two respective "OK" labels are highlighted.
22. Press the rotary push button consecutively until "OK" is highlighted.
23. Press any key to start the next test. The display shows "Fist MIC test"
24. Press any key to continue. Connect a fist microphone. The display shows "Accessory connected"
25. Press PTT to highlight all "0".
26. Place the microphone on / off hook to highlight all "0".
27. Press any key again. The display shows "End of user tests", "Press any key to power off or use softkeys to scoll to any previous test".
28. This completes the test. Press any key to turn the radio OFF.

# Service Flow Chart (Board Level)



**NOTE:**

Before replacing any kits, check the flexes to the control head or expansion head.

If the main board has been replaced: Send the new TEI number to service provider. Clone/reprogram customer details to new radio.

If fuse F0301 or F0302 or F0303 needs to be replaced use Motorola part No. 6580542Z01 (see figure on following pages).

A list of replacement kits can be found in the Appendix B (Replmt. Parts & Kits). For a list of replacement parts refer to Chapter 7 (Maintenance).

Figure 6-2 Servicing the MTM800 ENH



# CHAPTER 7

## MAINTENANCE

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### Introduction

This chapter provides details about the following:

- Preventive maintenance (inspection and cleaning)
- Safe handling of CMOS and LDMOS devices
- Pre-baking of Integrated Circuits
- Repair procedures and techniques
- Disassembly and reassembly of the terminal
- Exploded views and parts lists

---

### Preventive Maintenance

The terminals do not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

#### Inspection

Check that the external surfaces of the terminal are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

#### Cleaning

The following procedures describe the recommended cleaning agents and methods to be used when cleaning the external and internal surfaces of the terminal. External surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, compound, or grime. Internal surfaces (circuit boards and components) should be cleaned only when the terminal is disassembled for servicing or repair.

The only recommended agent for cleaning external terminal surfaces is a 0.5% solution (one teaspoon of detergent per gallon of water) of mild dishwashing detergent in water. The internal surfaces should be cleaned only with isopropyl alcohol (70% by volume).

**NOTE:** Internal surfaces should be cleaned only when the terminal is disassembled for service or repair.



**CAUTION:** The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners, and other chemicals.

## Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the terminal. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the terminal. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

## Cleaning Internal Circuit Boards and Components

Isopropyl alcohol (70%) may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the terminal. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. After completing of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

**NOTE:** Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).



## Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of terminals, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. Handling precautions are mandatory for CMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the terminal without first referring to the following CAUTION statement.

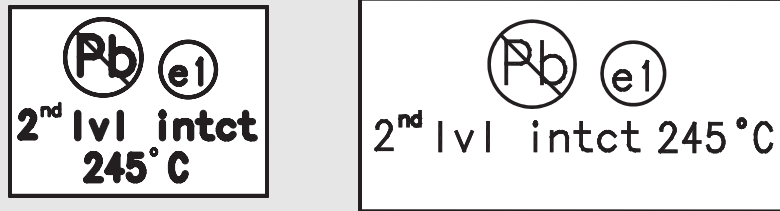


**CAUTION: This terminal contains static-sensitive devices. Do not open the terminal unless you are properly grounded. Take the following precautions when working on this unit:**

- **Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.**
- **Ground the working surface of the service bench to protect the CMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.**
- **Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number RSX4015\_).**
- **Do not wear nylon clothing while handling CMOS devices.**
- **Do not insert or remove CMOS devices with power applied. Check all power supplies used for testing CMOS devices to be certain that there are no voltage transients present.**
- **When straightening CMOS pins, provide ground straps for the apparatus used.**
- **When soldering, use a grounded soldering iron.**
- **If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.**

## General Repair Procedures and Techniques

**NOTE** Environmentally Preferred Products (EPP) (refer to the marking on the printed circuit boards — examples shown below) were developed and assembled using environmentally preferred components and solder assembly techniques to comply with the European Union’s **Restriction of Hazardous Substances (ROHS) Directive 2002/95/EC** and **Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC**. To maintain product compliance and reliability, use only the Motorola specified parts in this manual.



Any rework or repair on Environmentally Preferred Products must be done using the appropriate lead-free solder wire and lead-free solder paste as stated in the following table:

**Table 7-1** Lead Free Solder Wire Part Number List

Motorola Part Number	Alloy	Flux Type	Flux Content by Weight	Melting Point	Supplier Part number	Diameter	Weight
1088929Y01	95.5Sn/3.8Ag/0.7Cu	RMA Version	2.7-3.2%	217C	52171	0.015"	1lb spool

**Table 7-2** Lead Free Solder Paste Part Number List

Motorola Part Number	Manufacturer Part Number	Viscosity	Type	Composition & Percent Metal	Liquid Temperature
1085674C03	NC-SMQ230	9001000KCPs Brookfield (5rpm)	Type 3 (-325/+500)	(95.5%Sn-3.8%Ag-0.7%Cu) 89.3%	217°C

### Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement component is not locally available, check the parts list for the proper Motorola part number and order the component from the nearest Motorola Communications parts center listed in the “Piece Parts” section of this manual.

### Rigid Circuit Boards

The family of radios uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The through-plated holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.

When soldering near connector pins:

- avoid accidentally getting solder in the connector.
- be careful not to form solder bridges between the connector pins
- closely examine your work for shorts due to solder bridges.

## Chip Components

Use the RLN4062 Hot-Air Repair Station for chip component replacement. Adjust the temperature control to 390 °C (735 °F), and adjust the airflow to a minimum setting. Airflow can vary due to component density.

- **To remove a chip component:**
  1. Use a hot-air hand piece and position the nozzle of the hand piece approximately 0.3 cm (1/8) above the component to be removed.
  2. Begin applying the hot air. Once the solder reflows, remove the component using a pair of tweezers.
  3. Using a solder wick and a soldering iron or a power desoldering station, remove the excess solder from the pads.
- **To replace a chip component using a soldering iron:**
  1. Select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads.
  2. Using a pair of tweezers, position the new chip component in place while heating the fresh solder.
  3. Once solder wicks onto the new component, remove the heat from the solder.
  4. Heat the remaining pad with the soldering iron and apply solder until it wicks to the component. If necessary, touch up the first side. All solder joints should be smooth and shiny.
- **To replace a chip component using hot air:**
  1. Use the hot-air hand piece and reflow the solder on the solder pads to smooth it.
  2. Apply a drop of solder paste flux to each pad.
  3. Using a pair of tweezers, position the new component in place.
  4. Position the hot-air hand piece approximately 0.3 cm (1/8" ) above the component and begin applying heat.
  5. Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

## Shields

Removing and replacing shields is recommended to be done with the Air Blower, BOSCH GHG 603 or equivalent.

- **To remove the shield:**
  1. Place the circuit board in the circuit board holder.
  2. Add solder paste flux around the base of the shield.
  3. Position the heat-focus head onto the shield.
  4. Turn on the heater and wait until the shield lifts off the circuit board.
  5. Once the shield is off, turn off the heat, and grab the part with a pair of tweezers.
  6. Remove the circuit board from the circuit board holder.
- **To replace the shield:**
  1. Add solder to the shield if necessary, using a micro-tipped soldering iron.
  2. Next, rub the soldering iron tip along the edge of the shield to smooth out any excess solder. Use solder wick and a soldering iron to remove excess solder from the solder pads on the circuit board.
  3. Place the circuit board back in the circuit board holder.
  4. Place the shield on the circuit board using a pair of tweezers.



## Repair Procedures and Techniques - General

### Parts Replacement and Substitution

When damaged parts are replaced, identical parts should be used. If the identical replacement part is not locally available, check the parts list for the proper Motorola part number and order the part from the nearest Motorola Communications parts center listed in the "SUPPORT CENTRES" section of this manual.

### Disassembling and Reassembling the Terminal - General

Since these terminals may be disassembled and reassembled with the use of only six (board to casting) screws, it is important to pay particular attention to the snaps and tabs, and how parts align with each other.

The following tools are required for disassembling the terminal:

- Small flat blade screwdriver
- Dismantling Tool (Motorola Part No.: 6686119B01)
- TORX™ T screwdriver
- **TORQUES:**

<b>Diecast Top Cover (6x):</b>	<b>1.92 Nm ... 2.03Nm</b>	<b>(17-18 lbin)</b>
<b>GPS Cover (5x), GPS Board (1x):</b>	<b>1.13 Nm +/- 10%</b>	<b>(10 lbin +/- 10%)</b>
<b>UCM Board Cover (3x):</b>	<b>1.13 Nm +/- 10%</b>	<b>(10 lbin +/- 10%)</b>
<b>Enhanced Control Head Screws:</b>	<b>0.57Nm +/- 0.046Nm</b>	<b>(5 lbin +/- 0.4 lbin)</b>

**NOTE:** If a unit requires more complete testing or service than is customarily performed at the basic level, send this unit to a Motorola Authorized Service Center (refer to Appendix A: Support Centers). The following described disassembly procedures should be performed only if necessary.

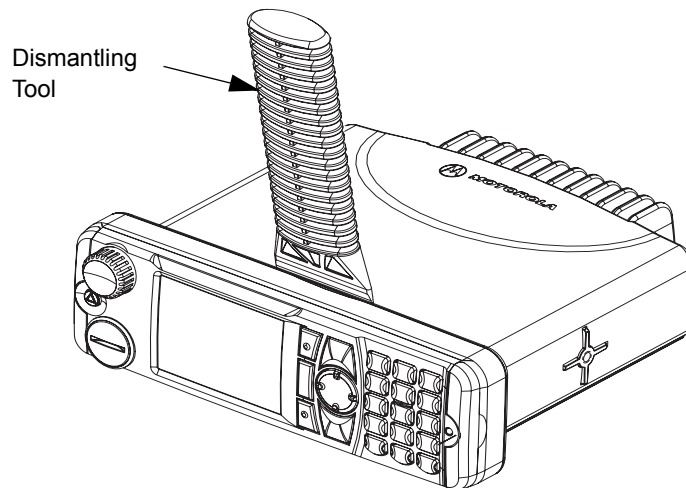
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## Terminal Disassembly and Reassembly - Detailed

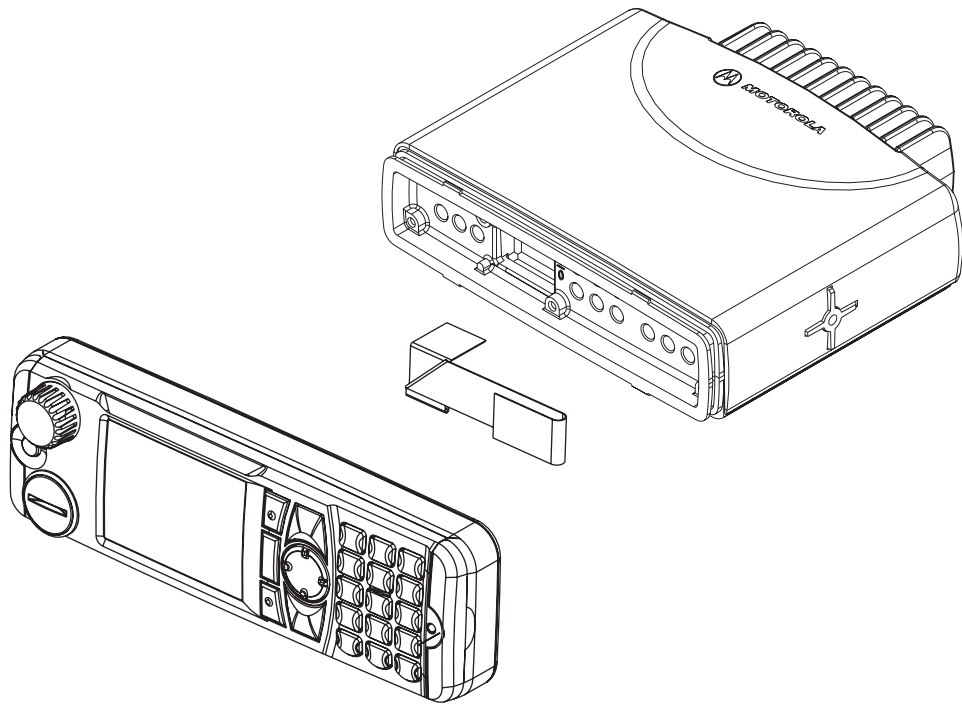
The procedure to remove and replace an Enhanced Control Head, Top Cover or Transceiver Board is similar for all models of terminal. A typical procedure is therefore shown followed by specific disassembly procedures for Enhanced Control Heads, Remote Head Enhanced and Data Expansion Head Enhanced on terminal models.

### Enhanced Control Head Removal

1. Insert the dismantling tool in the groove between the Enhanced Control Head and the terminal assembly as shown in the Figure.
2. Press on the dismantling tool until the snap connectors on the side of the Enhanced Control Head release from the terminal assembly.
3. Pull the Enhanced Control Head away from the terminal assembly as shown below.



**Figure 7-1** Typical Enhanced Control Head Removal

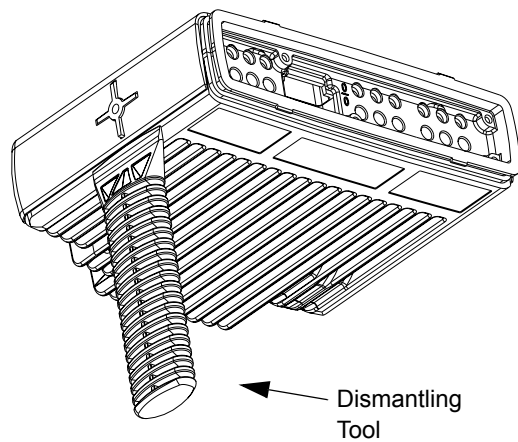


**Figure 7-2** Flexible Connection Removal

4. Remove the flexible connection from the socket on the Enhanced Control Head board.

### Top Plastic Cover Removal

1. Insert the dismantling tool in the middle of the terminal assembly side groove as shown in Figure 7-3.
2. Press on the dismantling tool until the snap connectors on the side of the plastic cover release from the terminal chassis.
3. Lift the plastic cover from the chassis.



**Figure 7-3** Top Cover Removal.

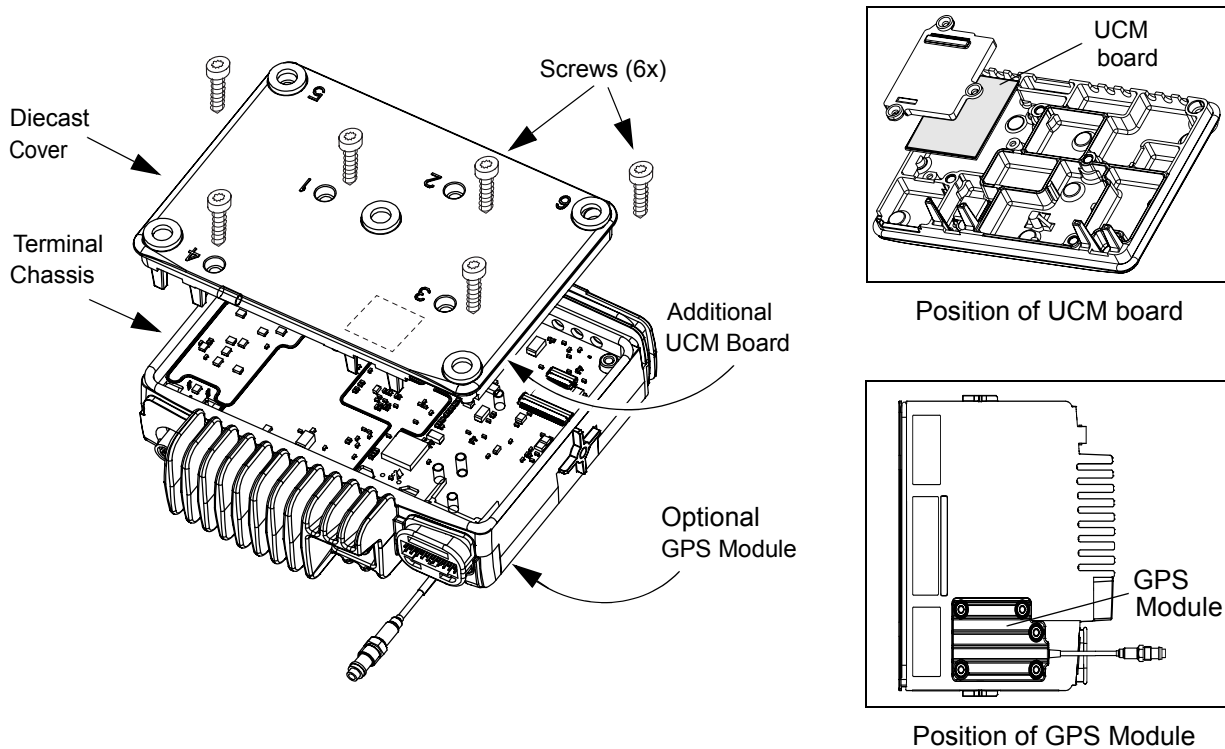
### Transceiver Board Removal



**CAUTION:** Some terminals are equipped with a GPS module at the left side bottom of the transceiver and/or an additional UCM Board inside the transceiver cover plate, refer to special label at the cover plate (dotted line at the figure below).

There are flex cables installed connecting these boards to the main board. Take extra care not to tear off the flex when dis-assembling or re-assembling the board from/to the transceiver or this could damage the GPS/UCM Board and the main board (refer to chapter explosion views figure 11, 12 for a detailed view).

1. Remove six screws from the diecast cover using the T20 TORX™ driver as shown in Figure 7-4.
2. If existing remove the metal GPS cover from the bottom (5 screws, T10 TORX™). Remove the internal GPS board (one screw) from the transceiver and disconnect the flex cable from the main board.
3. Lift the cover from the chassis.



**Figure 7-4** Diecast Cover Removal

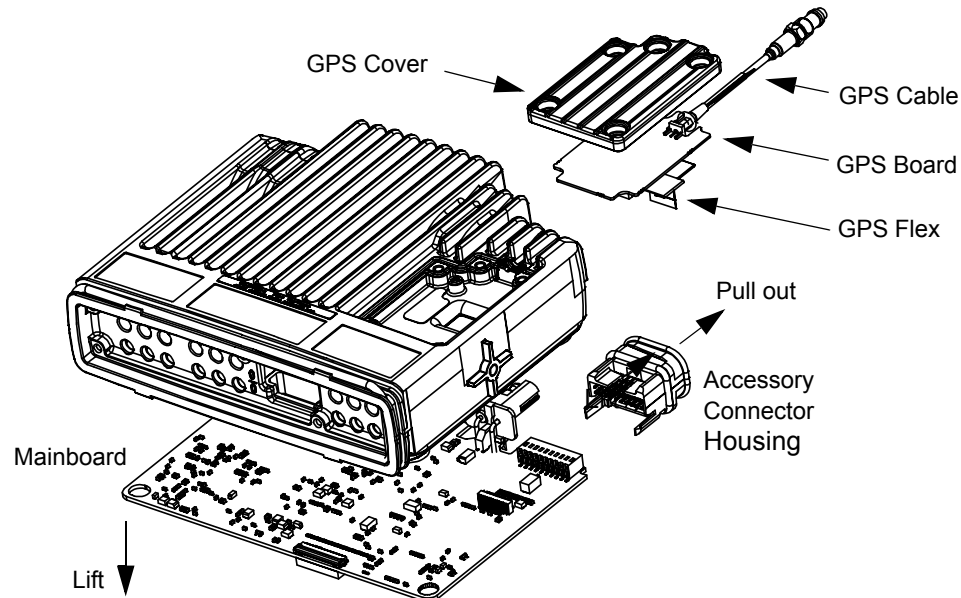
4. Pull out the plastic accessory connector housing to the back.
5. Slowly lift the transceiver board on the edge at the front of the terminal (the edge that mates with the Enhanced Control Head) and pull gently toward the front of the terminal as shown in Figure 7-5. Take care to slide the antenna connector and power connector out of the chassis towards the front.
6. If existing, take extra care of the UCM Board inside the cover plate and disconnect the flex



cable from the mainboard.



**CAUTION:** The thermal pad can act as an adhesive and cause the leads of the heat dissipating devices to be over stressed if the board is lifted too quickly. If the board can't be easily lifted, the chassis must be heated up to 55 degree Celsius.



**Figure 7-5** GPS and Mainboard Removal (view from bottom side)

### Reassembly the Terminal Chassis And Transceiver Board (torques, see page 7-7)

1. Inspect the transceiver board and ONLY if the surface of the thermal pads show signs of damage, remove the thermal pads and apply thermal grease to the heatsink area on the chassis and heat dissipating devices.
2. Insert the transceiver board at an angle (approximately 30°) into the chassis taking care to slide the antenna connector and accessory connector into their cut-outs in the chassis.
3. Lower the transceiver board onto the chassis and align the two locating holes in the board with the locating pins in the chassis.
4. If a UCM board was mounted, reconnect the flex cable to the mainboard. Take care of the specific flex bending. Note: After removal the UCM board has to be reprogrammed (App. C).
5. Secure the cover to the chassis with the six screws previously removed.
6. Torque the six screws to 1.9 NM (17 in lbs) using the T20 TORX™ driver. Begin with screw 6 followed by 5 to 1. Since the screws usually take a set, torque the screws a second time (1.9 NM) in the same order.
7. If existing, reconnect the GPS flex cable and reassemble the GPS module and cover plate.
8. Refit top cover over the assembled terminal chassis. Press cover down until it snaps into place.

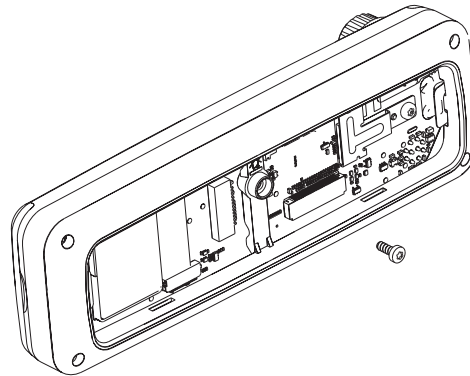
### Enhanced Control Head Fitting

1. Align the 'dot' or 'O' marking on the flex with the 'O' mark on the chassis to the socket on the terminal assembly as shown in Figure 7-2.
2. Check that the back housing o-ring seal is undamaged and fitted in the groove. Replace the seal if it is damaged (refer to the exploded view diagrams and parts list).

3. Fit the back housing to the Enhanced Control Head. Ensure that the tags on the back housing align with the snap catch grooves on the Enhanced Control Head. Press the back housing into place until it snaps into place.
4. Check that the terminal chassis o-ring seal is undamaged and fitted in the groove on the chassis assembly. Replace the seal if it is damaged.

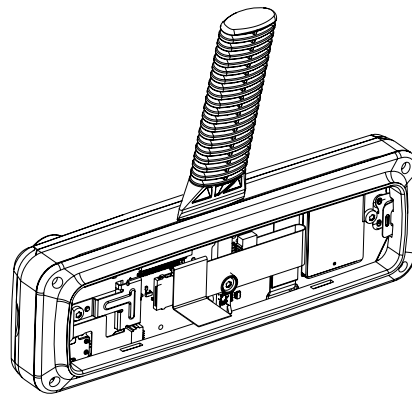
### Enhanced Control Head - Disassembly

1. Remove the middle screw from the back of the Enhanced Control Head using a T10 TORX™ as shown in the following figure.



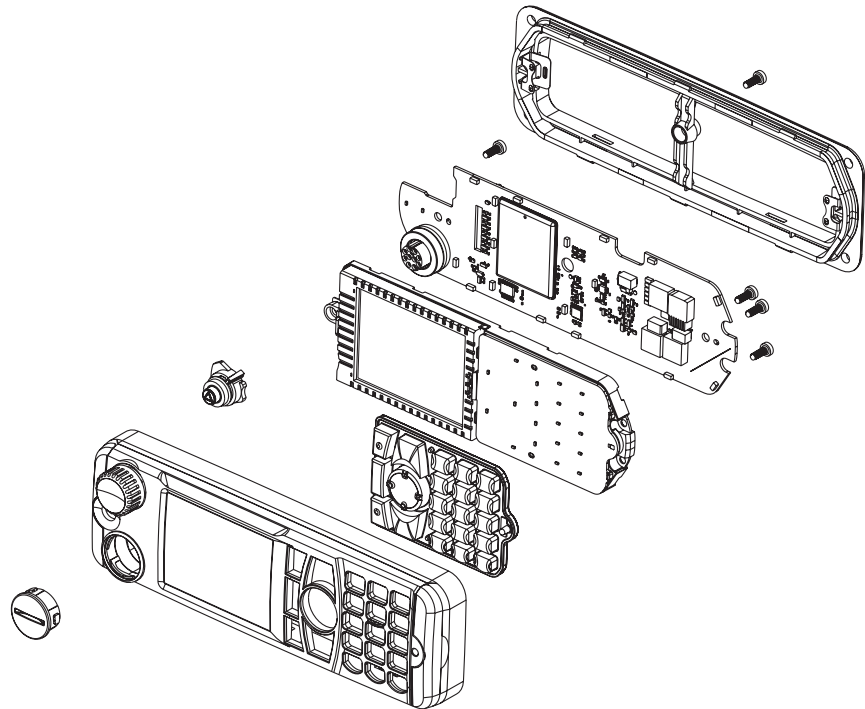
**Figure 7-6** Middle Screw Removal

2. To dismount the Enhanced Control Head front housing from the back housing, insert the dismantling tool in the groove between the two housings as shown in the following figure.



**Figure 7-7** Enhanced Control Head Back Housing Removal

3. Press the dismantling tool until the snap connectors on the side of the back housing release from the Enhanced Control Head.



**Figure 7-8** Enhanced Control Head Board Removal

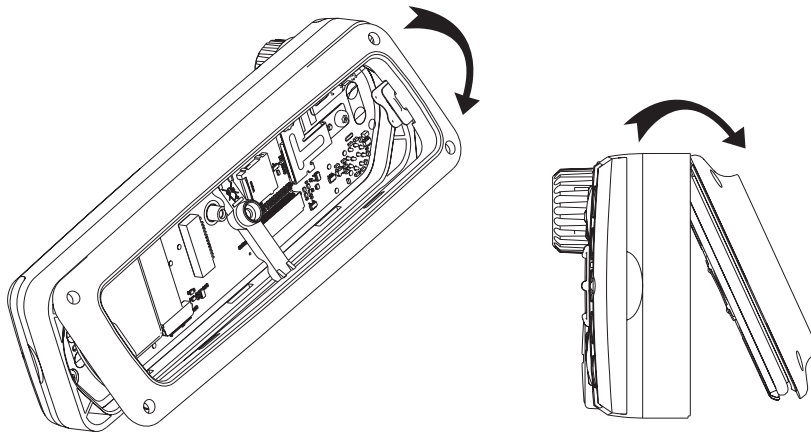
4. Remove the board from the Enhanced Control Head front housing by unscrewing the screws using a T10 TORX™ and disassemble the encoder switch flex from the socket on the board.
5. Remove the board from the Enhanced Control Head housing by stretching the Enhanced Control Head housing and pulling up the board.
6. Remove the keypad by gently pressing the keypad out from the Enhanced Control Head front housing.

**NOTE** Care should be taken not to touch or contaminate the conductive pads on the under side of the keypad or the conductive contacts on the printed circuit board.

### Enhanced Control Head - Reassembly

1. Fit the rubber keypad onto the Enhanced Control Head housing and ensure that the keypad is correctly aligned and pressed onto the groove on the front housing.
2. Assemble the board to the Enhanced Control Head front housing.
3. Assemble the encoder switch flex to the socket on the board.
4. Screw the two 8mm self tapping screws and one 14mm self tapping screw.

5. Snap the back housing into the Enhanced Control Head front housing in the orientation shown below.



**Figure 7-9** Reassemble Enhanced Control Head Housing

6. Screw the middle screw to the back housing.

## Remote Head Enhanced - Disassembly



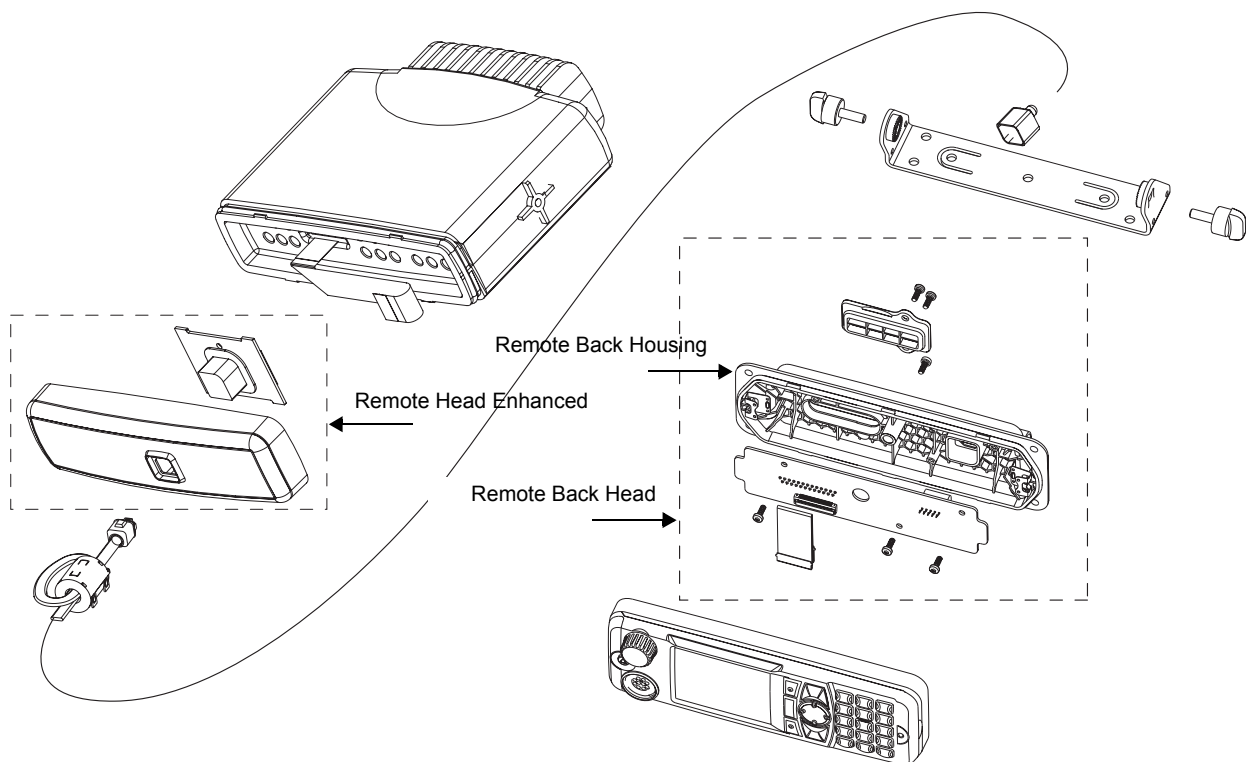
**CAUTION:** The terminal must be disconnected from the power supply before commencing any disassembly. The Installation Manual should be referred to for more detailed information on warnings and safety.

### To Disassemble the Remote Head Enhanced from the Terminal:

1. Remove the Remote Head Enhanced (PMLN4904\_) from the Transceiver by inserting the dismantling tool (Motorola part number 6686119B01) in the recess between the Remote Head Enhanced and the Transceiver.

**NOTE:** To minimize cosmetic damage disassemble from the bottom side (label side).

2. Remove the flex.



**Figure 7-10** Remote Mount Enhanced Control Head with Remote Head Enhanced

## Remote Head Enhanced - Reassembly

### To Reassemble the Remote Front Housing:

1. Connect the flex from the Remote Head Enhanced to the top small connector in the Transceiver.

**NOTE:** For correct orientation of the flex in the Transceiver, the “plastic” tab should be up, contacts facing down. Align the ‘dot’ or ‘O’ marking on the flex with the ‘O’ mark on the Transceiver. The flex must be pushed into the connector until it meets the stop.

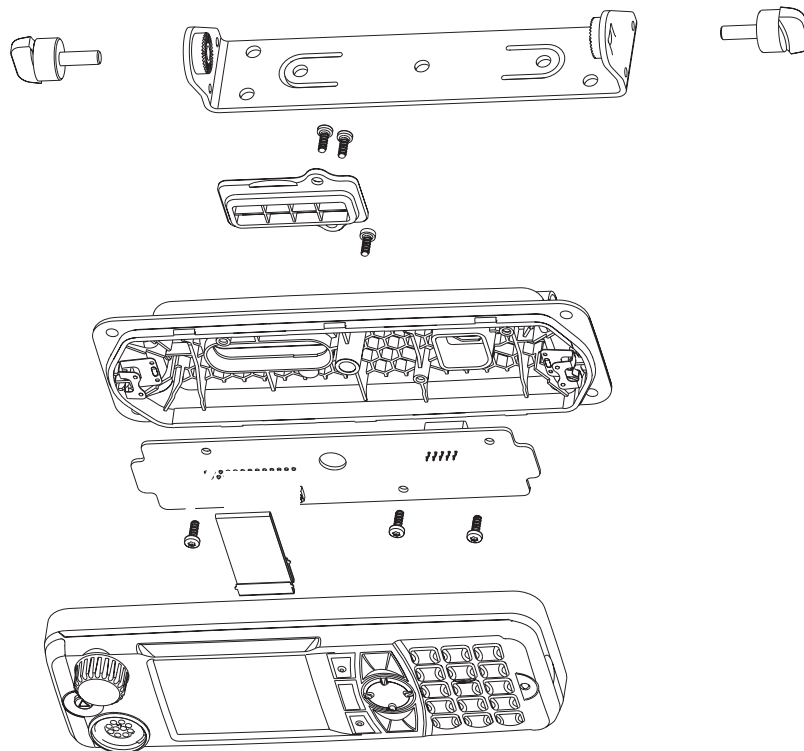
2. Press the Remote Head Enhanced onto the Transceiver chassis until the chassis tabs snap into place.

## Remote Mount Enhanced Control Head - Disassembly

### To Disassemble the Remote Mount Enhanced Control Head:

1. Unscrew the wing screws of the remote trunnion and remove the remote trunnion from the Remote Mount Enhanced Control Head.
2. Unscrew the middle screw from the back housing.
3. Remove the back housing by inserting the dismantling tool (Part No. 6686119B01) in the recess between the back housing and Remote Mount Enhanced Control Head front housing.

4. Remove the flex between the remote PCB and Main PCB.
5. Remove the board from the Remote Mount Enhanced Control Head front housing by unscrewing the screws using T10 TORX™ and disassemble the encoder switch flex from the socket on the board.
6. Remove the board from the Remote Mount Enhanced Control head front housing by stretching the Remote Mount Enhanced Control Head front housing and pulling up the board.
7. Remove the keypad by gently pressing the keypad out from the Remote Mount Enhanced Control Head front housing.
8. Unscrew 3 screws using T10 TORX™ to extract remote PCB from the remote back housing.



**Figure 7-11** Remote Mount Enhanced Control Head

### Remote Mount Enhanced Control Head - Reassembly

1. Fit the rubber keypad onto the Remote Mount Enhanced Control Head front housing and ensure that the keypad is correctly aligned and pressed onto the groove of the front housing.
2. Assemble the board to the Remote Mount Enhanced Control Head front housing.
3. Assemble the encoder switch flex to the socket on the board.
4. Screw the two 8mm self tapping screws and one 14mm self tapping screw.
5. Assemble the remote PCB into the remote back housing by screwing the 3 screws.
6. Connect the flex from the remote board on the back housing to the connector on the PCB board of the Remote Mount Enhanced Control Head front housing.
7. Snap the back housing into the Remote Mount Enhanced Control Head front housing.
8. Screw the middle screw to the back housing.

## Data Expansion Head Enhanced - Disassembly



**CAUTION:** The terminal must be disconnected from the power supply before commencing any disassembly. The Terminal Installation Manual should be referred to for more detailed information warnings and safety.

### To Disassemble the Data Expansion Head Enhanced from the Terminal

1. Remove the Data Expansion Head Enhanced from the transceiver by inserting the dismantling tool (Part No. 6686119B01) in the recess between the expansion head enhanced and the transceiver.

**NOTE:** To minimize cosmetic damage disassemble from the bottom side, (label side).

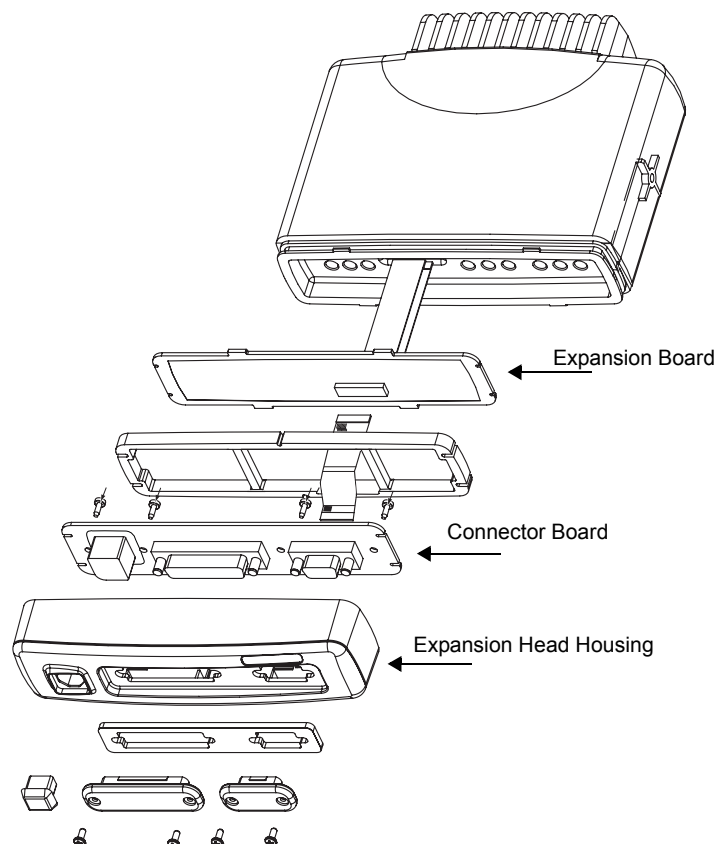
2. Remove the two flexes from the terminal.

### To Disassemble the Expansion Board from Expansion Head Housing

1. Remove the board from the expansion head housing by levering the expansion head housing and pulling up on the expansion board.

**NOTE:** The 40 pin connector has a top latch that needs to be lifted before the flex is inserted and closed after flex insertion.

2. Lift the top latch and remove the 40-Pin flex from connector board.



**Figure 7-12** Expansion Head Enhanced Exploded View

### To Disassemble the Connector Board from Expansion Head Housing

1. Remove the silicon rubber frame
2. Remove the four screws from the connector board.
3. Remove all the protection caps on the front of the expansion head housing.
4. Lift the connector board from the expansion head housing.

## Data Expansion Head Enhanced - Reassembly

### To Reassemble the Data Expansion Head Enhanced

1. Insert the connector board into the expansion head housing.
2. Secure the connector board with the four screws previously removed.
3. Insert the rubber frame
4. Insert the 40 pin flex from the connector board to the Expansion board, ensuring that the top latch is firmly closed.
5. Snap the Expansion board into the expansion head housing
6. Connect the 12 line flex to the Terminal, top small connector.
7. Connect the 40 line flex to the Terminal, bottom large connector

**NOTE:** For correct orientation of the flex align the 'dot' or 'O' marking on the flex with the 'O' mark on the PCB.

8. Close the top latch after flex insertion
9. Push the expansion head housing onto the Transceiver until all 4 tabs snap firmly into place.

**NOTE:** The Expansion Head has a protection grade of IP54. To maintain IP54 sealing when connecting a RS232 data cable make sure to use a IP54 specified cable. (example: ROLINE AT-Modem cable ST-BU 1,8m order no. 11.01.4518)

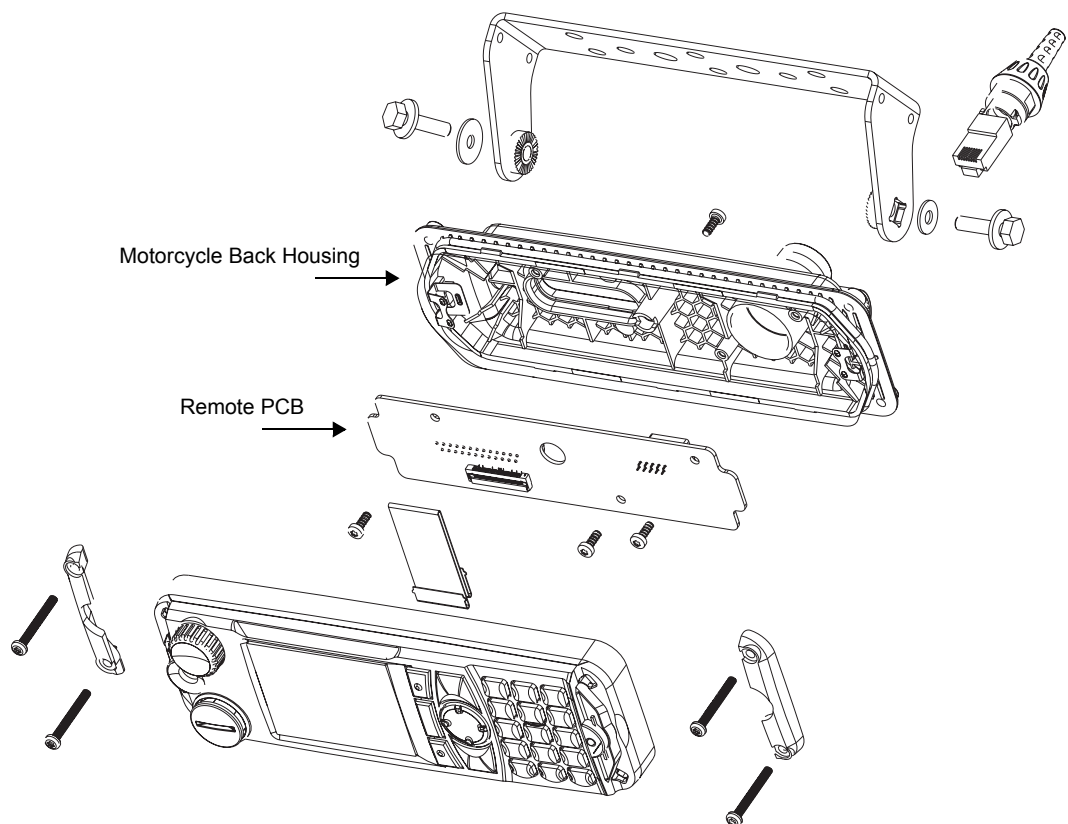
**NOTE:** The flex is not designed for continuous insertion, replace after several uses.



## Motorcycle Mount Enhanced Control Head - Disassembly

### To disassembly the Motorcycle Mount Enhanced Control Head:

1. Unscrew the screws of the Motorcycle Mount Enhanced Control Head trunnion and remove the Motorcycle Mount Enhanced Control Head from the trunnion.
2. Twist and pull out the telco cable from the connector.
3. Unscrew the middle screw from the back housing.
4. Unscrew the four screws of the two side caps.
5. Remove the back housing by inserting the dismantling tool (Part No. 6686119B01) in the recess between the back housing and Motorcycle Mount Enhanced Control Head front housing.



**Figure 7-13** Motorcycle Enhanced Control Head Exploded View

6. Remove the flex between the remote PCB and Main PCB.
7. Remove the board from the Motorcycle Mount Enhanced Control Head front housing by unscrewing the screws using T10 TORX™ and disassemble the encoder switch flex from the socket on the board.
8. Remove the board from the Motorcycle Mount Enhanced Control head front housing by stretching the Motorcycle Mount Enhanced Control Head front housing and pulling up the board.
9. Remove the keypad by gently pressing the keypad out from the Motorcycle Mount Enhanced Control Head front housing.
10. Unscrew 3 screws using T10 TORX™ to extract remote PCB from the motorcycle back housing.

## Motorcycle Mount Enhanced Control Head - Reassembly

1. Fit the rubber keypad onto the Motorcycle Mount Enhanced Control Head front housing and ensure that the keypad is correctly aligned and pressed onto the groove of the front housing.
2. Assemble the board to the Motorcycle Mount Enhanced Control Head front housing.
3. Assemble the encoder switch flex to the socket on the board.
4. Screw the two 8mm self tapping screws and one 14mm self tapping screw.
5. Assemble the remote PCB into the motorcycle back housing by screwing the 3 screws.
6. Connect the flex from the remote board on the back housing to the connector on the PCB board of the Motorcycle Mount Enhanced Control Head front housing.
7. Snap the back housing into the Motorcycle Mount Enhanced Control Head front housing.
8. Screw the middle screw to the back housing.

## Service Aids

The following table lists the service aids recommended for working on the terminal. While all of these items are available from Motorola, most are standard workshop equipment items, and any equivalent item capable of the same performance may be substituted for the item listed.

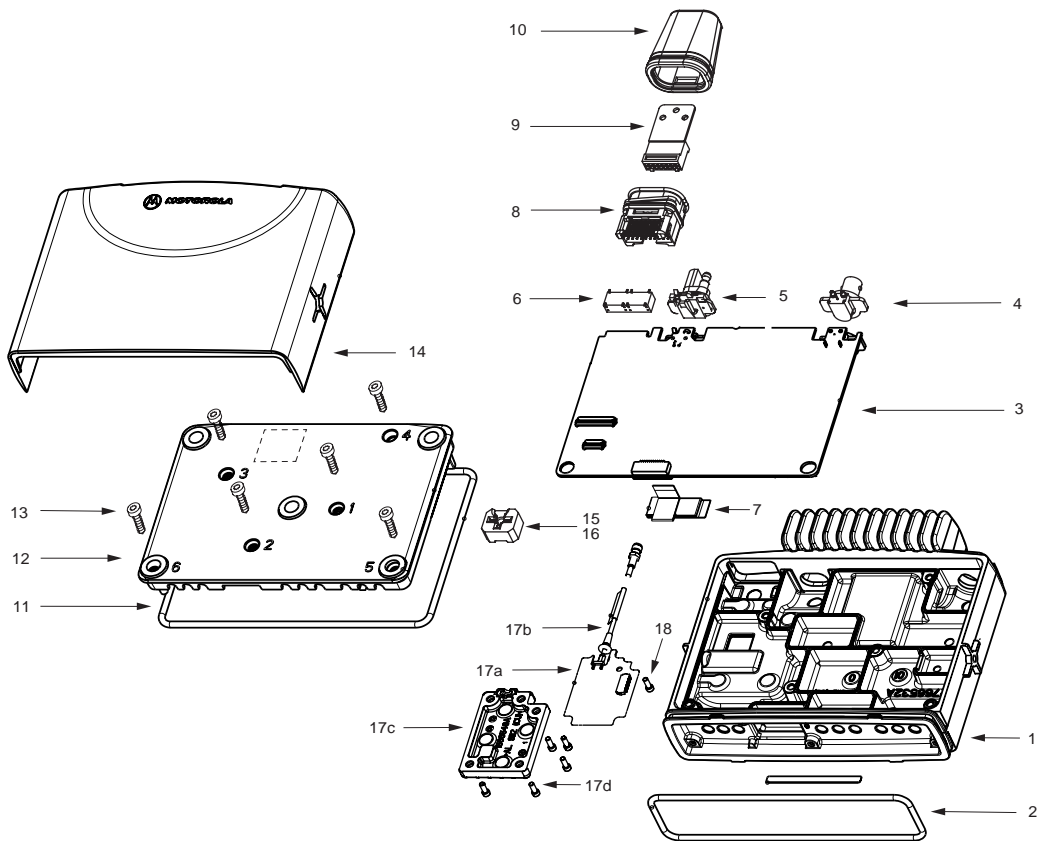
**Table 7-4** Service Aids

Motorola Part No.	Description	Application
6666500A01	Housing Eliminator	Test Fixture used to bench test the terminal pcb
6686119B01	Dismantling Tool	Assists in the removal of terminal Enhanced Control Head
0180320B16	Torx Screw Driver Kit (T6,8,10,15,25)	
6680321B81	Torx Bit	
6680321B56	Insert Bit extra long	
T-20 TORX (or equivalent)	Screwdriver with torque meter	

## EXPLODED VIEWS & PARTS LISTS

**NOTE:** For optimum performance, all replacement parts, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

### Transceiver - Exploded View and Parts List

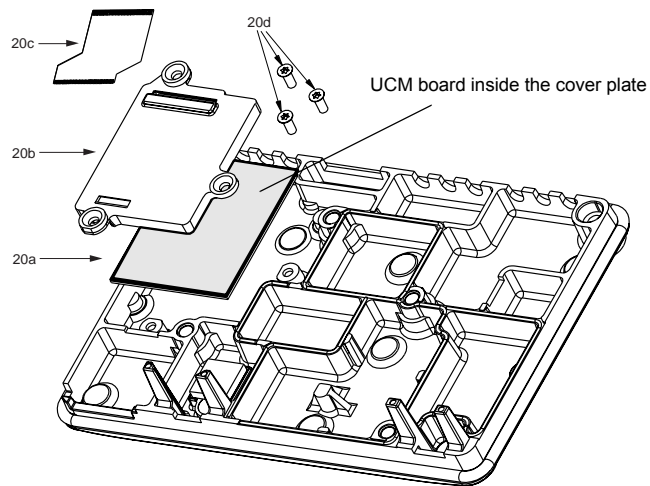


**Figure 7-14** Transceiver Exploded View

**NOTE:** Terminals with special label **OPTION BOARD MOUNTED** (see dotted lines on figure above) are equipped with an additional board inside the transceiver cover plate. Refer to the figure next page before disassembling such terminals.

**Table 7-5** Transceiver Parts List

<b>Item No.</b>	<b>Description</b>	<b>Part Number</b>
1	Chassis (item 2 included)	2766532A01
2	Gasket, Enhanced Control Head	3202620Y01
3	Main PCB (items 4 - 7 included)	refer to Appendix: Service Kits
4	BNC Antenna Connector	0986166B01
5	Power Connector	0986165B01
6	Accessory Connector	0986105B01
7	Flex to optional GPS	3066541B01
8	Connector Assembly	2886122B02
9	Connector Housing 16Pos.	1580922V01
10	Gasket Accessory Connector	3202606Y02
11	Gasket Cover	3286095B01
12	Cover	1566511A02
13	Screw T20, 6x (M4)	0310911A30
14	Cover, Plastic	1586170B01
15	Silicon Pressurepad for UHF only	7566500A01
16	Silicon Pressurepad for 800MHz only	7566502A01
17	GPS Module Kit:	0166502N65
	17a GPS Board with flex	0166502N20
	17b Coax Cable	3366540B01
	17c GPS Cover	1566548A01
	17d Screw, 5x (M3x8)	0310907A19
18	Screw for GPS board, 1x (M3x8)	0310907A19
19	Bushing for IP 54 Protection w/o GPS (not shown)	4366504A02
20	UCM Board Kit:	GMLN4210_
	20a UCM Board Module	CLN8041_
	20b UCM Board Cover	0786183B01
	20c UCM Board Flex	8485615Z02
	20d Screw 3x (M5x8)	0310943R55



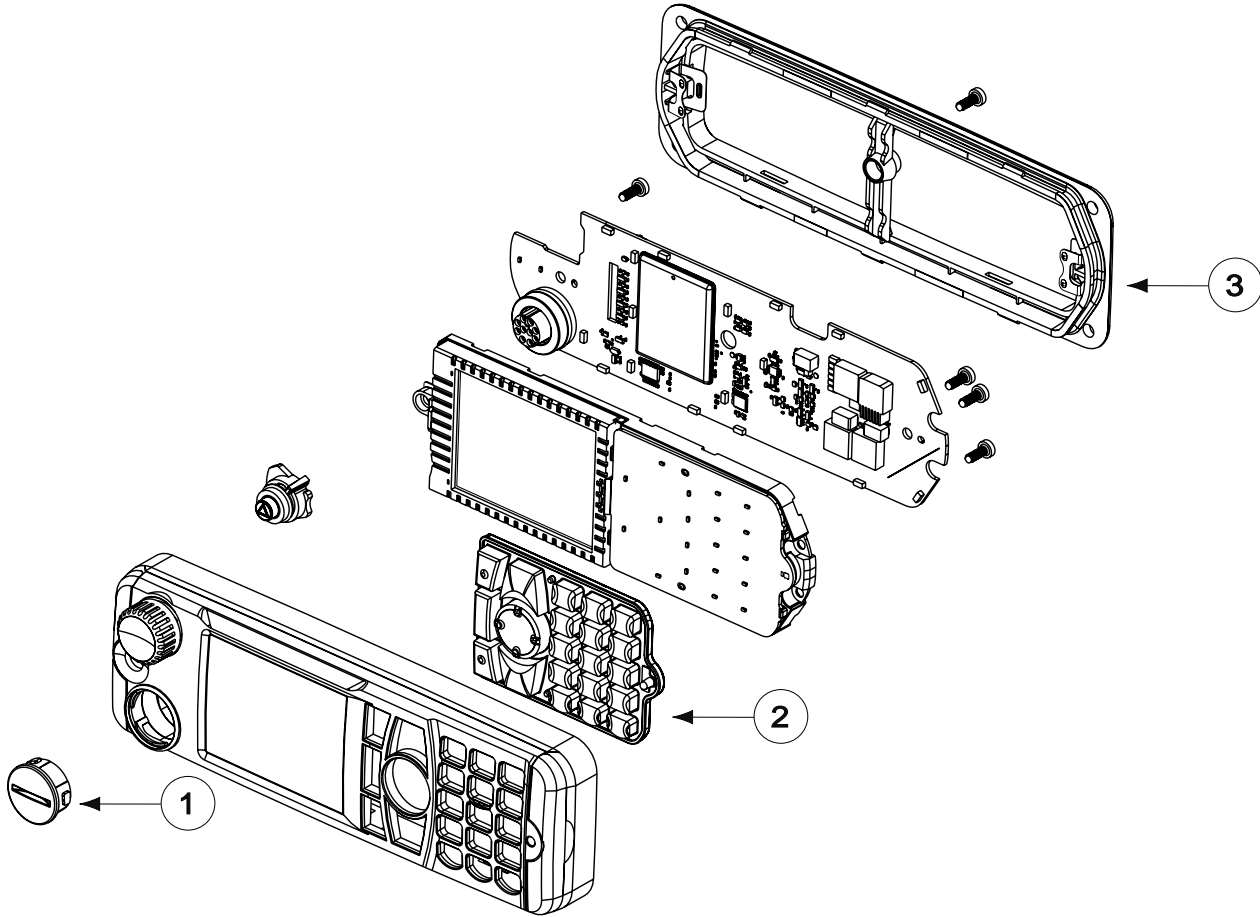
**Figure 7-15** Location of additional UCM Board inside the Cover Plate



**CAUTION:** There is a flex installed connecting the UCM board to the main board. Take extra care not to tear off the flex when dis-assembling or re-assembling the board from/to the transceiver cover plate or this could damage the UCM board and the main board.

**NOTE:** The CLN8041\_ UCM board is not repairable. Order a replacement board if necessary.

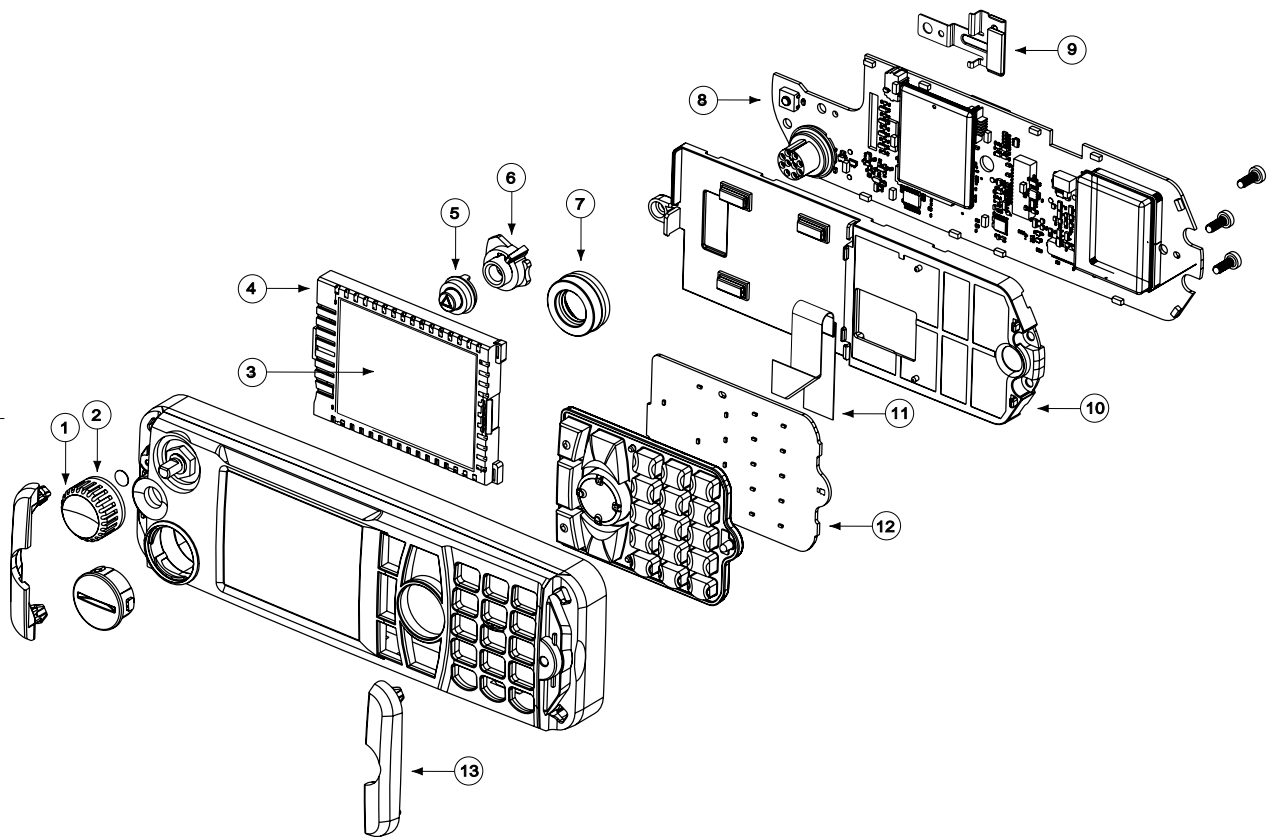
### Enhanced Control Head - Exploded View and Parts List



**Figure 7-16** Enhanced Control Head - Exploded View 1

**Table 7-6** Enhanced Control Head - Parts List 1

Item No	Description	Part No
1	GCAI Cover	1515048C01
2	KeyPad Assy	7571017L01
3	Head Bridge Assy	0104025J29

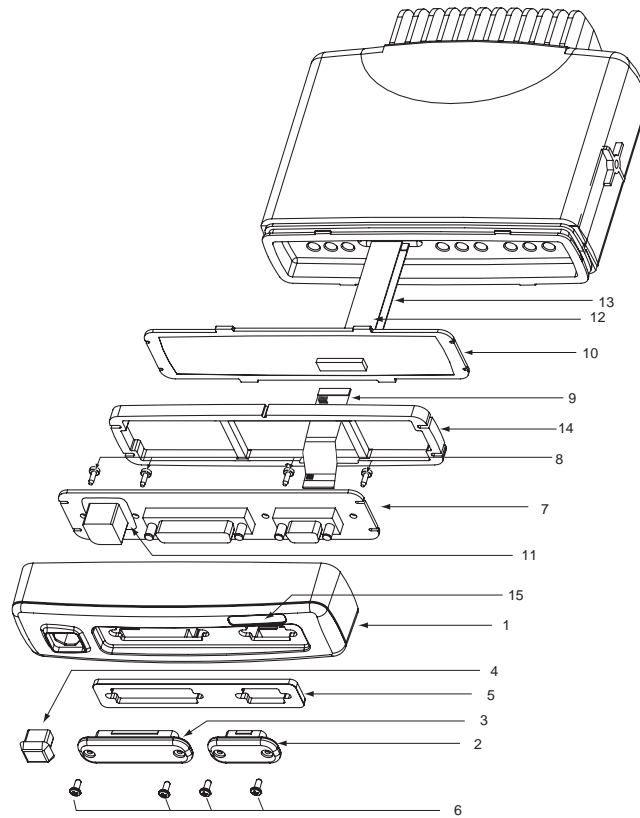


**Figure 7-17** Enhanced Control Head - Exploded View 2

**Table 7-7** Enhanced Control Head - Parts List 2

Item No	Description	Part No
1	Encoder Knob	3616898H01
2	Gore Port	3205472M02
3	LCD Module	7271138D01
4	LCD Rubber Jacket	7516954H01
5a	Emergency Key	3816953H01
6	Emergency Key Frame	0716944H01
7	GCAI Seal	3264133H01
8	Main PWA Kit	0166500N86
9	LCD Metal Retainer	4216900H01
10	Chassis	2716937H01
11	KeyPad FFC	8471919L01
12	KeyPad PWA Kit	0166501N35
13	Side Cap	3816950H01

## Data Expansion Head Enhanced - Exploded View and Parts List



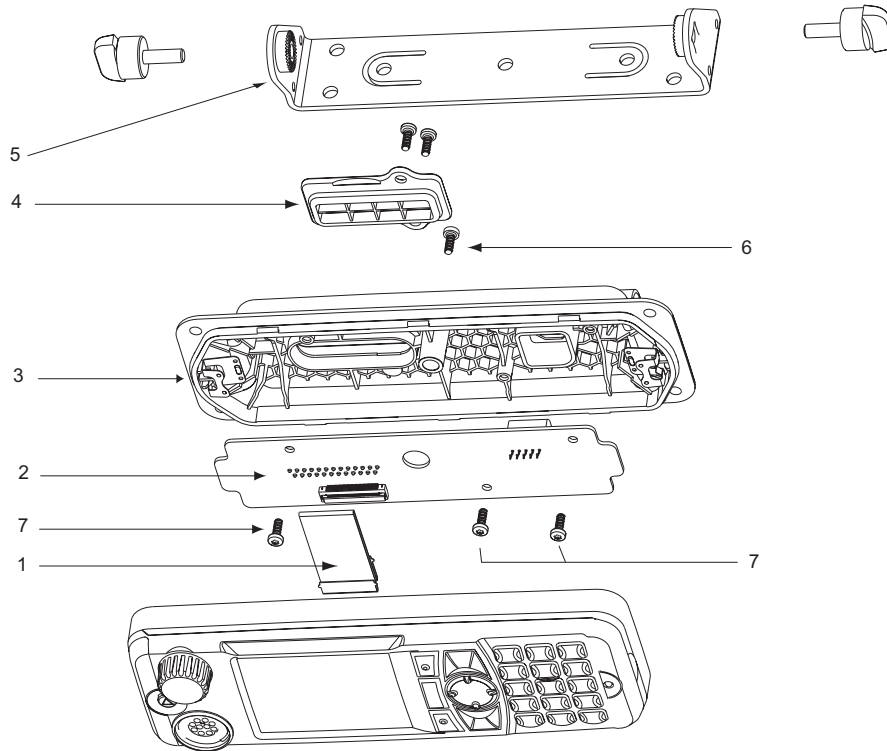
**Figure 7-18** Data Expansion Head Enhanced - Exploded View

**Table 7-8** Data Expansion Head Enhanced - Parts List

Item No	Description	Part No
1	Expansion Head Housing	1564290B01
2	Cover 9 Sub-D	3864326B01
3	Cover 25 Sub-D	3864326B02
4	Protection Caps/Bung, Telco	GLN7306_
5	Seal, Expansion Head	3264325B01
6	Screw, Protection Caps/Bung (4 required)	0305137Q02
7	Connector Board	PMLN5087A
8	Screw, Connector PCB (4 required)	0385944A02
9	Flex 40 Pin	8415157H01
10	Expansion Board, not part of Housing Kit	PMLN4939A
11	Seal for 10 Pin Telco on PCB	3264291B01
12	Flex 12 Pin	8486127B01
13	Flex 40Pin	8466543A01
14	Silicone Pressure Pad	3264337B01
15	Label	5464344B07



## Remote Mount Enhanced Control Head - Exploded View and Parts List

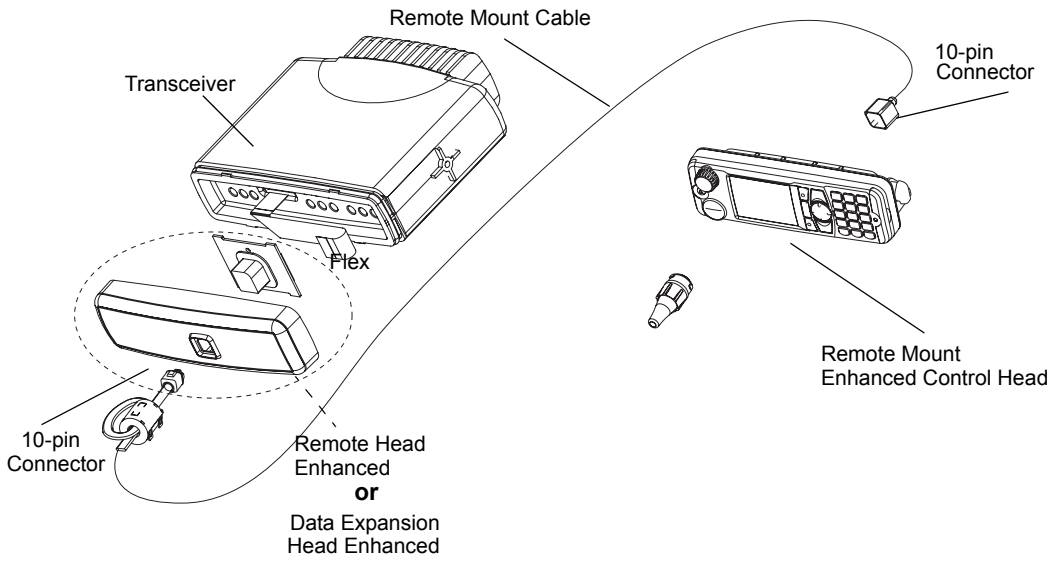


**Figure 7-19** Remote Mount Enhanced Control Head - Exploded View

**Table 7-9** Remote Mount Enhanced Control Head - Parts List

Item No.	Description	Part No.
1	Remote FFC (Main to Remote)	8471921L01
2	Remote PWA Kit	0166501N45
3	Remote Back Hsg Assy	0104025J30
4	D Sub Cover	1571012L01
5	Trunnion	0716933H01
6	Middle Screw	0371912L01
7	Self Tapping Screw	0316961H01

## Remote Mount Configuration - Exploded View and Parts List

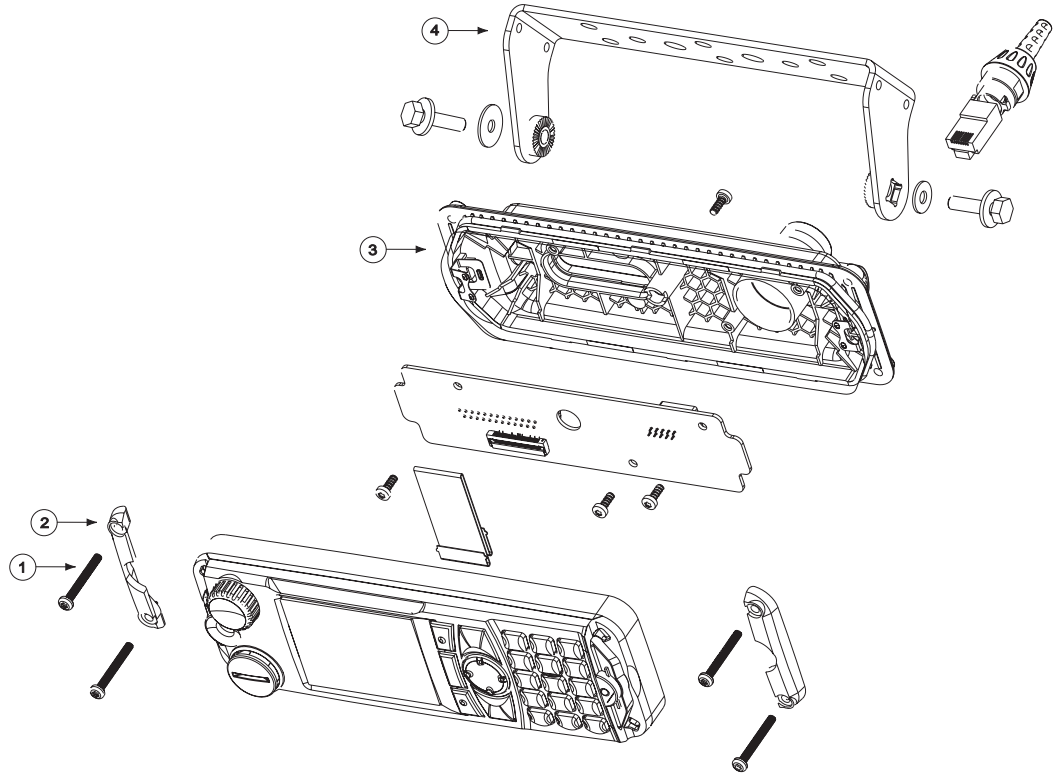


**Figure 7-20** Remote Mount Configuration - Exploded View

**Table 7-10** Associated Components for Remote Mount Configuration

No.	Description	Part Number
1	Remote Mount Cable, 3 m	RKN4077_
2	Remote Mount Cable, 5 m	RKN4078_
3	Remote Mount Cable, 7 m	RKN4079_
4	Remote Mount Cable, 10 m	PMKN4020_
5	Speaker Extension Cable	GMKN4084_
6	Remote Head Enhanced	PMLN4904_
7	Data Expansion Control Head	PMLN4908_
8	Ferrite Clamp	PMLN5148_

## Motorcycle Mount Enhanced Control Head - Exploded View and Parts List



**Figure 7-21** Motorcycle Mount Enhanced Control Head - Exploded View

**Table 7-11** Motorcycle Mount Enhanced Control Head - Parts List

Item No.	Description	Part No.
1	Side Cap Screw	0316960H02
2	MC Side Cap	3871547L01
3	MC Back Hsg Assy	0104025J31
4	MC trunnion	0771445L01

## Notes

## CHAPTER 8

## SCHEMATICS, PCBs AND PARTS LISTS



**Any level 3 repairs can deeply affect the performance of the MTM800 ENH terminal and may cause a new tuning procedure. This tuning procedure can only be applied by certain authorized Motorola depots where the appropriate TEST&TUNE EQUIPMENT is available. The appropriate TEST&TUNE EQUIPMENT is a special automated test equipment which is only available at some Motorola factories and Motorola repair centres.**

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## Section Introduction

This Chapter contains the following Sections:

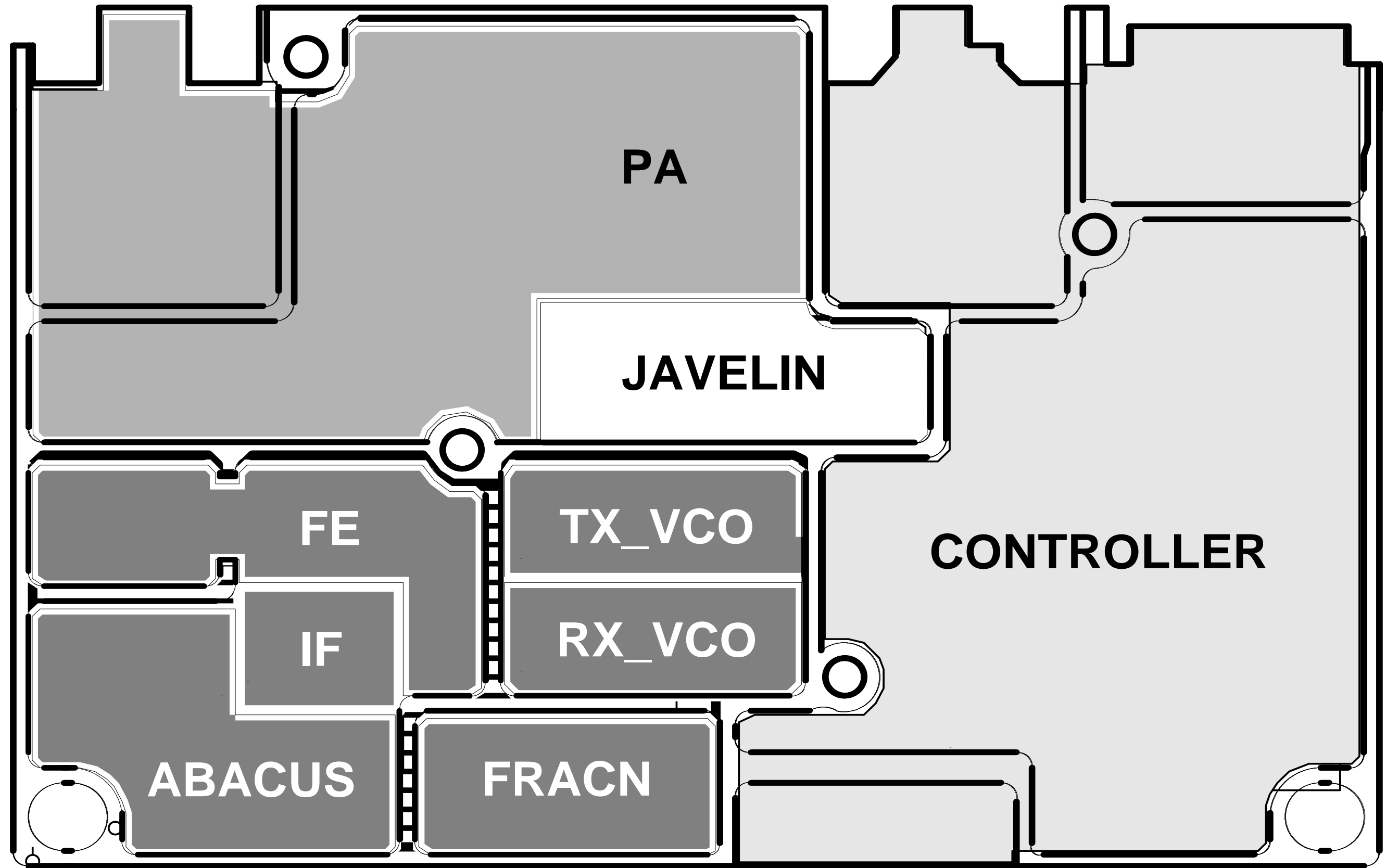
- 8.1 Transceiver 450-470MHz: Schematics/PCBs and Parts Lists**
- 8.2 Enhanced Control Heads:** Enhanced Control Head
  - Data Expansion Head Enhanced
  - Remote Head Enhanced
  - Remote Back Head Enhanced
  - Keypad Board for Enhanced Control Head

**NOTE:** For optimum performance, all replacement parts, diodes, transistors and integrated circuits must be ordered by MOTOROLA part numbers.

## Notes

CHAPTER 8.1

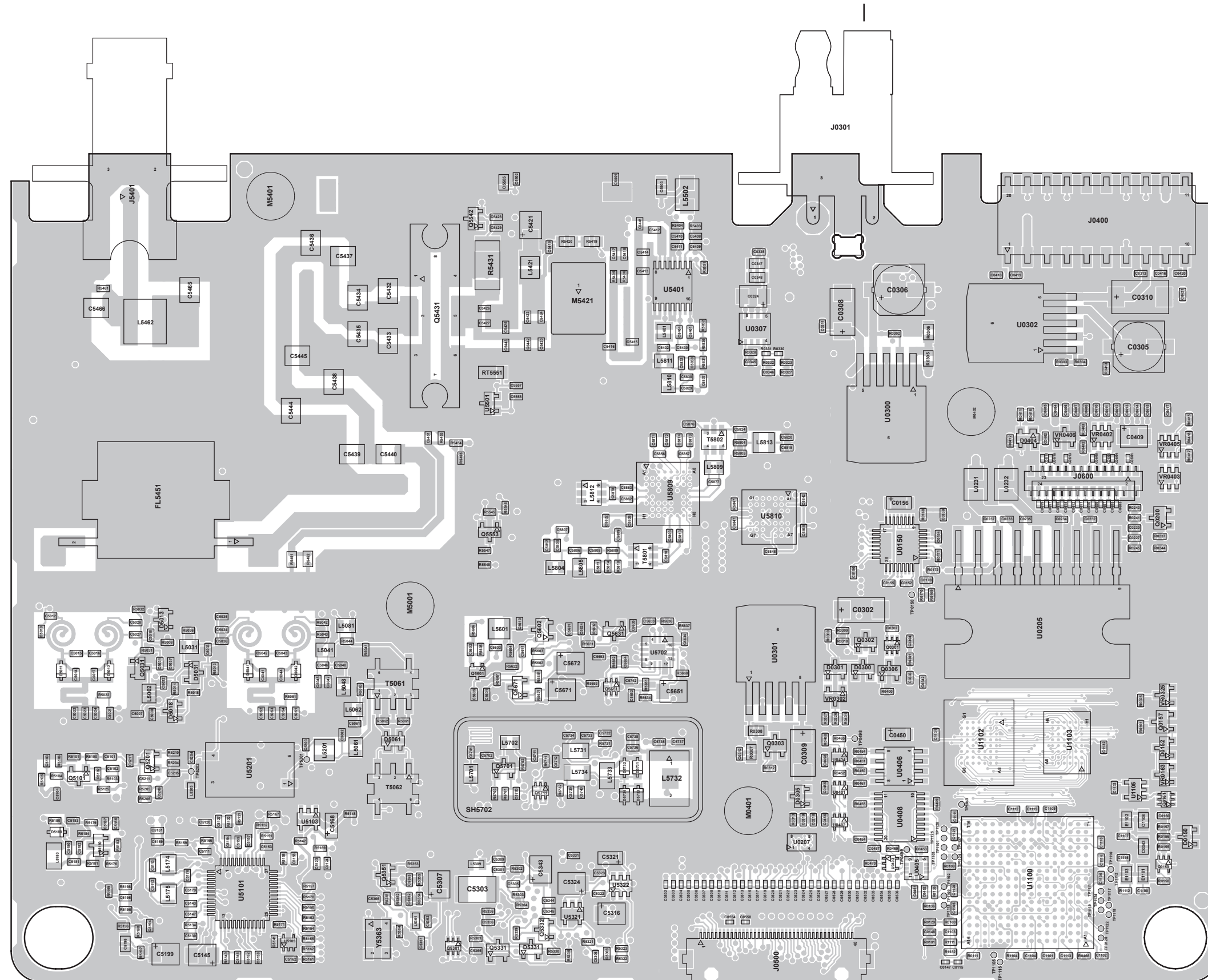
TRANSCEIVER 450-470MHZ: SCHEMATICS, PCBs AND PARTS LISTS



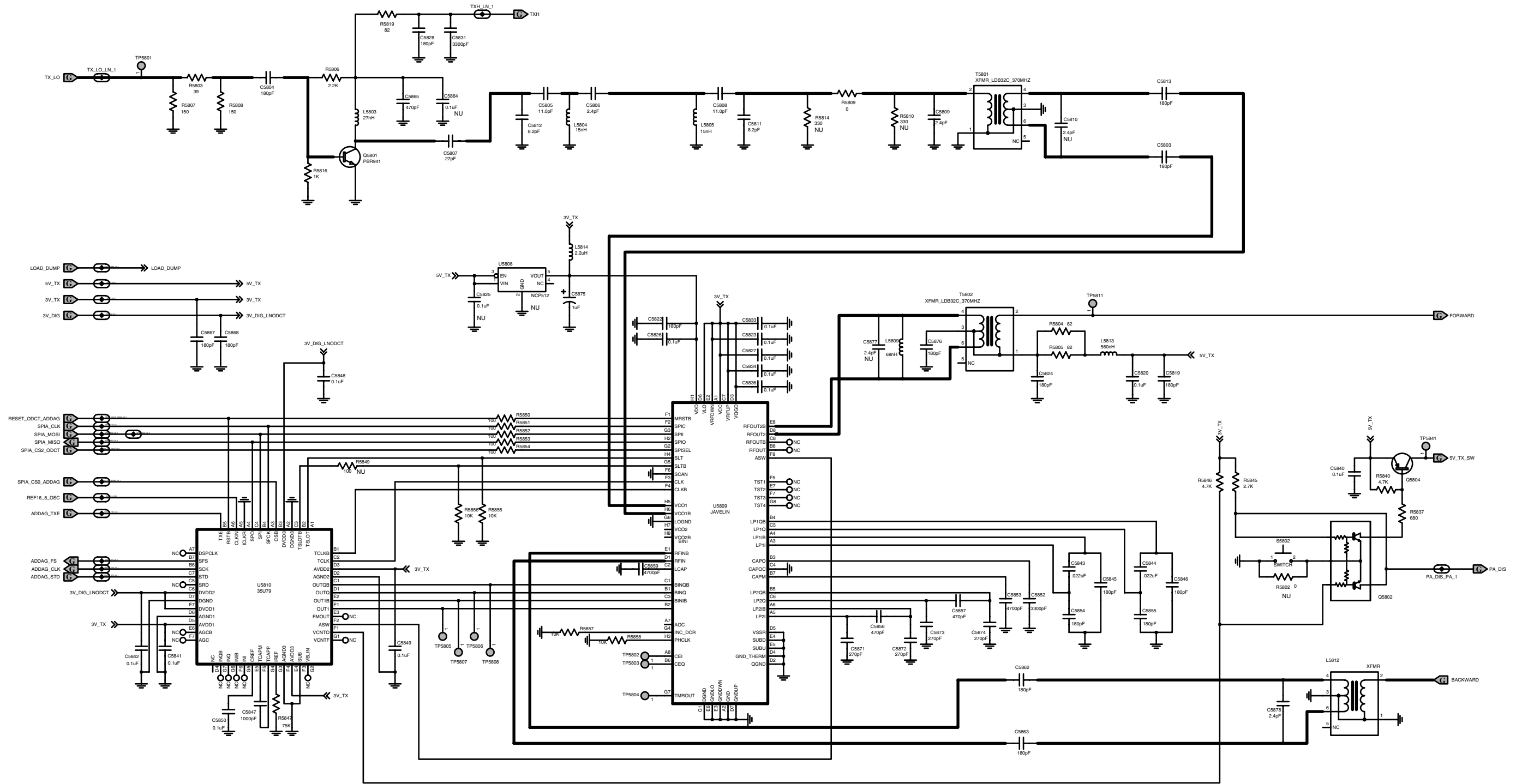
CHASSIS\_OVERVIEW TRANSCEIVER



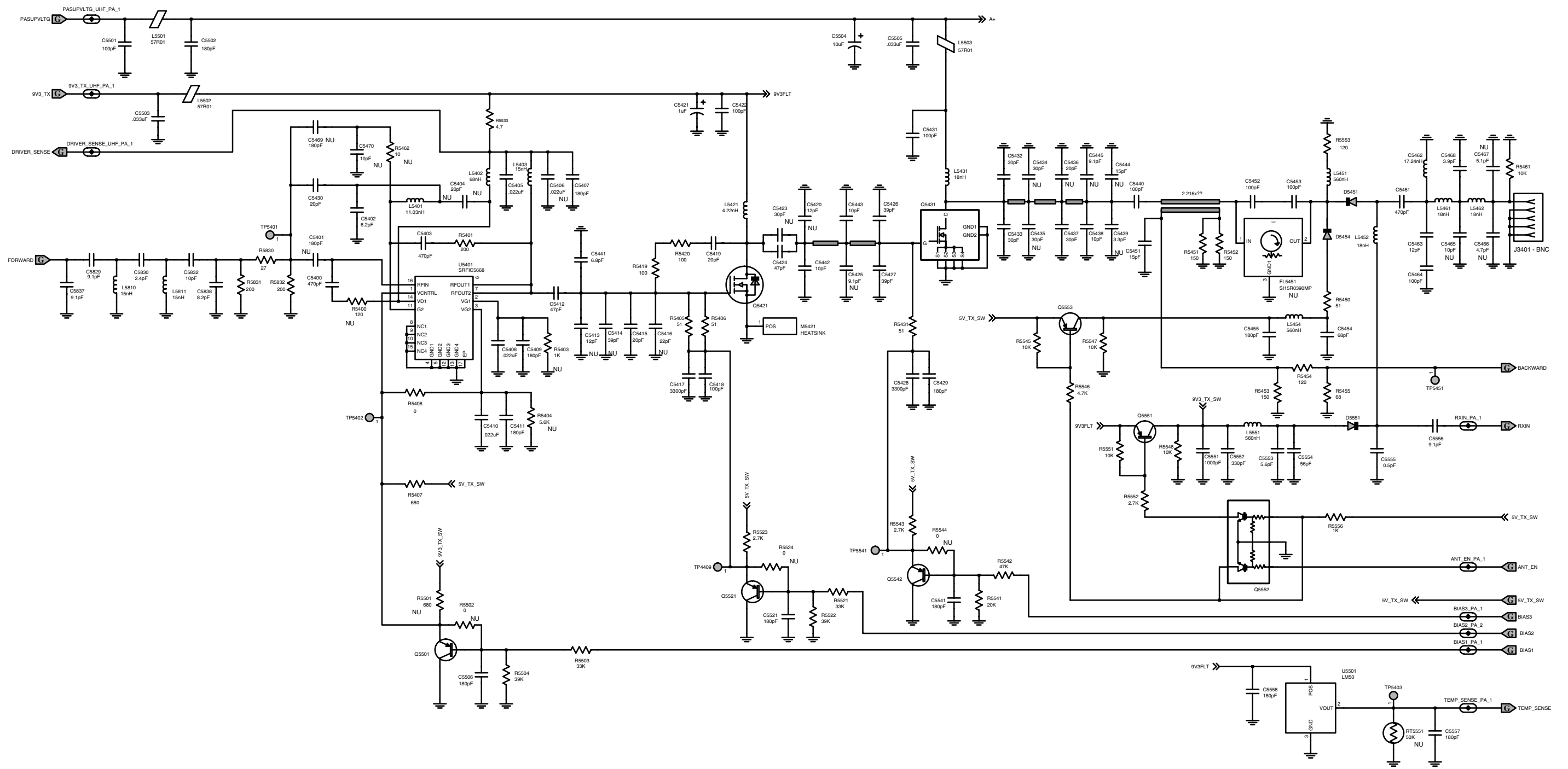




PCB / Main Board 8466575A01\_A / BOT SIDE

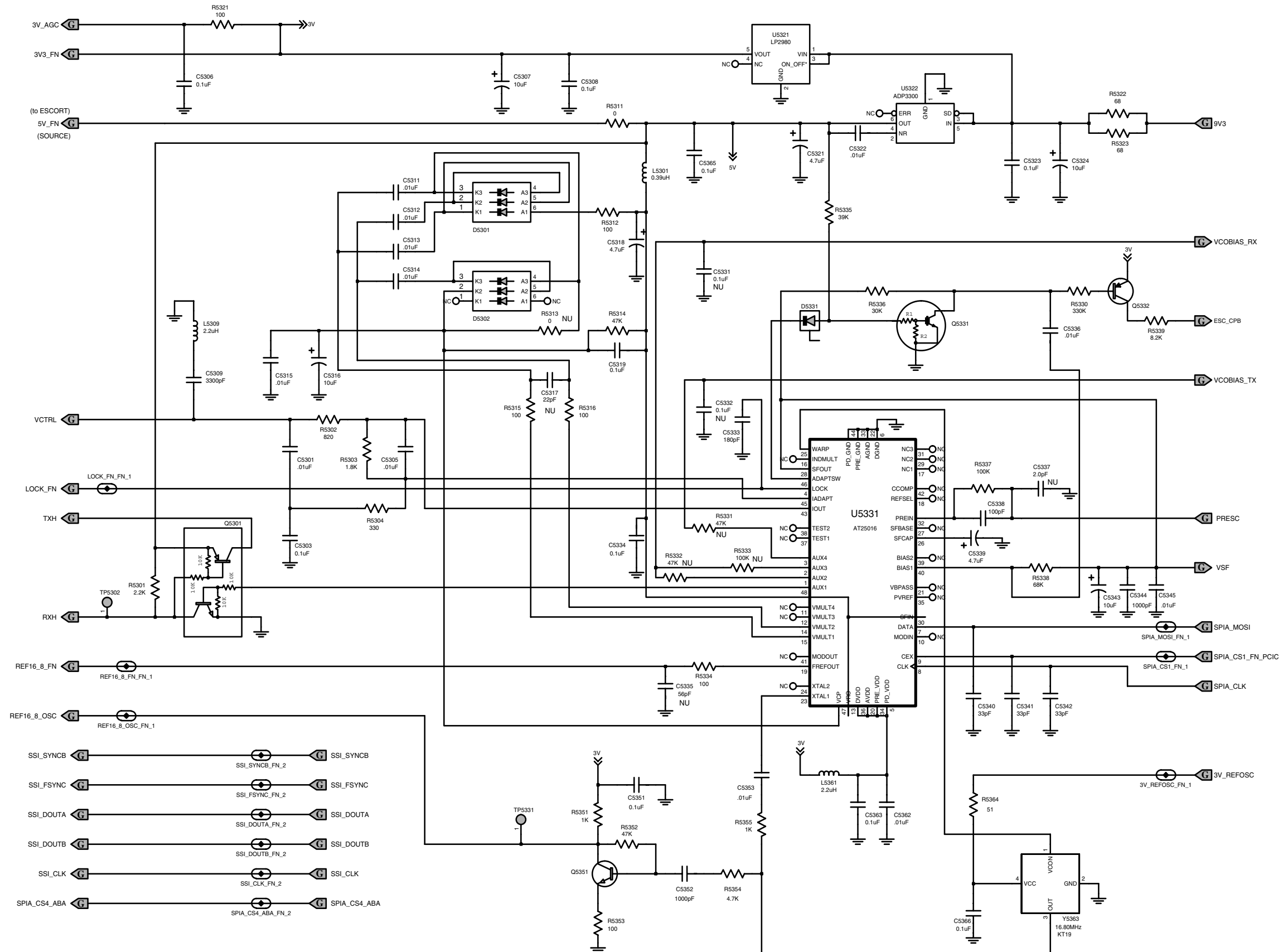


Main Board 8466575A01\_A / TX-LOW SECTION (JAVELIN)

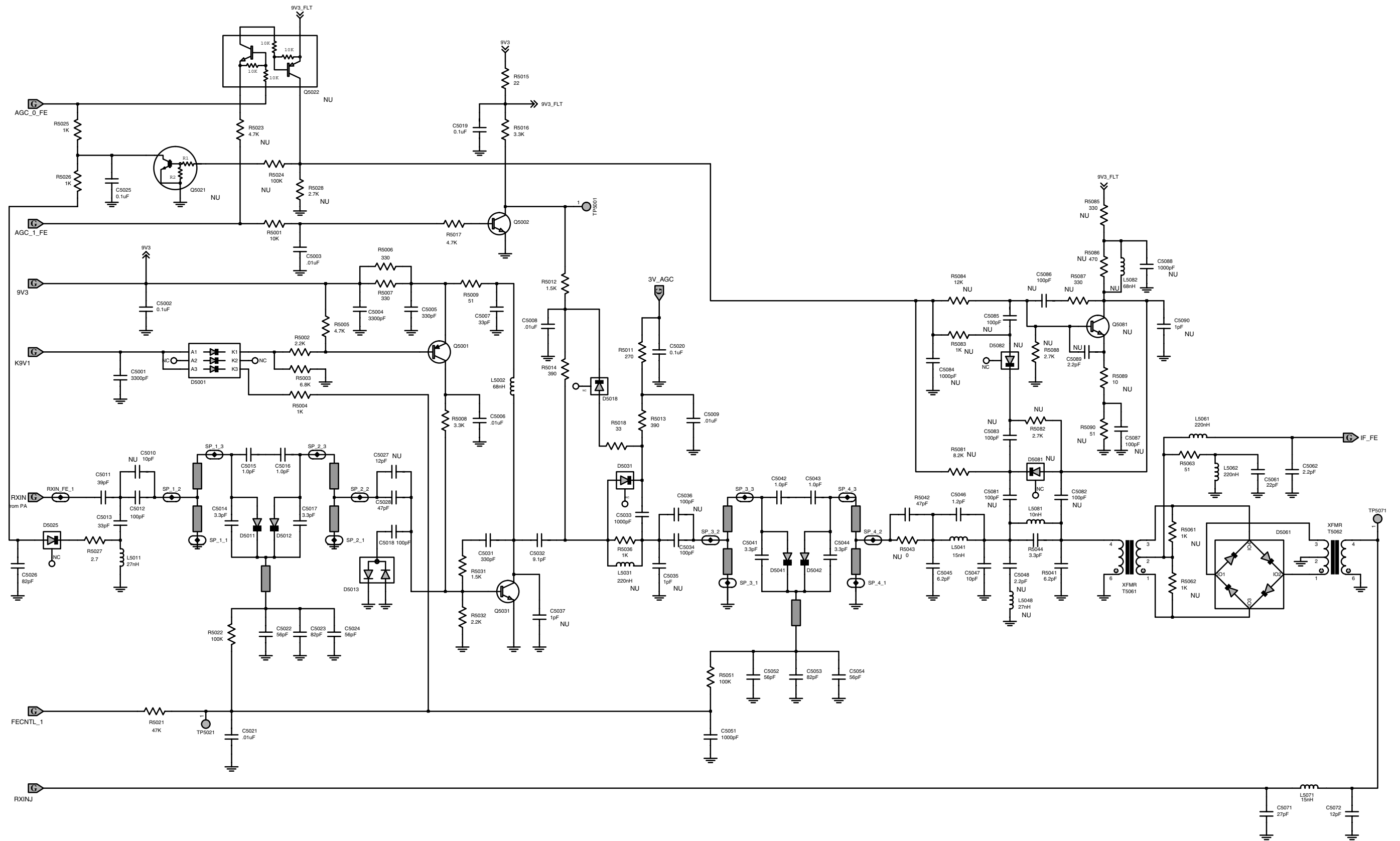


Main Board 8466575A01\_A / PA SECTION

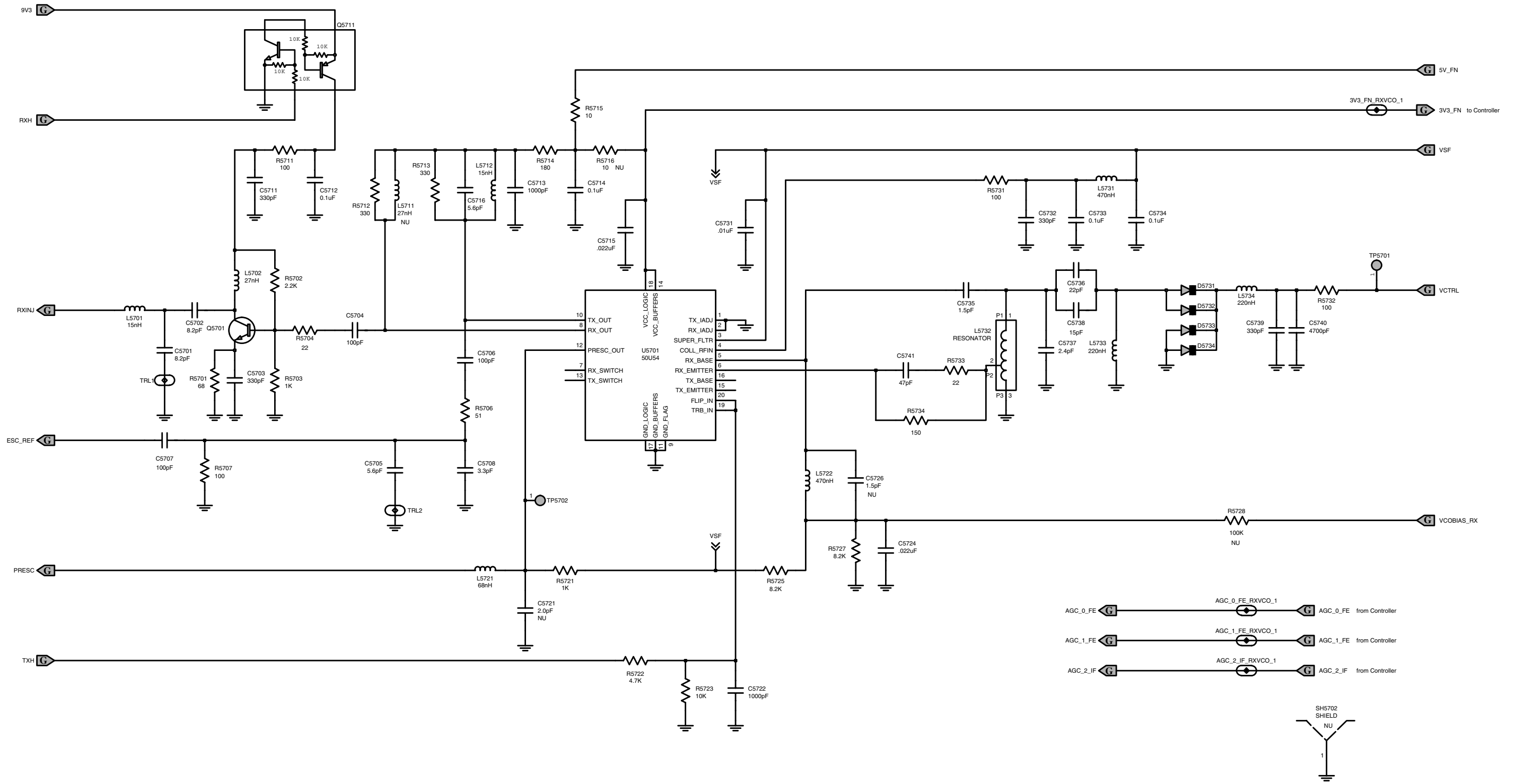




Main Board 8466575A01\_A / FRAC-N Section

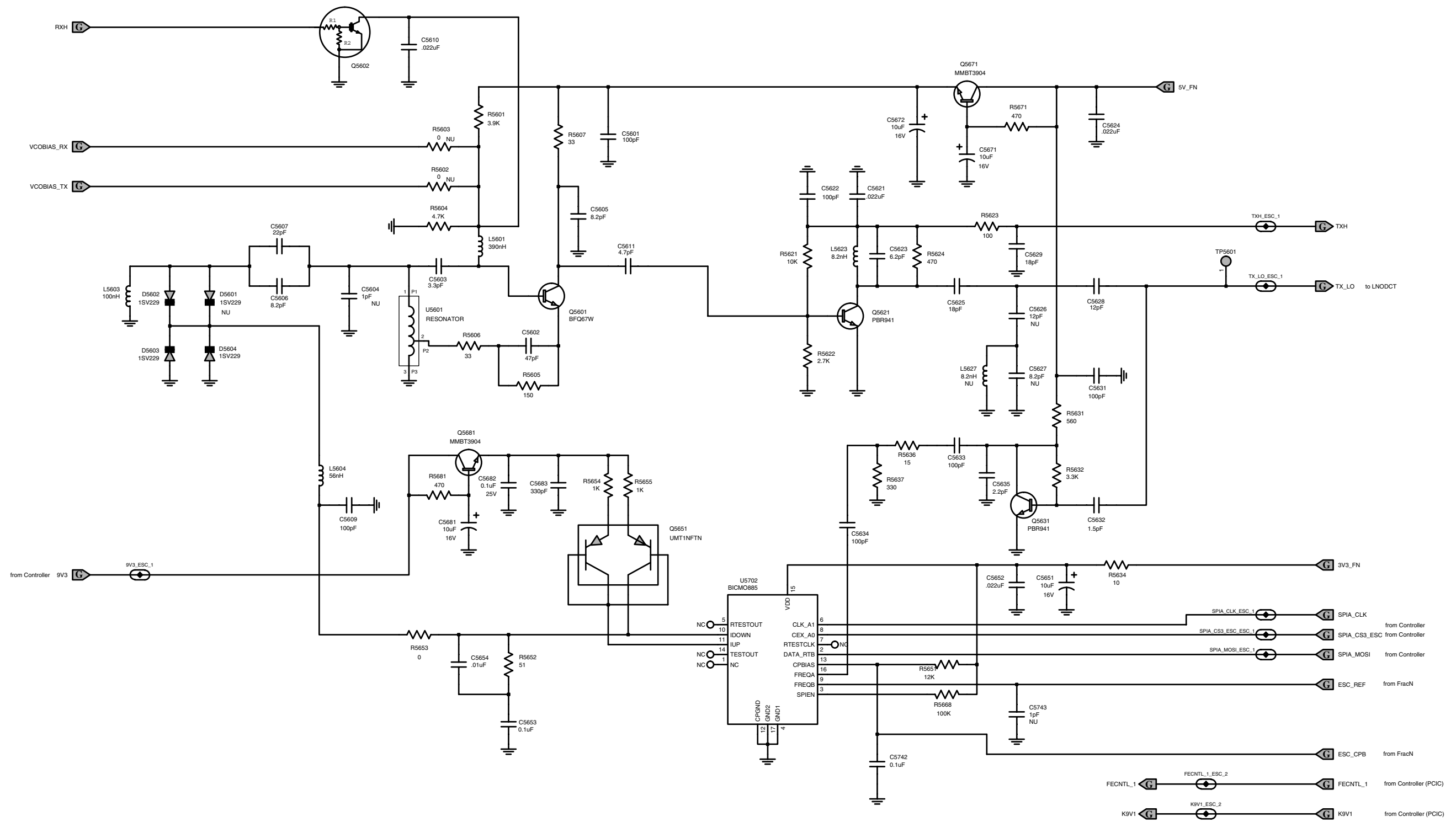


Main Board 8466575A01\_A / FE and Mixer Section

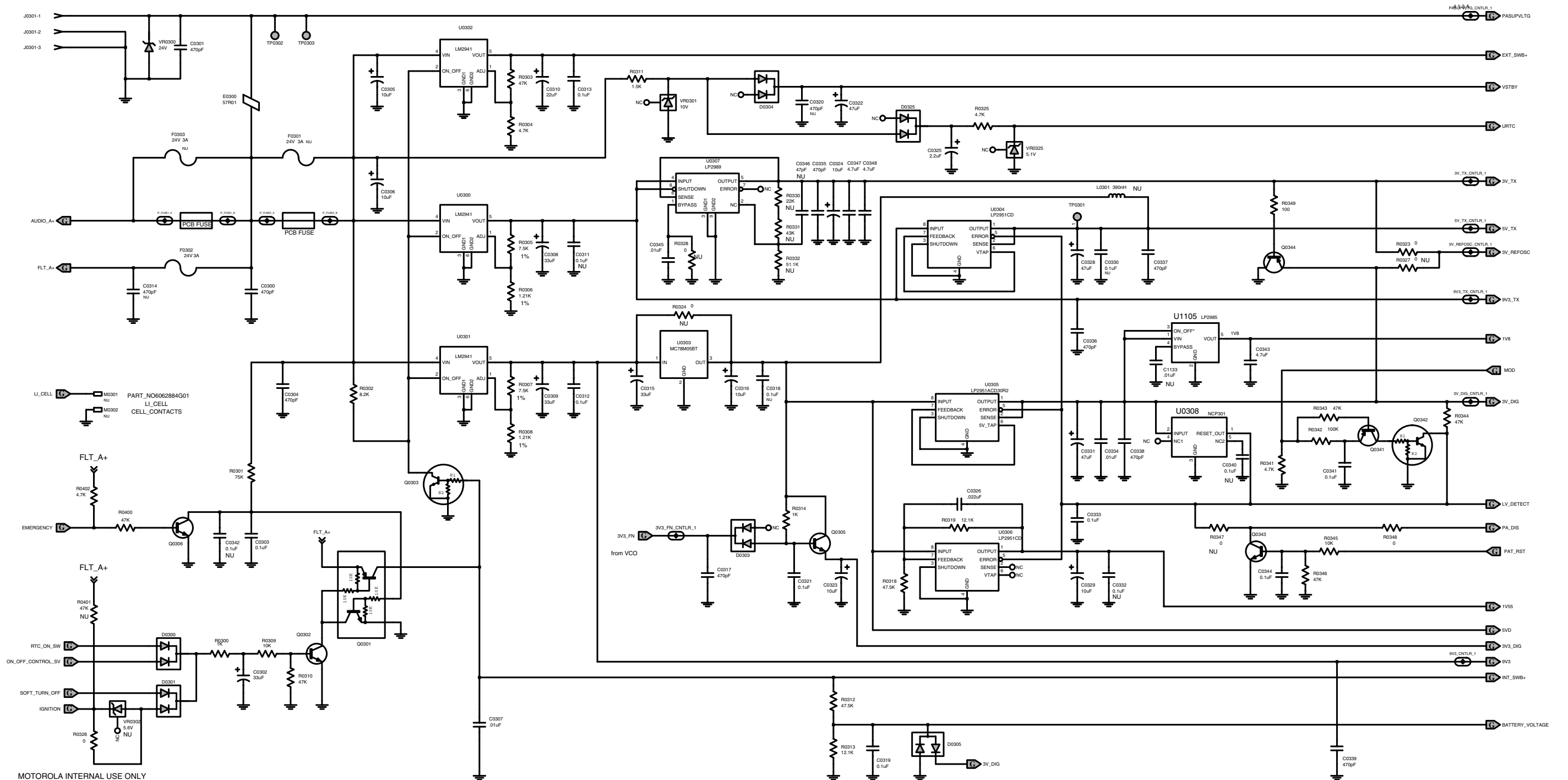


Main Board 8466575A01\_A / RX VCO Section



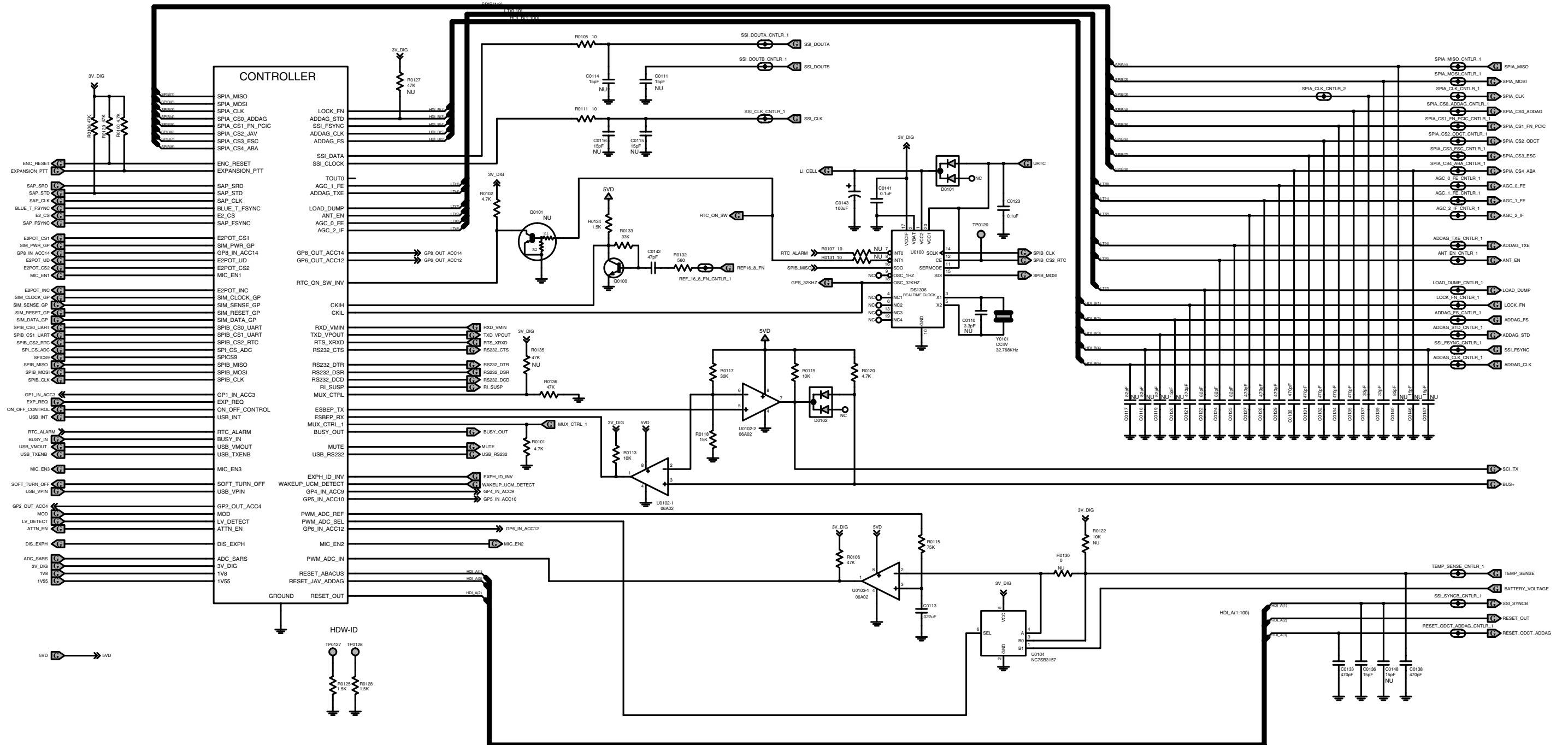


Main Board 8466575A01\_A / TX VCO Section



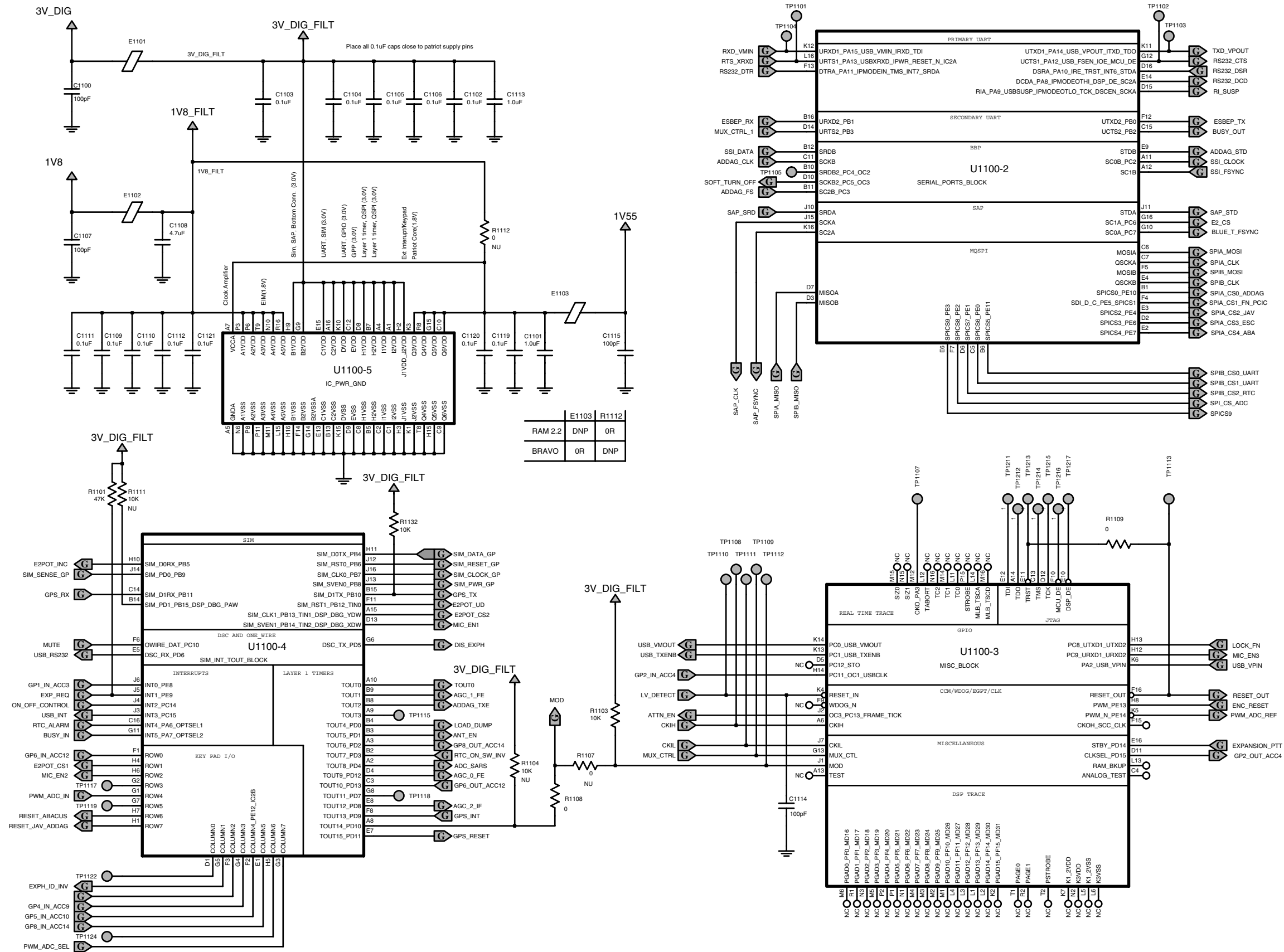
Main Board 8466575A01\_A / Controller Power Supply Section



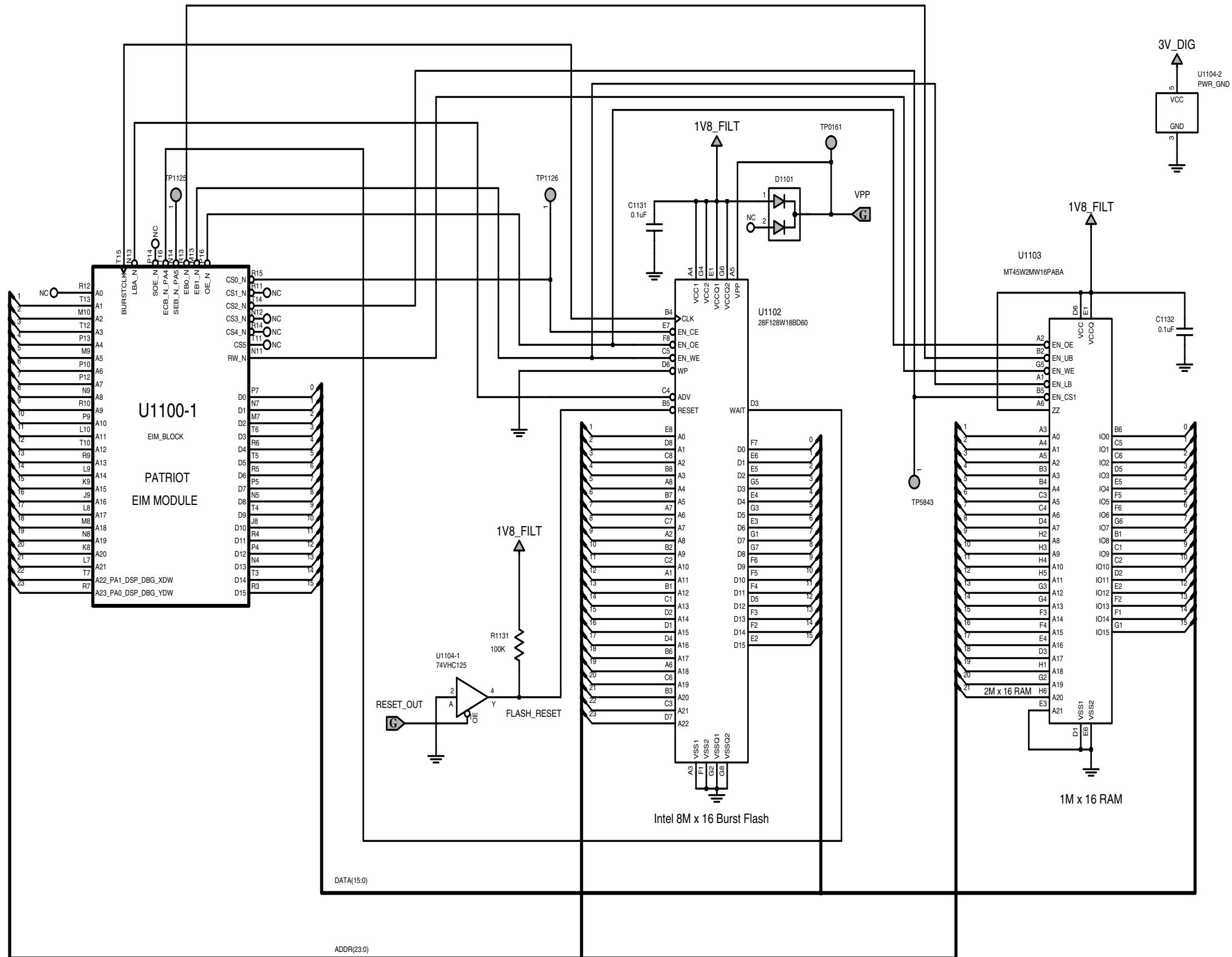


Main Board 8466575A01\_A / Controller Section





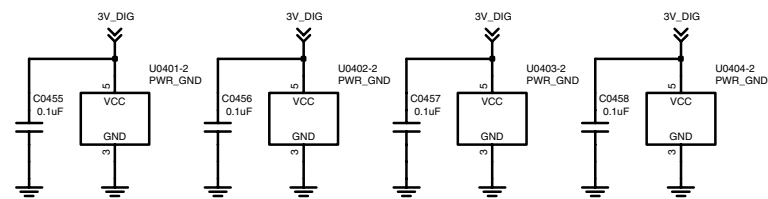
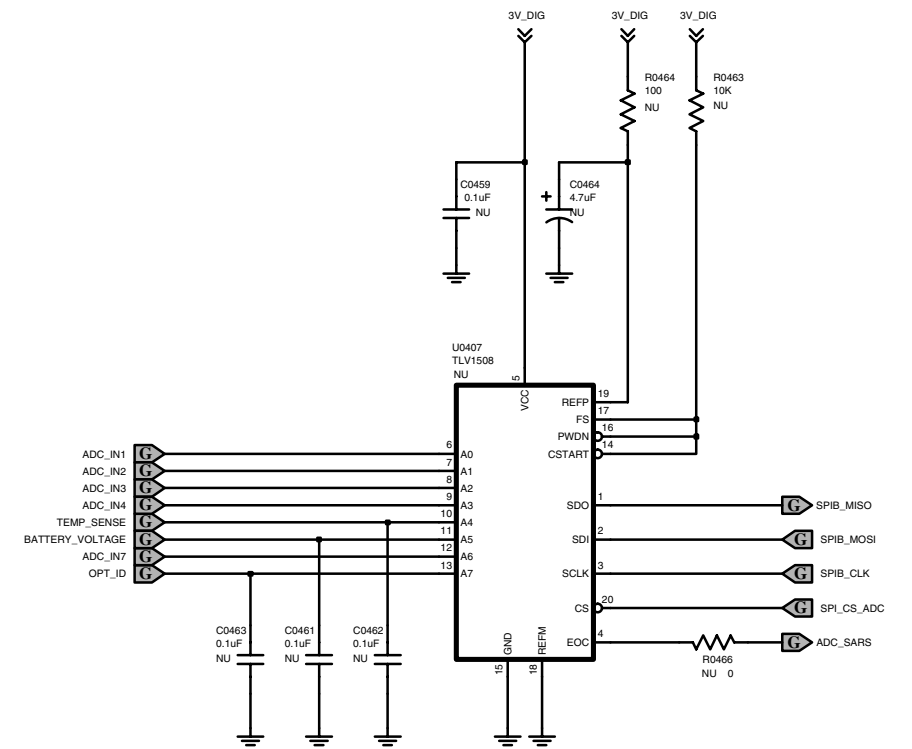
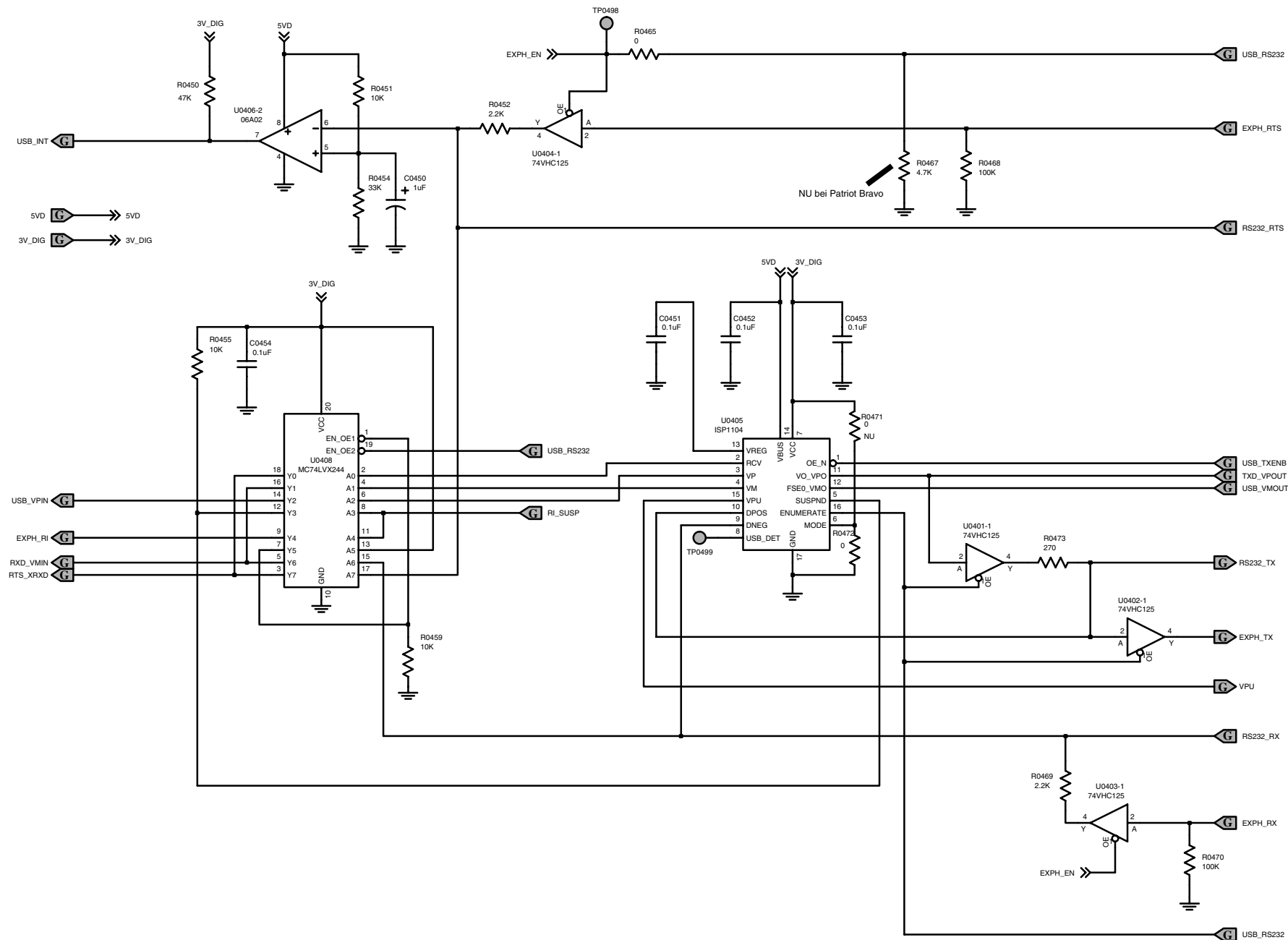
Main Board 8466575A01\_A / PATRIOT Controller Section



Main Board 8466575A01\_A / PATRIOT Memory Section

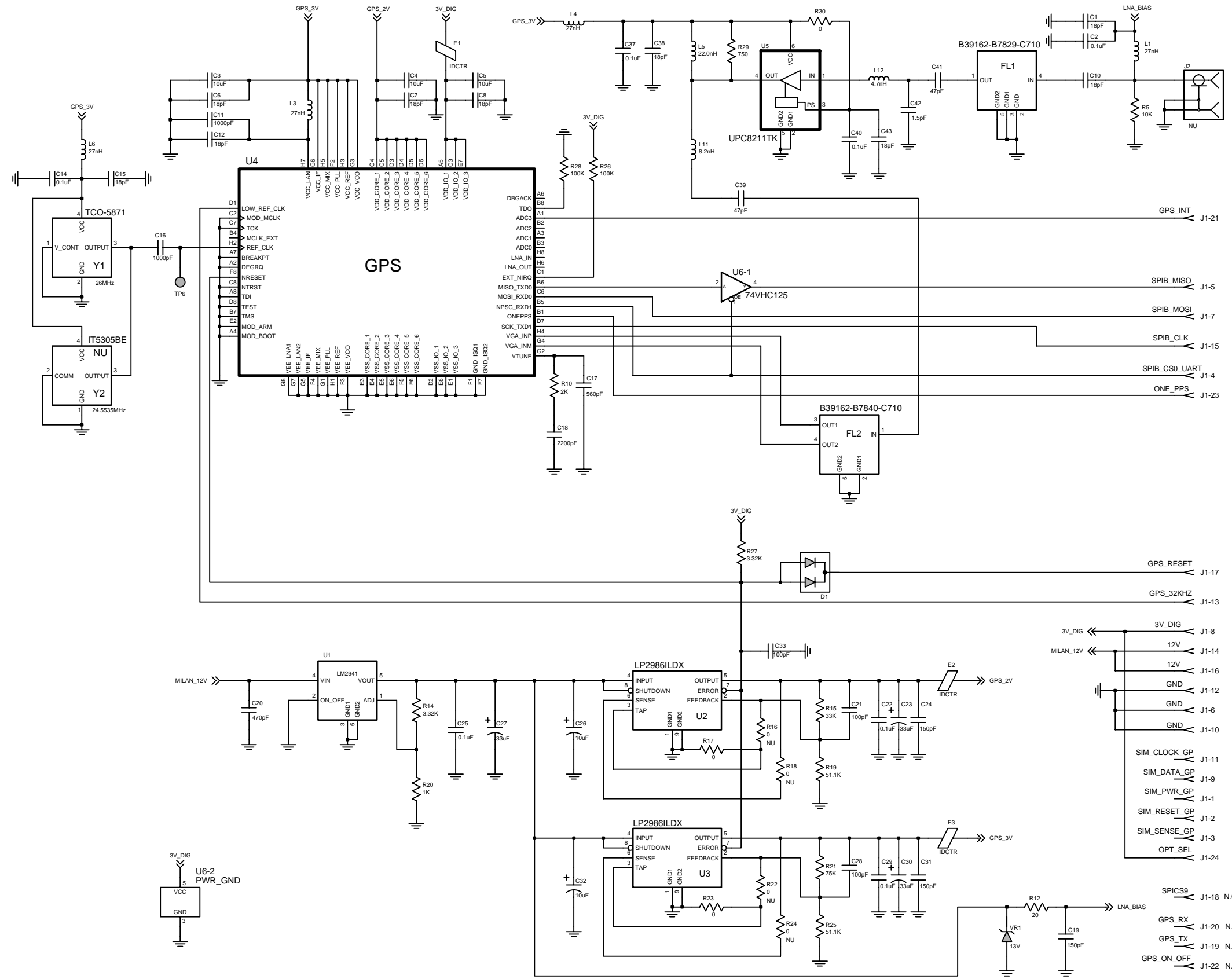






Main Board 8466575A01\_A / Controller USB/ADC Section





GPS Sub Module 8466576A01\_O / Schematic

## PARTS LISTS

## Parts on the Mainboard (0166501N85)

Reference	Motorola PN	Value
C0110	2113944C18	CAP, 3.3pF
C0111	2113944A27	CAP, 15pF
C0113	2113945C04	CAP, .022uF
C0114	2113944A27	CAP, 15pF
C0115	2113944A27	CAP, 15pF
C0116	2113944A27	CAP, 15pF
C0117	2113944C43	CAP, 82pF
C0118	2113944C43	CAP, 82pF
C0119	2113944C43	CAP, 82pF
C0120	2113944A27	CAP, 15pF
C0121	2113944C06	CAP, 470pF
C0122	2113944C43	CAP, 82pF
C0123	2113945D04	CAP, 0.1uF
C0124	2113944C43	CAP, 82pF
C0125	2113944C43	CAP, 82pF
C0127	2113944C06	CAP, 470pF
C0128	2113944C06	CAP, 470pF
C0129	2113944C06	CAP, 470pF
C0130	2113945A05	CAP, 470pF
C0131	2113944C06	CAP, 470pF
C0132	2113944C06	CAP, 470pF
C0133	2113944C06	CAP, 470pF
C0134	2113944C06	CAP, 470pF
C0135	2113944C06	CAP, 470pF
C0136	2113944A27	CAP, 15pF
C0137	2113944C36	CAP, 33pF
C0138	2113944C06	CAP, 470pF
C0139	2113944C36	CAP, 33pF
C0140	2113944C43	CAP, 82pF
C0141	2113945D04	CAP, 0.1uF
C0142	2113944C38	CAP, 47pF
C0143	2313960H07	CAPP, 100uF
C0146	2113944A27	CAP, 15pF
C0147	2113944A27	CAP, 15pF
C0148	2113944C32	CAP, 15pF
C0150	2113944C06	CAP, 470pF
C0151	2113944C06	CAP, 470pF
C0152	2113944C06	CAP, 470pF
C0154	2113944C06	CAP, 470pF
C0155	2113945L33	CAP, 2200pF
C0156	2313960B01	CAPP, 1uF
C0157	2113944C06	CAP, 470pF
C0158	2113944C06	CAP, 470pF
C0159	2113944C06	CAP, 470pF
C0160	2113945D04	CAP, 0.1uF

Reference	Motorola PN	Value
C0161	2113945D04	CAP, 0.1uF
C0162	2113945D04	CAP, 0.1uF
C0163	2113945D04	CAP, 0.1uF
C0164	2113945D04	CAP, 0.1uF
C0170	2113944C06	CAP, 470pF
C0200	2313960D07	CAPP, 10uF
C0201	2313960D07	CAPP, 10uF
C0202	2113945D04	CAP, 0.1uF
C0203	2113945D04	CAP, 0.1uF
C0204	2113945D04	CAP, 0.1uF
C0205	2113945D04	CAP, 0.1uF
C0213	2113945D04	CAP, 0.1uF
C0218	2113945D04	CAP, 0.1uF
C0219	2113945C02	CAP, .01uF
C0220	2113945D04	CAP, 0.1uF
C0221	2313960B01	CAPP, 1uF
C0222	2113945D04	CAP, 0.1uF
C0223	2113945D04	CAP, 0.1uF
C0224	2313960D07	CAPP, 10uF
C0225	2113945D04	CAP, 0.1uF
C0226	2113945D04	CAP, 0.1uF
C0227	2113945D04	CAP, 0.1uF
C0228	2113944C01	CAP, 180pF
C0229	2113944C43	CAP, 82pF
C0230	2113945L37	CAP, 3300pF
C0231	2313960F04	CAPP, 33uF
C0232	2113945D04	CAP, 0.1uF
C0233	2113945L25	CAP, 1000pF
C0234	2113945L25	CAP, 1000pF
C0235	2113945L25	CAP, 1000pF
C0236	2113945D04	CAP, 0.1uF
C0237	2113945D04	CAP, 0.1uF
C0300	2113944C06	CAP, 470pF
C0301	2113944C06	CAP, 470pF
C0302	2313960F04	CAPP, 33uF
C0303	2113945D04	CAP, 0.1uF
C0304	2113944C06	CAP, 470pF
C0305	2389289U01	CAPP, 10uF
C0306	2389289U01	CAPP, 10uF
C0307	2113945C02	CAP, .01uF
C0308	2313960F04	CAPP, 33uF
C0309	2313960F04	CAPP, 33uF
C0310	2314030J28	CAPP, 22uF
C0311	2113945D04	CAP, 0.1uF
C0312	2113945D04	CAP, 0.1uF
C0313	2113945D04	CAP, 0.1uF
C0314	2113944C06	CAP, 470pF

Reference	Motorola PN	Value
C0315	2313960F04	CAPP, 33uF
C0316	2313960D07	CAPP, 10uF
C0317	2113944C06	CAP, 470pF
C0318	2113945D04	CAP, 0.1uF
C0319	2113945D04	CAP, 0.1uF
C0320	2113944C06	CAP, 470pF
C0321	2113945D04	CAP, 0.1uF
C0322	2313960F30	CAPP, 47uF
C0323	2313960D07	CAPP, 10uF
C0324	2313960D07	CAPP, 10uF
C0325	2313960C78	CAPP, 2.2uF
C0326	2113945C04	CAP, .022uF
C0328	2313960F30	CAPP, 47uF
C0329	2313960F01	CAPP, 10uF
C0330	2113945D04	CAP, 0.1uF
C0331	2313960F30	CAPP, 47uF
C0332	2113945D04	CAP, 0.1uF
C0333	2113945D04	CAP, 0.1uF
C0334	2113945C02	CAP, .01uF
C0335	2113944C06	CAP, 470pF
C0336	2113944C06	CAP, 470pF
C0337	2113944C06	CAP, 470pF
C0338	2113944C06	CAP, 470pF
C0339	2113944C06	CAP, 470pF
C0340	2113945D04	CAP, 0.1uF
C0341	2113945D04	CAP, 0.1uF
C0342	2113945D04	CAP, 0.1uF
C0343	2113946F03	CAP, 4.7uF
C0344	2113945D04	CAP, 0.1uF
C0345	2113945C02	CAP, .01uF
C0346	2113944C38	CAP, 47pF
C0347	2113946F03	CAP, 4.7uF
C0348	2113946F03	CAP, 4.7uF
C0401	2113945D04	CAP, 0.1uF
C0402	2113945D04	CAP, 0.1uF
C0404	2113945C02	CAP, .01uF
C0405	2113944C01	CAP, 180pF
C0406	2113944C01	CAP, 180pF
C0407	2113944C01	CAP, 180pF
C0408	2113944C01	CAP, 180pF
C0409	2313960C78	CAPP, 2.2uF
C0410	2113944C01	CAP, 180pF
C0411	2113944C01	CAP, 180pF
C0412	2113944C01	CAP, 180pF
C0413	2113944C01	CAP, 180pF
C0414	2113944C01	CAP, 180pF
C0415	2113944C01	CAP, 180pF

Reference	Motorola PN	Value
C0416	2113944C43	CAP, 82pF
C0417	2113945C02	CAP, .01uF
C0418	2113944C36	CAP, 33pF
C0419	2113944C36	CAP, 33pF
C0420	2113944C43	CAP, 82pF
C0421	0613952J17	RES, 47k
C0450	2313960B01	CAPP, 1uF
C0451	2113945D04	CAP, 0.1uF
C0452	2113945D04	CAP, 0.1uF
C0453	2113945D04	CAP, 0.1uF
C0454	2113945D04	CAP, 0.1uF
C0455	2113945D04	CAP, 0.1uF
C0456	2113945D04	CAP, 0.1uF
C0457	2113945D04	CAP, 0.1uF
C0458	2113945D04	CAP, 0.1uF
C0459	2113945D04	CAP, 0.1uF
C0460	2113945D04	CAP, 0.1uF
C0461	2113945D04	CAP, 0.1uF
C0462	2113945D04	CAP, 0.1uF
C0463	2113945D04	CAP, 0.1uF
C0464	2313960B30	CAPP, 4.7uF
C0502	2113944B01	CAP, 180pF
C0503	2113944A38	CAP, 82pF
C0504	2113944B01	CAP, 180pF
C0505	2113944B01	CAP, 180pF
C0506	2113944B01	CAP, 180pF
C0507	2113944B01	CAP, 180pF
C0508	2113944B01	CAP, 180pF
C0509	2113944B01	CAP, 180pF
C0510	2113944B01	CAP, 180pF
C0511	2113944B01	CAP, 180pF
C0512	2113944B01	CAP, 180pF
C0513	2113944A38	CAP, 82pF
C0515	2113944A38	CAP, 82pF
C0517	2113944A38	CAP, 82pF
C0519	2113944B01	CAP, 180pF
C0520	2113944B01	CAP, 180pF
C0521	2113944B01	CAP, 180pF
C0522	2113944A38	CAP, 82pF
C0523	2113944A38	CAP, 82pF
C0524	2113944A38	CAP, 82pF
C0525	2113944A38	CAP, 82pF
C0526	2113944B01	CAP, 180pF
C0527	2113944B01	CAP, 180pF
C0528	2113944B01	CAP, 180pF
C0529	2113944A38	CAP, 82pF
C0530	2113944A38	CAP, 82pF

Reference	Motorola PN	Value
C0531	2113944A38	CAP, 82pF
C0532	2113944A38	CAP, 82pF
C0533	2113944A38	CAP, 82pF
C0534	2113944A38	CAP, 82pF
C0535	2113944A38	CAP, 82pF
C0536	2113944A38	CAP, 82pF
C0537	2113944B01	CAP, 180pF
C0538	2113944B01	CAP, 180pF
C0539	2113944B01	CAP, 180pF
C0540	2113944B01	CAP, 180pF
C0550	2113944A38	CAP, 82pF
C0551	2113944C43	CAP, 82pF
C0552	2113944C01	CAP, 180pF
C0553	2113944C01	CAP, 180pF
C0554	2113944A38	CAP, 82pF
C0555	2113944C43	CAP, 82pF
C0556	2113944C01	CAP, 180pF
C0557	2113944C01	CAP, 180pF
C0558	2113944C43	CAP, 82pF
C0559	2113944C43	CAP, 82pF
C0560	2113944C01	CAP, 180pF
C0561	2113944C01	CAP, 180pF
C0601	2113944B01	CAP, 180pF
C0603	2113944B01	CAP, 180pF
C0604	2113944A38	CAP, 82pF
C0605	2113944A38	CAP, 82pF
C0606	2113944B01	CAP, 180pF
C0607	2113944B01	CAP, 180pF
C0608	2113944B01	CAP, 180pF
C0609	2113944A38	CAP, 82pF
C0610	2113944A38	CAP, 82pF
C0611	2113944A38	CAP, 82pF
C0612	2113944A38	CAP, 82pF
C0613	2113944B01	CAP, 180pF
C0614	2113944A38	CAP, 82pF
C0615	2113944A38	CAP, 82pF
C0616	2113944B01	CAP, 180pF
C0617	2113944B01	CAP, 180pF
C0618	2113944B01	CAP, 180pF
C0619	2113944B01	CAP, 180pF
C1100	2113944C45	CAP, 100pF
C1101	2113946M01	CAP, 1.0uF
C1102	2113945D04	CAP, 0.1uF
C1103	2113945D04	CAP, 0.1uF
C1104	2113945D04	CAP, 0.1uF
C1105	2113945D04	CAP, 0.1uF
C1106	2113945D04	CAP, 0.1uF

Reference	Motorola PN	Value
C1107	2113944C45	CAP, 100pF
C1108	2113946F03	CAP, 4.7uF
C1109	2113945D04	CAP, 0.1uF
C1110	2113945D04	CAP, 0.1uF
C1111	2113945D04	CAP, 0.1uF
C1112	2113945D04	CAP, 0.1uF
C1113	2113946M01	CAP, 1.0uF
C1114	2113944C45	CAP, 100pF
C1115	2113944C45	CAP, 100pF
C1119	2113945D04	CAP, 0.1uF
C1120	2113945D04	CAP, 0.1uF
C1121	2113945D04	CAP, 0.1uF
C1131	2113945D04	CAP, 0.1uF
C1132	2113945D04	CAP, 0.1uF
C1133	2113945C02	CAP, .01uF
C5001	2113945L37	CAP, 3300pF
C5002	2113945D04	CAP, 0.1uF
C5003	2113945C02	CAP, .01uF
C5004	2113945L37	CAP, 3300pF
C5005	2113944C04	CAP, 330pF
C5006	2113945C02	CAP, .01uF
C5007	2113944C36	CAP, 33pF
C5008	2113945C02	CAP, .01uF
C5009	2113945C02	CAP, .01uF
C5010	2113944C30	CAP, 10pF
C5011	2113944C37	CAP, 39pF
C5012	2113944C45	CAP, 100pF
C5013	2113944C36	CAP, 33pF
C5014	2113944M06	CAP, 3.3pF
C5015	2113944C63	CAP, 1pF
C5016	2113944C63	CAP, 1pF
C5017	2113944M06	CAP, 3.3pF
C5018	2113944C45	CAP, 100pF
C5019	2113945D04	CAP, 0.1uF
C5020	2113945D04	CAP, 0.1uF
C5021	2113945C02	CAP, .01uF
C5022	2113944C39	CAP, 56pF
C5023	2113944C43	CAP, 82pF
C5024	2113944C39	CAP, 56pF
C5025	2113945D04	CAP, 0.1uF
C5026	2113944C43	CAP, 82pF
C5027	2113944C31	CAP, 12pF
C5028	2113944C38	CAP, 47pF
C5031	2113944C04	CAP, 330pF
C5032	2113944C29	CAP, 9.1pF
C5033	2113945L25	CAP, 1000pF
C5034	2113944C45	CAP, 100pF

Reference	Motorola PN	Value
C5035	2113944C63	CAP, 1pF
C5036	2113944C45	CAP, 100pF
C5037	2113944C63	CAP, 1pF
C5041	2113944M06	CAP, 3.3pF
C5042	2113944C63	CAP, 1.0pF
C5043	2113944C63	CAP, 1.0pF
C5044	2113944M06	CAP, 3.3pF
C5045	2113944M13	CAP, 6.2pF
C5046	2113944C65	CAP, 1.2pF
C5047	2113944C30	CAP, 10pF
C5048	2113944C14	CAP, 2.2pF
C5051	2113945L25	CAP, 1000pF
C5052	2113944C39	CAP, 56pF
C5053	2113944C43	CAP, 82pF
C5054	2113944C39	CAP, 56pF
C5061	2113944C34	CAP, 22pF
C5062	2113944C14	CAP, 2.2pF
C5071	2113944C35	CAP, 27pF
C5072	2113944C31	CAP, 12pF
C5081	2113944C45	CAP, 100pF
C5082	2113944C45	CAP, 100pF
C5083	2113944C45	CAP, 100pF
C5084	2113945L25	CAP, 1000pF
C5085	2113944C45	CAP, 100pF
C5086	2113944C45	CAP, 100pF
C5087	2113944C45	CAP, 100pF
C5088	2113945L25	CAP, 1000pF
C5089	2113944C14	CAP, 2.2pF
C5090	2113944C63	CAP, 1pF
C5101	2113944C04	CAP, 330pF
C5102	2113944C04	CAP, 330pF
C5103	2113945C02	CAP, .01uF
C5104	2113945D04	CAP, 0.1uF
C5111	2113945D04	CAP, 0.1uF
C5112	2113944C93	CAP, 430pF
C5113	2113944C93	CAP, 430pF
C5120	2113944C04	CAP, 330pF
C5121	2113945L25	CAP, 1000pF
C5122	2113945L25	CAP, 1000pF
C5123	2113945C02	CAP, .01uF
C5124	2113945C02	CAP, .01uF
C5125	2113944C28	CAP, 8.2pF
C5126	2113944C32	CAP, 15pF
C5127	2113944C04	CAP, 330pF
C5128	2113945D04	CAP, 0.1uF
C5129	2113945C02	CAP, .01uF
C5130	2113945D04	CAP, 0.1uF

Reference	Motorola PN	Value
C5131	2113945C02	CAP, .01uF
C5132	2113945D04	CAP, 0.1uF
C5133	2113945D04	CAP, 0.1uF
C5134	2113945D04	CAP, 0.1uF
C5135	2113945D04	CAP, 0.1uF
C5136	2113945D04	CAP, 0.1uF
C5137	2113945C02	CAP, .01uF
C5138	2113945D04	CAP, 0.1uF
C5139	2113945D04	CAP, 0.1uF
C5140	2113945D04	CAP, 0.1uF
C5141	2113945D04	CAP, 0.1uF
C5142	2113945L25	CAP, 1000pF
C5143	0613952G67	RES, 0
C5144	2113944C45	CAP, 100pF
C5145	2313960D07	CAPP, 10uF
C5146	2113944C45	CAP, 100pF
C5147	2113945D04	CAP, 0.1uF
C5148	2113945D04	CAP, 0.1uF
C5150	2113945C02	CAP, .01uF
C5151	2113945C02	CAP, .01uF
C5152	2113945D04	CAP, 0.1uF
C5153	2113945D04	CAP, 0.1uF
C5154	2113945D04	CAP, 0.1uF
C5155	2113945D04	CAP, 0.1uF
C5156	2113945C02	CAP, .01uF
C5157	2113945C02	CAP, .01uF
C5158	2113945L25	CAP, 1000pF
C5159	2113945C02	CAP, .01uF
C5160	2113945L25	CAP, 1000pF
C5161	2113944C36	CAP, 33pF
C5162	2113944C36	CAP, 33pF
C5163	2113944C36	CAP, 33pF
C5164	2113944C36	CAP, 33pF
C5166	2313960B01	CAPP, 1uF
C5167	2313960B30	CAPP, 4.7uF
C5168	2313960B30	CAPP, 4.7uF
C5169	2313960B01	CAPP, 1uF
C5171	2113944C32	CAP, 15pF
C5172	2113945D04	CAP, 0.1uF
C5173	2113944C32	CAP, 15pF
C5174	2113944C32	CAP, 15pF
C5175	2113944C32	CAP, 15pF
C5176	2113944C01	CAP, 180pF
C5177	2113944C32	CAP, 15pF
C5178	2113944C45	CAP, 100pF
C5179	2113944C45	CAP, 100pF
C5180	2113944C41	CAP, 68pF

Reference	Motorola PN	Value
C5181	2113944C32	CAP, 15pF
C5182	2113944C34	CAP, 22pF
C5183	2113944C34	CAP, 22pF
C5184	2113945C02	CAP, .01uF
C5185	2113945D04	CAP, 0.1uF
C5186	2113945L25	CAP, 1000pF
C5187	2113944C30	CAP, 10pF
C5188	2113945G95	CAP, 0.22uF
C5189	2313960C78	CAPP, 2.2uF
C5190	2113944C45	CAP, 100pF
C5191	2113944C45	CAP, 100pF
C5192	2113944C47	CAP, 150pF
C5193	2113944C45	CAP, 100pF
C5194	2113945C02	CAP, .01uF
C5195	2113945D04	CAP, 0.1uF
C5197	2113944C32	CAP, 15pF
C5198	2113945G95	CAP, 0.22uF
C5199	2313960C78	CAPP, 2.2uF
C5202	2113944C32	CAP, 15pF
C5203	2113944C22	CAP, 4.7pF
C5204	2113944C63	CAP, 1pF
C5205	2113944C35	CAP, 27pF
C5206	2113944C04	CAP, 330pF
C5208	2113945D04	CAP, 0.1uF
C5209	2113945D04	CAP, 0.1uF
C5210	2113944C04	CAP, 330pF
C5211	2113944C04	CAP, 330pF
C5212	2113945L25	CAP, 1000pF
C5213	2113945L25	CAP, 1000pF
C5214	2113945C02	CAP, .01uF
C5215	2113945C02	CAP, .01uF
C5216	2113945C02	CAP, .01uF
C5217	2113944C14	CAP, 2.2pF
C5218	2113944C04	CAP, 330pF
C5219	2113945L25	CAP, 1000pF
C5220	2113944M14	CAP, 6.8pF
C5221	2113944M25	CAP, 20pF
C5301	2113945C02	CAP, .01uF
C5303	0804533C37	CAP, 0.1uF
C5305	2113945C02	CAP, .01uF
C5306	2113945D04	CAP, 0.1uF
C5307	2313960D07	CAPP, 10uF
C5308	2113945D04	CAP, 0.1uF
C5309	2113945L37	CAP, 3300pF
C5311	2113945C02	CAP, .01uF
C5312	2113945C02	CAP, .01uF
C5313	2113945C02	CAP, .01uF

Reference	Motorola PN	Value
C5314	2113945C02	CAP, .01uF
C5315	2113945C02	CAP, .01uF
C5316	2313960D07	CAPP, 10uF
C5317	2113944C34	CAP, 22pF
C5318	2313960B30	CAPP, 4.7uF
C5319	2113945D04	CAP, 0.1uF
C5321	2313960B30	CAPP, 4.7uF
C5322	2113945C02	CAP, .01uF
C5323	2113945D04	CAP, 0.1uF
C5324	2313960D07	CAPP, 10uF
C5331	2113945D04	CAP, 0.1uF
C5332	2113945D04	CAP, 0.1uF
C5333	2113944C01	CAP, 180pF
C5334	2113945D04	CAP, 0.1uF
C5335	2113944C39	CAP, 56pF
C5336	2113945C02	CAP, .01uF
C5337	2113944C13	CAP, 2.0pF
C5338	2113944C45	CAP, 100pF
C5339	2313960B30	CAPP, 4.7uF
C5340	2113944C36	CAP, 33pF
C5341	2113944C36	CAP, 33pF
C5342	2113944C36	CAP, 33pF
C5343	2313960D07	CAPP, 10uF
C5344	2113945L25	CAP, 1000pF
C5345	2113945C02	CAP, .01uF
C5351	2113945D04	CAP, 0.1uF
C5352	2113945L25	CAP, 1000pF
C5353	2113945C02	CAP, .01uF
C5362	2113945C02	CAP, .01uF
C5363	2113945D04	CAP, .1uF
C5365	2113945D04	CAP, 0.1uF
C5366	2113945D04	CAP, 0.1uF
C5400	2113944C06	CAP, 470pF
C5401	2113944C01	CAP, 180pF
C5402	2113944M13	CAP, 6.2pF
C5403	2113944C06	CAP, 470pF
C5404	2113944M25	CAP, 20pF
C5405	2113945C04	CAP, .022uF
C5406	2113945C04	CAP, .022uF
C5407	2113944C01	CAP, 180pF
C5408	2113945C04	CAP, .022uF
C5409	2113944C01	CAP, 180pF
C5410	2113945C04	CAP, .022uF
C5411	2113944C01	CAP, 180pF
C5412	2113944C38	CAP, 47pF
C5413	2113944C31	CAP, 12pF
C5414	2113944C37	CAP, 39pF

Reference	Motorola PN	Value
C5415	2113944M25	CAP, 20pF
C5416	2113944C34	CAP, 22pF
C5417	2113945L37	CAP, 3300pF
C5418	2113944C45	CAP, 100pF
C5419	2113944M25	CAP, 20pF
C5420	2113944C31	CAP, 12pF
C5421	2313960C26	CAPP, 1uF
C5422	2113944F01	CAP, 100pF
C5423	2113944C82	CAP, 30pF
C5424	2113944C38	CAP, 47pF
C5425	2113944C29	CAP, 9.1pF
C5426	2113944C37	CAP, 39pF
C5427	2113944C37	CAP, 39pF
C5428	2113945L37	CAP, 3300pF
C5429	2113944C01	CAP, 180pF
C5430	2113944C80	CAP, 20pF
C5431	2111078B42	CAP, 100pF
C5432	2111078B27	CAP, 30pF
C5433	2111078B27	CAP, 30pF
C5434	2111078B27	CAP, 30pF
C5435	2111078B27	CAP, 30pF
C5436	2111078B21	CAP, 20pF
C5437	2111078B27	CAP, 30pF
C5438	2111078B13	CAP, 10pF
C5439	2111078B01	CAP, 3.3pF
C5440	2111078B42	CAP, 100pF
C5441	2113944C26	CAP, 6.8pF
C5442	2113944C30	CAP, 10pF
C5443	2113944C30	CAP, 10pF
C5444	2111078B18	CAP, 15pF
C5445	2111078B12	CAP, 9.1pF
C5451	2113944C32	CAP, 15pF
C5452	2111078B42	CAP, 100pF
C5453	2111078B42	CAP, 100pF
C5454	2111078B38	CAP, 68pF
C5455	2113944C01	CAP, 180pF
C5461	2111078B59	CAP, 470pF
C5462	2460591D23	CAP, 17.24nH
C5463	2111078B15	CAP, 12pF
C5464	2111078B42	CAP, 100pF
C5465	2111078B13	CAP, 10pF
C5466	2111078B05	CAP, 4.7pF
C5467	2111078B06	CAP, 5.1pF
C5468	2111078B03	CAP, 3.9pF
C5469	2113944C01	CAP, 180pF
C5470	2113944C30	CAP, 10pF
C5501	2113944C45	CAP, 100pF

Reference	Motorola PN	Value
C5502	2113944C01	CAP, 180pF
C5503	2113945G57	CAP, .033uF
C5504	2313960J01	CAPP, 10uF
C5505	2113945G57	CAP, .033uF
C5506	2113944C01	CAP, 180pF
C5521	2113944C01	CAP, 180pF
C5541	2113944C01	CAP, 180pF
C5551	2113945L25	CAP, 1000pF
C5552	2113944C04	CAP, 330pF
C5553	2113944M12	CAP, 5.6pF
C5554	2111078B36	CAP, 56pF
C5555	2113944C61	CAP, 0.5pF
C5556	2113944C29	CAP, 9.1pF
C5557	2113944C01	CAP, 180pF
C5558	2113944C01	CAP, 180pF
C5601	2113944C45	CAP, 100pF
C5602	2113944C38	CAP, 47pF
C5603	2113944M06	CAP, 3.3pF
C5604	2113944C63	CAP, 1pF
C5605	2113944M16	CAP, 8.2pF
C5606	2113944M16	CAP, 8.2pF
C5607	2113944C34	CAP, 22pF
C5609	2113944C45	CAP, 100pF
C5610	2113945C04	CAP, .022uF
C5611	2113944C22	CAP, 4.7pF
C5621	2113945C04	CAP, .022uF
C5622	2113944C45	CAP, 100pF
C5623	2113944M13	CAP, 6.2pF
C5624	2113945C04	CAP, .022uF
C5625	2113944M24	CAP, 18pF
C5626	2113944M20	CAP, 12pF
C5627	2113944M16	CAP, 8.2pF
C5628	2113944M20	CAP, 12pF
C5629	2113945C04	CAP, .022uF
C5631	2113944C45	CAP, 100pF
C5632	2113944C67	CAP, 1.5pF
C5633	2113944C45	CAP, 100pF
C5634	2113944C45	CAP, 100pF
C5635	2113944C14	CAP, 2.2pF
C5651	2313960D07	CAPP, 10uF
C5652	2113945C04	CAP, .022uF
C5653	2113945D04	CAP, 0.1uF
C5654	2113945C02	CAP, .01uF
C5671	2313960D07	CAPP, 10uF
C5672	2313960D07	CAPP, 10uF
C5681	2313960D07	CAPP, 10uF
C5682	2113945D04	CAP, 0.1uF

Reference	Motorola PN	Value
C5683	2113944C04	CAP, 330pF
C5701	2113944M16	CAP, 8.2pF
C5702	2113944C28	CAP, 8.2pF
C5703	2113944C04	CAP, 330pF
C5704	2113944C45	CAP, 100pF
C5705	2113944M12	CAP, 5.6pF
C5706	2113944C45	CAP, 100pF
C5707	2113944C45	CAP, 100pF
C5708	2113944C18	CAP, 3.3pF
C5711	2113944C04	CAP, 330pF
C5712	2113945D04	CAP, 0.1uF
C5713	2113945L25	CAP, 1000pF
C5714	2113945D04	CAP, 0.1uF
C5715	2113945C04	CAP, .022uF
C5716	2113944M12	CAP, 5.6pF
C5721	2113944C13	CAP, 2.0pF
C5722	2113945L25	CAP, 1000pF
C5724	2113945C04	CAP, .022uF
C5726	2113944C67	CAP, 1.5pF
C5731	2113945C02	CAP, .01uF
C5732	2113944C04	CAP, 330pF
C5733	2113945D04	CAP, 0.1uF
C5734	2113945D04	CAP, 0.1uF
C5735	2113944C67	CAP, 1.5pF
C5736	2113944C34	CAP, 22pF
C5737	2113944M03	CAP, 2.4pF
C5738	2113944C32	CAP, 15pF
C5739	2113944C04	CAP, 330pF
C5740	2113945L41	CAP, 4700pF
C5741	2113944C38	CAP, 47pF
C5742	2113945D04	CAP, 0.1uF
C5743	2113944C63	CAP, 1pF
C5803	2113944C01	CAP, 180pF
C5804	2113944C01	CAP, 180pF
C5805	2113951A35	CAP, 11pF
C5806	2113944M03	CAP, 2.4pF
C5807	2113944C35	CAP, 27pF
C5808	2113951A35	CAP, 11pF
C5809	2113944M03	CAP, 2.4pF
C5810	2113944M03	CAP, 2.4pF
C5811	2113944C28	CAP, 8.2pF
C5812	2113944C28	CAP, 8.2pF
C5813	2113944C01	CAP, 180pF
C5819	2113944C01	CAP, 180pF
C5820	2113945D04	CAP, 0.1uF
C5822	2113944C01	CAP, 180pF
C5823	2113945D04	CAP, 0.1uF

Reference	Motorola PN	Value
C5824	2113944C01	CAP, 180pF
C5825	2113945D04	CAP, 0.1uF
C5826	2113945D04	CAP, 0.1uF
C5827	2113945D04	CAP, 0.1uF
C5828	2113944C01	CAP, 180pF
C5829	2113944C76	CAP, 9.1pF
C5830	2113944M03	CAP, 2.4pF
C5831	2113945L37	CAP, 3300pF
C5832	2113944M18	CAP, 10pF
C5833	2113945D04	CAP, 0.1uF
C5834	2113945D04	CAP, 0.1uF
C5836	2113945D04	CAP, 0.1uF
C5837	2113944C76	CAP, 9.1pF
C5838	2113944C28	CAP, 8.2pF
C5840	2113945D04	CAP, 0.1uF
C5841	2113945D04	CAP, 0.1uF
C5842	2113945D04	CAP, 0.1uF
C5843	2113945C04	CAP, .022uF
C5844	2113945C04	CAP, .022uF
C5845	2113944C01	CAP, 180pF
C5846	2113944C01	CAP, 180pF
C5847	2113945L25	CAP, 1000pF
C5848	2113945D04	CAP, 0.1uF
C5849	2113945D04	CAP, 0.1uF
C5850	2113945D04	CAP, 0.1uF
C5852	2113945L37	CAP, 3300pF
C5853	2113945L41	CAP, 4700pF
C5854	2113944C01	CAP, 180pF
C5855	2113944C01	CAP, 180pF
C5856	2113944C06	CAP, 470pF
C5857	2113944C06	CAP, 470pF
C5859	2113945L41	CAP, 4700pF
C5862	2113944C01	CAP, 180pF
C5863	2113944C01	CAP, 180pF
C5864	2113945D04	CAP, 0.1uF
C5865	2113944C06	CAP, 470pF
C5867	2113944C01	CAP, 180pF
C5868	2113944C01	CAP, 180pF
C5871	2113944C03	CAP, 270pF
C5872	2113944C03	CAP, 270pF
C5873	2113944C03	CAP, 270pF
C5874	2113944C03	CAP, 270pF
C5875	2313960B01	CAPP, 1uF
C5876	2113944C01	CAP, 180pF
C5877	2409377M13	IDCTR, 56nH
C5878	2113944M03	CAP, 2.4pF
D0101	4813978C02	78C02

Reference	Motorola PN	Value
D0102	4813978C02	78C02
D0150	4813974A21	BAS70-04LT1G
D0151	4813974A21	BAS70-04LT1G
D0152	4813978C02	78C02
D0153	4813974A21	BAS70-04LT1G
D0300	4813978C02	78C02
D0301	4813978C02	78C02
D0303	4813978C02	78C02
D0304	4813978C02	78C02
D0305	4813974A21	BAS70-04LT1G
D0325	4813978C02	78C02
D0404	4866544A01	SR05
D1101	4813978C02	78C02
D5001	4815011H01	IMN10
D5011	4805656W90	1SV304
D5012	4805656W90	1SV304
D5013	4813974A17	MMBD353LT1G
D5018	4813974A06	MMBV3401LT1G
D5025	4813974A06	MMBV3401LT1G
D5031	4813974A06	MMBV3401LT1G
D5041	4805656W90	1SV304
D5042	4805656W90	1SV304
D5061	4886143B01	SMS3927-99
D5081	4813974A06	MMBV3401LT1G
D5082	4813974A06	MMBV3401LT1G
D5121	4813974A17	MMBD353LT1G
D5180	4885055Y01	1SV229
D5190	4813974A01	MMBV609LT1G
D5201	4813974A06	MMBV3401LT1G
D5202	4813974A06	MMBV3401LT1G
D5301	4815011H01	IMN10
D5302	4815011H01	IMN10
D5331	4813974A05	MMBD301LT1G
D5451	4802482J02	MA4P959
D5454	4802482J02	MA4P959
D5551	4802482J02	MA4P959
D5601	4885055Y01	1SV229
D5602	4885055Y01	1SV229
D5603	4885055Y01	1SV229
D5604	4885055Y01	1SV229
D5731	4885055Y01	1SV229
D5732	4885055Y01	1SV229
D5733	4885055Y01	1SV229
D5734	4885055Y01	1SV229
E0300	2415954H01	57R01
E1101	2480067M02	BLM21A121S
E1102	2480067M02	BLM21A121S

Reference	Motorola PN	Value
E1103	2480067M02	BLM21A121S
F0301	6515076H01	FUSE
F0302	6515076H01	FUSE
F0303	6515076H01	FUSE
FL0200	5185941F33	MC145483
FL5451	5804901K04	SI15R0390MP
J0301	0986165B02	CONN_J
J0400	0966512A01	CONN_J
J0450	0905505Y04	CONN_J
J0500	0905505Y04	CONN_J
J0550	0916162H02	in CONN_J
J0570	0905505Y03	CONN_J
J0600	0980521Z04	pin CONN_J
J5401	0986166B01	CONN_J
L0231	2415954H01	57R01
L0232	2415954H01	57R01
L0301	2414017Q42	IDCTR, 390nH
L5002	2414015B02	IDCTR, 68nH
L5011	2414015B16	IDCTR, 27nH
L5031	2414015B08	IDCTR, 220nH
L5041	2414015B24	IDCTR, 15nH
L5048	2414015B16	IDCTR, 27nH
L5061	2414015B08	IDCTR, 220nH
L5062	2414015B08	IDCTR, 220nH
L5071	2414015B24	IDCTR, 15nH
L5081	2414032F66	IDCTR, 10nH
L5082	2414015B02	IDCTR, 68nH
L5126	2414032D23	IDCTR, 470nH
L5174	2466505A01	IDCTR, 10uH
L5175	2466505A01	IDCTR, 10uH
L5180	2414032D19	IDCTR, 220nH
L5190	2414032D30	IDCTR, 1uH
L5201	2414015A11	IDCTR, 390nH
L5202	2414015A11	IDCTR, 390nH
L5203	2414017Q44	IDCTR, 560nH
L5204	2414015A08	IDCTR, 220nH
L5218	2414015B08	IDCTR, 220nH
L5219	2414015B08	IDCTR, 220nH
L5301	2414017Q42	IDCTR, 390nH
L5309	2414017Q20	IDCTR, 2.2uH
L5361	2414017Q20	IDCTR, 2.2uH
L5401	2460591B04	IDCTR, 11.03uH
L5402	2414015B02	IDCTR, 68nH
L5403	2414015B24	IDCTR, 15nH
L5421	2460591A01	IDCTR, 4.22nH
L5431	2485873L01	IDCTR, 18nH
L5451	2414015A13	IDCTR, 560nH

Reference	Motorola PN	Value
L5452	2485873L01	IDCTR, 18nH
L5454	2414015A13	IDCTR, 560nH
L5461	2485873L01	IDCTR, 18nH
L5462	2485873L01	IDCTR, 18nH
L5501	2415954H01	57R01
L5502	2415954H01	57R01
L5503	2415954H01	57R01
L5551	2414015A13	IDCTR, 560nH
L5601	2414015A11	IDCTR, 390nH
L5603	2414015A04	IDCTR, 100nH
L5604	2414015A01	IDCTR, 56nH
L5623	2414015B25	IDCTR, 8.2nH
L5627	2414015B25	IDCTR, 8.2nH
L5701	2414015B24	IDCTR, 15nH
L5702	2414015B16	IDCTR, 27nH
L5711	2414015B16	IDCTR, 27nH
L5712	2414015B24	IDCTR, 15nH
L5721	2414015B02	IDCTR, 68nH
L5722	2414032D23	IDCTR, 470nH
L5731	2414032D23	IDCTR, 470nH
L5732	2460593C02	RESONATOR
L5733	2414032D19	IDCTR, 220nH
L5734	2414032D19	IDCTR, 220nH
L5803	2414015B16	IDCTR, 27nH
L5804	2414015B24	IDCTR, 15nH
L5805	2414015B24	IDCTR, 15nH
L5809	2414015B02	IDCTR, 68nH
L5810	2414015B24	IDCTR, 15nH
L5811	2414015B24	IDCTR, 15nH
L5812	2580443L13	XFMR
L5813	2414015A13	IDCTR, 560nH
L5814	2414017Q20	IDCTR, 2.2uH
M0301	3980502Z01	BATTERY_CONTACT
M0302	3980501Z01	BATTERY_CONTACT
M5421	2686201B02	HEATSINK
Q0100	4813973M07	73M07
Q0101	4813973A42	DTC144EKA
Q0150	4815066H01	UMG5
Q0152	4815066H01	UMG5
Q0156	4813973A42	DTC144EKA
Q0157	4813973A42	DTC144EKA
Q0158	4813973A42	DTC144EKA
Q0159	4816147H01	RXT-A28
Q0160	4813973A42	DTC144EKA
Q0161	4813973A81	UMD3N
Q0163	4813973A42	DTC144EKA
Q0164	4813973M07	73M07

Reference	Motorola PN	Value
Q0200	4813973A42	DTC144EKA
Q0201	4815066H01	UMG5
Q0202	4813973A42	DTC144EKA
Q0203	4813973A42	DTC144EKA
Q0301	4813973A81	UMD3N
Q0302	4813973M07	73M07
Q0303	4813973A42	DTC144EKA
Q0305	4813973M07	73M07
Q0306	4813973M07	73M07
Q0341	4813973A13	73A13
Q0342	4813973A42	DTC144EKA
Q0343	4813973M07	73M07
Q0344	4813973A13	73A13
Q0401	4813973A81	UMD3N
Q0600	5166540A01	FDC6330L
Q5001	4813973A13	73A13
Q5002	4813973M07	73M07
Q5021	4813973A42	DTC144EKA
Q5022	4813973A81	UMD3N
Q5031	4802197J95	PBR941
Q5081	4802197J95	PBR941
Q5101	4802197J95	PBR941
Q5151	4802197J95	PBR941
Q5180	4802197J95	PBR941
Q5190	4802197J95	PBR941
Q5201	4802197J95	PBR941
Q5202	4813973M07	73M07
Q5301	4813973A81	UMD3N
Q5331	4813973A42	DTC144EKA
Q5332	4813973A13	73A13
Q5351	4802197J95	PBR941
Q5421	4813976A04	MRF1518
Q5431	4813976A13	MRF1535
Q5501	4813973A13	73A13
Q5521	4813973A13	73A13
Q5542	4813973A13	73A13
Q5551	4813973A13	73A13
Q5552	4815066H01	UMG5
Q5553	4813973A13	73A13
Q5601	4805218N63	BFQ67W
Q5602	4813973A42	DTC144EKA
Q5621	4802197J95	PBR941
Q5631	4802197J95	PBR941
Q5651	4815267H01	UMT1
Q5671	4813973M07	73M07
Q5681	4813973M07	73M07
Q5701	4802197J95	PBR941

Reference	Motorola PN	Value
Q5711	4813973A81	UMD3N
Q5801	4802197J95	PBR941
Q5802	4815066H01	UMG5
Q5804	4813973A13	73A13
R0100	0613952H89	RES, 4.7K
R0101	0613952H89	RES, 4.7K
R0102	0613952H89	RES, 4.7K
R0105	0613952H25	RES, 10
R0106	0613952J17	RES, 47K
R0107	0613952H25	RES, 10
R0108	0613952J17	RES, 47K
R0111	0613952H25	RES, 10
R0113	0613952J01	RES, 10K
R0115	0613952J22	RES, 75K
R0117	0613952J12	RES, 30K
R0118	0613952J05	RES, 15K
R0119	0613952J01	RES, 10K
R0120	0613952H89	RES, 4.7K
R0122	0613952J01	RES, 10K
R0125	0613952H77	RES, 1.5K
R0127	0613952J17	RES, 47K
R0128	0613952H77	RES, 1.5K
R0129	0613952J17	RES, 47K
R0130	0613952G67	RES, 0
R0131	0613952H25	RES, 10
R0132	0613952H67	RES, 560
R0133	0613952J13	RES, 33K
R0134	0613952H77	RES, 1.5K
R0135	0613952J17	RES, 47K
R0136	0613952J17	RES, 47K
R0150	0613952J17	RES, 47K
R0151	0613952J13	RES, 33K
R0152	0613952J13	RES, 33K
R0153	0613952J17	RES, 47K
R0154	0613952H81	RES, 2.2K
R0155	0613952H81	RES, 2.2K
R0156	0613952J25	RES, 100K
R0157	0613952J13	RES, 33K
R0159	0613952J17	RES, 47K
R0160	0613952H89	RES, 4.7K
R0161	0613952J17	RES, 47K
R0162	0613952J17	RES, 47K
R0163	0613952J17	RES, 47K
R0165	0613952H89	RES, 4.7K
R0166	0613952J01	RES, 10K
R0167	0613952J17	RES, 47K
R0168	0613952J01	RES, 10K

Reference	Motorola PN	Value
R0169	0613952J01	RES, 10K
R0170	0613952J01	RES, 10K
R0171	0613952J01	RES, 10K
R0172	0613952J01	RES, 10K
R0173	0613952H81	RES, 2.2K
R0174	0613952J01	RES, 10K
R0175	0613952J01	RES, 10K
R0176	0613952J17	RES, 47K
R0177	0613952J09	RES, 22K
R0178	0613952J25	RES, 100K
R0179	0613952J13	RES, 33K
R0180	0613952J25	RES, 100K
R0181	0613952J13	RES, 33K
R0182	0613952J25	RES, 100K
R0200	0613952H67	RES, 560
R0201	0613952H49	RES, 100
R0202	0613952H49	RES, 100
R0203	0613952H67	RES, 560
R0204	0613952J32	RES, 200K
R0205	0613952J32	RES, 200K
R0206	0613952J17	RES, 47K
R0207	0613952J17	RES, 47K
R0208	0613952J17	RES, 47K
R0218	0613952J01	RES, 10K
R0220	0613952H73	RES, 1K
R0221	0613952H49	RES, 100
R0222	0613952J01	RES, 10K
R0223	0613952H89	RES, 4.7K
R0224	0613952J05	RES, 15K
R0225	0613952H73	RES, 1K
R0228	0613952J01	RES, 10K
R0237	0613952J05	RES, 15K
R0238	0613952J11	RES, 27K
R0239	0613952J03	RES, 12K
R0240	0613952J25	RES, 100K
R0241	0613952J05	RES, 15K
R0242	0613952J35	RES, 270K
R0243	0613952J11	RES, 27K
R0244	0613952J01	RES, 10K
R0245	0613952H85	RES, 3.3K
R0246	0613952J05	RES, 15K
R0300	0613952H73	RES, 1K
R0301	0613952J22	RES, 75K
R0302	0613952H95	RES, 8.2K
R0303	0613952J17	RES, 47K
R0304	0613952H89	RES, 4.7K
R0305	0613958D85	RES, 7.5K



Reference	Motorola PN	Value
R0306	0613958D09	RES, 1.21K
R0307	0613958D85	RES, 7.5K
R0308	0613958D09	RES, 1.21K
R0309	0613952J01	RES, 10K
R0310	0613952J17	RES, 47K
R0311	0613952H77	RES, 1.5K
R0312	0613952E66	RES, 47.5K
R0313	0613952E09	RES, 12.1K
R0314	0613952H73	RES, 1K
R0318	0613952E66	RES, 47.5K
R0319	0613952E09	RES, 12.1K
R0323	0613952G67	RES, 0
R0324	0613952G67	RES, 0
R0325	0613952H89	RES, 4.7K
R0326	0613952G67	RES, 0
R0327	0613952G67	RES, 0
R0328	0613952G67	RES, 0
R0330	0613952Z58	RES, 22K
R0331	0613952Z65	RES, 43K
R0332	0613952E69	RES, 51.1K
R0341	0613952H89	RES, 4.7K
R0342	0613952J25	RES, 100K
R0343	0613952J17	RES, 47K
R0344	0613952J17	RES, 47K
R0345	0613952J01	RES, 10K
R0346	0613952J17	RES, 47K
R0347	0613952G67	RES, 0
R0348	0613952G67	RES, 0
R0349	0613952H49	RES, 100
R0400	0613952J17	RES, 47K
R0401	0613952J17	RES, 47K
R0402	0613952H89	RES, 4.7K
R0403	0613952J01	RES, 10K
R0404	0613952H89	RES, 4.7K
R0405	0613952H75	RES, 1.2K
R0406	0613952J01	RES, 10K
R0409	0613952H67	RES, 560
R0410	0613952J25	RES, 100K
R0411	0613952H33	RES, 22
R0412	0613952H33	RES, 22
R0413	0613952J01	RES, 10K
R0415	0613952H49	RES, 100
R0416	0613952H77	RES, 1.5K
R0417	0613952H49	RES, 100
R0418	0613952H49	RES, 100
R0420	0613952G67	RES, 0
R0421	0613952G67	RES, 0

Reference	Motorola PN	Value
R0423	0613952G67	RES, 0
R0424	0613952G67	RES, 0
R0427	0613952G67	RES, 0
R0428	0613952J01	RES, 10K
R0450	0613952J17	RES, 47K
R0451	0613952J01	RES, 10K
R0452	0613952H81	RES, 2.2K
R0454	0613952J13	RES, 33K
R0455	0613952J01	RES, 10K
R0459	0613952J01	RES, 10K
R0463	0613952J01	RES, 10K
R0464	0613952H49	RES, 100
R0465	0613952G67	RES, 0
R0466	0613952G67	RES, 0
R0467	0613952H89	RES, 4.7K
R0468	0613952J25	RES, 100K
R0469	0613952H81	RES, 2.2K
R0470	0613952J25	RES, 100K
R0471	0613952G67	RES, 0
R0472	0613952G67	RES, 0
R0473	0613952H59	RES, 270
R0505	0613952H33	RES, 22
R0527	0613952H89	RES, 4.7K
R0555	0613952H65	RES, 470
R0557	0613952H25	RES, 10
R0559	0613952H25	RES, 10
R0562	0613952G67	RES, 0
R0571	0613952J17	RES, 47K
R0600	0613952G67	RES, 0
R0601	0613952G67	RES, 0
R0602	0613952G67	RES, 0
R0603	0613952G67	RES, 0
R0604	0613952J17	RES, 47K
R0605	0613952J01	RES, 10K
R1101	0613952J17	RES, 47K
R1103	0613952J01	RES, 10K
R1104	0613952J01	RES, 10K
R1107	0613952G67	RES, 0
R1108	0613952G67	RES, 0
R1109	0613952G67	RES, 0
R1111	0613952J01	RES, 10K
R1112	0613952G67	RES, 0
R1131	0613952J25	RES, 100K
R1132	0613952J01	RES, 10K
R5001	0613952J01	RES, 10K
R5002	0613952H81	RES, 2.2K
R5003	0613952H93	RES, 6.8K

Reference	Motorola PN	Value
R5004	0613952H73	RES, 1K
R5005	0613952H89	RES, 4.7K
R5006	0613952H61	RES, 330
R5007	0613952H61	RES, 330
R5008	0613952H85	RES, 3.3K
R5009	0613952H42	RES, 51
R5011	0613952H59	RES, 270
R5012	0613952H77	RES, 1.5K
R5013	0613952H63	RES, 390
R5014	0613952H63	RES, 390
R5015	0613952H33	RES, 22
R5016	0613952H85	RES, 3.3K
R5017	0613952H89	RES, 4.7K
R5018	0613952H37	RES, 33
R5021	0613952J17	RES, 47K
R5022	0613952J25	RES, 100K
R5023	0613952H89	RES, 4.7K
R5024	0613952J25	RES, 100K
R5025	0613952H73	RES, 1K
R5026	0613952H73	RES, 1K
R5027	0613958H11	RES, 2.7
R5028	0613952H83	RES, 2.7K
R5031	0613952H77	RES, 1.5K
R5032	0613952H81	RES, 2.2K
R5036	0613952H73	RES, 1K
R5041	2113944M13	CAP, 6.2pF
R5042	2113944M34	CAP, 47pF
R5043	0613952G67	RES, 0
R5044	2113944C18	CAP, 3.3pF
R5051	0613952J25	RES, 100K
R5061	0613952H73	RES, 1K
R5062	0613952H73	RES, 1K
R5063	0613952H42	RES, 51
R5081	0613952H95	RES, 8.2K
R5082	0613952H83	RES, 2.7K
R5083	0613952H73	RES, 1K
R5084	0613952J03	RES, 12K
R5085	0613952H61	RES, 330
R5086	0613952H65	RES, 470
R5087	0613952H61	RES, 330
R5088	0613952H83	RES, 2.7K
R5089	0613952H25	RES, 10
R5090	0613952H42	RES, 51
R5100	0613952H42	RES, 51
R5101	0613952J03	RES, 12K
R5102	0613952J11	RES, 27K
R5103	0613952J01	RES, 10K

Reference	Motorola PN	Value
R5104	0613952H71	RES, 820
R5105	0613952H33	RES, 22
R5106	0613952H41	RES, 47
R5121	0613952H81	RES, 2.2K
R5122	0613952H65	RES, 470
R5125	0613952H67	RES, 560
R5131	0613952H25	RES, 10
R5132	0613952H25	RES, 10
R5133	0613952H25	RES, 10
R5134	0613952H25	RES, 10
R5140	0613952H33	RES, 22
R5141	0613952G67	RES, 0
R5142	0613952G67	RES, 0
R5144	0613952H81	RES, 2.2K
R5145	0613952H51	RES, 120
R5146	0613952H49	RES, 100
R5147	0613952H45	RES, 68
R5148	0613952H45	RES, 68
R5149	0613952J25	RES, 100K
R5150	0613952G67	RES, 0
R5151	0613952H25	RES, 10
R5152	0613952H25	RES, 10
R5153	0613952G67	RES, 0
R5154	0613952G67	RES, 0
R5155	0613952G67	RES, 0
R5157	0613952J17	RES, 47K
R5158	0613952H59	RES, 270
R5159	0613952G67	RES, 0
R5160	0613952H73	RES, 1K
R5161	0613952H33	RES, 22
R5162	0613952H33	RES, 22
R5163	0613952H33	RES, 22
R5164	0613952H73	RES, 1K
R5165	0613952J17	RES, 47K
R5166	0613952H25	RES, 10
R5167	0613952J01	RES, 10K
R5168	0613952J17	RES, 47K
R5169	0613952H33	RES, 22
R5170	0613952H25	RES, 10
R5171	0613952H85	RES, 3.3K
R5172	0613952H33	RES, 22
R5176	0613952J13	RES, 33K
R5177	0613952H65	RES, 470
R5178	0613952G67	RES, 0
R5179	0613952H59	RES, 270
R5180	0613952H85	RES, 3.3K
R5181	0613952J19	RES, 56K

Reference	Motorola PN	Value
R5182	0613952G67	RES, 0
R5183	0613952H49	RES, 100
R5184	0613952H75	RES, 1.2K
R5185	0613952H33	RES, 22
R5186	0613952J32	RES, 200K
R5187	0613952H59	RES, 270
R5188	0613952G67	RES, 0
R5189	0613952G67	RES, 0
R5190	0613952J08	RES, 20K
R5191	0613952J13	RES, 33K
R5192	0613952H93	RES, 6.8K
R5193	0613952H49	RES, 100
R5194	0613952H75	RES, 1.2K
R5195	0613952H33	RES, 22
R5196	0613952J32	RES, 200K
R5197	0613952H59	RES, 270
R5198	0613952G67	RES, 0
R5199	0613952G67	RES, 0
R5204	0613952J03	RES, 12K
R5205	0613952J11	RES, 27K
R5206	0613952H89	RES, 4.7K
R5207	0613952H59	RES, 270
R5208	0613952H69	RES, 680
R5209	0613952H77	RES, 1.5K
R5210	0613952H29	RES, 15
R5211	0613952H61	RES, 330
R5212	0613952H79	RES, 1.8K
R5213	0613952H89	RES, 4.7K
R5214	0613952H83	RES, 2.7K
R5215	0613952H65	RES, 470
R5216	0613952H59	RES, 270
R5217	0613952J01	RES, 10K
R5218	0613952H42	RES, 51
R5219	0613952H83	RES, 2.7K
R5220	0613952H81	RES, 2.2K
R5221	0613952H61	RES, 330
R5301	0613952H81	RES, 2.2K
R5302	0613952H71	RES, 820
R5303	0613952H79	RES, 1.8K
R5304	0613952H61	RES, 330
R5311	0613952G67	RES, 0
R5312	0613952H49	RES, 100
R5313	0613952G67	RES, 0
R5314	0613952J17	RES, 47K
R5315	0613952H49	RES, 100
R5316	0613952H49	RES, 100
R5321	0613952H49	RES, 100

Reference	Motorola PN	Value
R5322	0613952H45	RES, 68
R5323	0613952H45	RES, 68
R5330	0613952J37	RES, 330K
R5331	0613952J17	RES, 47K
R5332	0613952J17	RES, 47K
R5333	0613952J25	RES, 100K
R5334	0613952H49	RES, 100
R5335	0613952J15	RES, 39K
R5336	0613952J12	RES, 30K
R5337	0613952J25	RES, 100K
R5338	0613952J21	RES, 68K
R5339	0613952H95	RES, 8.2K
R5351	0613952H73	RES, 1K
R5352	0613952J17	RES, 47K
R5353	0613952H49	RES, 100
R5354	0613952H89	RES, 4.7K
R5355	0613952H73	RES, 1K
R5364	0613952H42	RES, 51
R5400	0613952H51	RES, 120
R5401	0613952H56	RES, 200
R5403	0613952H73	RES, 1K
R5404	0613952H91	RES, 5.6K
R5405	0613952H42	RES, 51
R5406	0613952H42	RES, 51
R5407	0613952H69	RES, 680
R5408	0613952G67	RES, 0
R5419	0613958H49	RES, 100
R5420	0613958H49	RES, 100
R5431	0613959Y42	RES, 51
R5450	0613959Y42	RES, 51
R5451	0613958H53	RES, 150
R5452	0613958H53	RES, 150
R5453	0613952H53	RES, 180
R5454	0613952H51	RES, 100
R5455	0613952H45	RES, 68
R5461	0613952J01	RES, 10K
R5462	0613952H25	RES, 10
R5501	0613952H69	RES, 680
R5502	0613952G67	RES, 0
R5503	0613952J13	RES, 33K
R5504	0613952J15	RES, 39K
R5521	0613952J13	RES, 33K
R5522	0613952J15	RES, 39K
R5523	0613952H83	RES, 2.7K
R5524	0613952G67	RES, 0
R5533	0613958H17	RES, 4.7
R5541	0613952J08	RES, 20K

Reference	Motorola PN	Value
R5542	0613952J17	RES, 47K
R5543	0613952H83	RES, 2.7K
R5544	0613952G67	RES, 0
R5545	0613952J01	RES, 10K
R5546	0613952H89	RES, 4.7K
R5547	0613952J01	RES, 10K
R5548	0613952J01	RES, 10K
R5551	0613952J01	RES, 10K
R5552	0613952H83	RES, 2.7K
R5553	0613959Y51	RES, 120
R5556	0613952H73	RES, 1K
R5601	0613952H87	RES, 3.9K
R5602	0613952G67	RES, 0
R5603	0613952G67	RES, 0
R5604	0613952H89	RES, 4.7K
R5605	0613952H53	RES, 150
R5606	0613952H37	RES, 33
R5607	0613952H37	RES, 33
R5621	0613952J01	RES, 10K
R5622	0613952H83	RES, 2.7K
R5623	0613952H49	RES, 100
R5624	0613952H65	RES, 470
R5631	0613952H67	RES, 560
R5632	0613952H85	RES, 3.3K
R5634	0613952H25	RES, 10
R5636	0613952H29	RES, 15
R5637	0613952H61	RES, 330
R5651	0613952J03	RES, 12K
R5652	0613952H42	RES, 51
R5653	0613952G67	RES, 0
R5654	0613952H73	RES, 1K
R5655	0613952H73	RES, 1K
R5668	0613952J25	RES, 100K
R5671	0613952H65	RES, 470
R5681	0613952H65	RES, 470
R5701	0613952H45	RES, 68
R5702	0613952H81	RES, 2.2K
R5703	0613952H73	RES, 1K
R5704	0613952H33	RES, 22
R5706	0613952H42	RES, 51
R5707	0613952H49	RES, 100
R5711	0613952H49	RES, 100
R5712	0613952H61	RES, 330
R5713	0613952H61	RES, 330
R5714	0613952H55	RES, 180
R5715	0613952H25	RES, 10
R5716	0613952H25	RES, 10

Reference	Motorola PN	Value
R5721	0613952H73	RES, 1K
R5722	0613952H89	RES, 4.7K
R5723	0613952J01	RES, 10K
R5725	0613952H95	RES, 8.2K
R5727	0613952H95	RES, 8.2K
R5728	0613952J25	RES, 100K
R5731	0613952H49	RES, 100
R5732	0613952H49	RES, 100
R5733	0613952H33	RES, 22
R5734	0613952H53	RES, 150
R5802	0613952G67	RES, 0
R5803	0613952H39	RES, 39
R5804	0613952H47	RES, 82
R5805	0613952H47	RES, 82
R5806	0613952H81	RES, 2.2K
R5807	0613952H53	RES, 150
R5808	0613952H53	RES, 150
R5809	0613952G67	RES, 0
R5810	0613952H61	RES, 330
R5814	0613952H61	RES, 330
R5816	0613952H73	RES, 1K
R5819	0613952H47	RES, 82
R5830	0613952H35	RES, 27
R5831	0613952H56	RES, 200
R5832	0613952H56	RES, 200
R5837	0613952H69	RES, 680
R5840	0613952H89	RES, 4.7K
R5845	0613952H83	RES, 2.7K
R5846	0613952H89	RES, 4.7K
R5847	0613952J22	RES, 75K
R5849	0613952Q49	RES, 100
R5850	0613952Q49	RES, 100
R5851	0613952Q49	RES, 100
R5852	0613952Q49	RES, 100
R5853	0613952Q49	RES, 100
R5854	0613952Q49	RES, 100
R5855	0613952R01	RES, 10K
R5856	0613952R01	RES, 10K
R5857	0613952R01	RES, 10K
R5858	0613952R01	RES, 10K
RT5551	0605621T02	THERM, 50K
SH5602	2666500A03	SHIELD
SH5702	2666500A03	SHIELD
T5061	2566506A01	46 XFMR
T5062	2566506A02	46 XFMR
T5801	2580443L14	XFMR_LDB32C_370MHZ
T5802	2580443L14	XFMR_LDB32C_370MHZ

Reference	Motorola PN	Value
U0100	5166537A01	DS1306
U0102	5114006A02	06A02
U0103	5114006A02	06A02
U0104	5188691V01	NC7SB3157
U0150	5185765B26	H99S4
U0201	5114002A17	MC14053BD
U0202	5166544A01	TC4S66F
U0203	5166542A01	X9315
U0204	5166542A01	X9315
U0205	5102463J95	TDA1519C
U0206	5114016A18	MC3403
U0207	5189233U89	75 AT25128-10UI-2_7
U0300	5164015H94	LM2941
U0301	5164015H94	LM2941
U0302	5164015H94	LM2941
U0303	5114014A07	MC78M05BT
U0304	5114014A22	LP2951CD
U0305	5114014M39	LP2951ACD30R2
U0306	5114014A22	LP2951CD
U0307	5166534A01	LP2989ILDY-2.8 NOPB
U0308	5114004A35	NCP301
U0401	5114000B39	74VHC125
U0402	5114000B39	74VHC125
U0403	5114000B39	74VHC125
U0404	5114000B39	74VHC125
U0405	5187970L15	w ISP1104
U0406	5114006A02	06A02
U0407	5166533A01	TLV1508
U0408	5114019M13	MC74LVX244
U0409	5114000B39	74VHC125
U1100	5166541A01	EIM_BLOCK
U1102	5185956E43	_75 28F128W18BD60
U1103	5185941F11	75 MT45W2MW16BFB-70IT
U1104	5114000B39	74VHC125
U1105	5109512F66	LP2985
U5101	5185963A85	AD9874
U5102	5115019H01	LP2980
U5103	5115019H01	LP2980
U5104	5114000B39	74VHC125
U5105	5114000B39	74VHC125
U5201	9166513A01	67C12
U5321	5115019H01	LP2980
U5322	5115026H01	ADP3300
U5331	5185177y01	63A27
U5401	5115678H01	30C65
U5501	5115022H01	LM50
U5601	2460593C01	RESONATOR

Reference	Motorola PN	Value
U5701	5105750U56	50U54
U5702	5185368C18	BICMO885
U5808	5114014A76	NCP512
U5809	5186988J77	JAVELIN
U5810	5166554A01	35U79
VR0163	4813977M11	77M11
VR0300	4813979C17	MR2835S
VR0301	4813977M19	77M19
VR0302	4813977M11	77M11
VR0325	4813977M10	77M10
VR0401	4813979C11	MMQA20VT1
VR0402	4813979C11	MMQA20VT1
VR0403	4813979C11	MMQA20VT1
VR0405	4813979P10	MMQA5V6T1
VR0406	4813977M36	MMBZ5257BLT1G
VR0407	4813977M36	MMBZ5257BLT1G
Y0101	4809995L05	CC4V
Y5363	5102463J73	KT19

Note: For optimum performance, diodes, transistors and integrated circuits must be ordered by MOTOROLA part numbers.

**Parts on the GPS Board (0166502N65)**

Reference	Motorola PN	Value
C1	2113944A28	CAP CER CHP 18.0PF 50V 5%
C10	2113944A28	CAP CER CHP 18.0PF 50V 5%
C11	2113741F25	CAP CHIP CL2 X7R REEL 1000
C12	2113944A28	CAP CER CHP 18.0PF 50V 5%
C14	2113945D04	CAP CER CHP 100,000PF 25V 10%
C15	2113944A28	CAP CER CHP 18.0PF 50V 5%
C16	2113741F25	CAP CHIP CL2 X7R REEL 1000
C17	2113944C48	CAP CER CHP 560.OPF 50V 5%
C18	2113944C55	CAP CER CHP 2200.OPF 50V 5%
C19	2113944C47	CAP CER CHP 150.0PF 50V 5%
C2	2113945D04	CAP CER CHP 100,000PF 25V 10%
C20	2113944C06	CAP CER CHP 470.0PF 50V 5%
C21	2113944C45	CAP CER CHP 100.0PF 50V 5%
C22	2113945D04	CAP CER CHP 100,000PF 25V 10%
C23	2313960F04	CAP TANT 33 UF 10% 16V 6032-28
C24	2113944C47	CAP CER CHP 150.0PF 50V 5%

Reference	Motorola PN	Value
C25	2113945D04	CAP CER CHP 100,000PF 25V 10%
C26	2313960D07	CAP TANT 10 UF 10% 16V 3528-21
C27	2313960F04	CAP TANT 33 UF 10% 16V 6032-28
C28	2113944C45	CAP CER CHP 100.0PF 50V 5%
C29	2113945D04	CAP CER CHP 100,000PF 25V 10%
C3	2113946F05	CAP,CHIP,10UF,+10%,-10%,6.3V-DC,08
C30	2313960F04	CAP TANT 33 UF 10% 16V 6032-28
C31	2113944C47	CAP CER CHP 150.0PF 50V 5%
C32	2313960D07	CAP TANT 10 UF 10% 16V 3528-21
C33	2113944C45	CAP CER CHP 100.0PF 50V 5%
C37	2113945D04	CAP CER CHP 100,000PF 25V 10%
C38	2113944A28	CAP CER CHP 18.0PF 50V 5%
C39	2113944A33	CAP CER CHP 47.0PF 50V 5%
C4	2113946F05	CAP,CHIP,10UF,+10%,-10%,6.3V-DC,08
C40	2113945D04	CAP CER CHP 100,000PF 25V 10%
C41	2113944A33	CAP CER CHP 47.0PF 50V 5%
C42	2113944A05	CAP CER CHP 1.5PF 50V 0.25PF
C43	2113944A28	CAP CER CHP 18.0PF 50V 5%
C5	2113946F05	CAP,CHIP,10UF,+10%,-10%,6.3V-DC,08
C6	2113944A28	CAP CER CHP 18.0PF 50V 5%
C7	2113944A28	CAP CER CHP 18.0PF 50V 5%
C8	2113944A28	CAP CER CHP 18.0PF 50V 5%
D1	4813978C02	PB FREE, NOT COMPLETELY ENRICHED
E1	7686949J08	FERRITE BEAD CHIP-0603 SIZE
E2	7686949J08	FERRITE BEAD CHIP-0603 SIZE
E3	7686949J08	FERRITE BEAD CHIP-0603 SIZE
FL1	9180310L38	PASSIVE FILTER, SAW, BAND-PASS,1.57542
FL2	9180310L39	PASSIVE FILTER, SAW,1.57542GHZNOM,1
J1	0986197B01	CONN ZIF HOR 24 PIN BOT CONT
J2	NOTPLACED	GCAM DUMMY PART NUMBER
L1	2414015B16	IDCTR,CHIP,27NH,2%,500MA,.2 5OHM,CER
L11	2414017P12	IND CER CHIP 8.2 NH 5%
L12	2414017P09	IND CER CHIP 4.7 NH +/-0.3NH
L3	2414015B16	IDCTR,CHIP,27NH,2%,500MA,.2 5OHM,CER

Reference	Motorola PN	Value
L4	2414015B16	IDCTR,CHIP,27NH,2%,500MA,.2 5OHM,CER
L5	2414017P17	IND CER CHIP 22.0 NH 5%
L6	2414015B16	IDCTR,CHIP,27NH,2%,500MA,.2 5OHM,CER
R10	0613952H80	CER CHIP RES 2000 OHM 5% 0603
R12	0613959Y32	CER CHIP RES 20.0 OHM 5% 2512
R14	0613958D51	CER CHIP RES 3320 OHM 1% 0805
R15	0613952J86	RES,MF,33KOHM,1%,.1W,SM,06 03,200PPM
R16	NOTPLACED	GCAM DUMMY PART NUMBER
R17	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R18	NOTPLACED	GCAM DUMMY PART NUMBER
R19	0613952E69	CER CHIP RES 51.1K OHM 1% 0603
R20	0613958D01	CER CHIP RES 1000 OHM 1% 0805
R21	0613952E85	CER CHIP RES 75.0K OHM 1% 0603
R22	NOTPLACED	GCAM DUMMY PART NUMBER
R23	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R24	NOTPLACED	GCAM DUMMY PART NUMBER
R25	0613952E69	CER CHIP RES 51.1K OHM 1% 0603
R26	0613952J25	CER CHIP RES 100K OHM 5% 0603
R27	0613958D51	CER CHIP RES 3320 OHM 1% 0805
R28	0613952J25	CER CHIP RES 100K OHM 5% 0603
R29	0613952Q70	CER CHIP RES 750 OHM 5% 0402
R30	0613952G67	CER CHIP RES 0.0 +/-0.050 OHM
R5	0613952J01	CER CHIP RES 10K OHM 5% 0603
U1	5164015H94	IC LM2941 SX NOPB
U2	5104187K94	IC LP2986ILDY-3.3 VLTG REG
U3	5104187K94	IC LP2986ILDY-3.3 VLTG REG
U4	5109841C71	IC,MICROP,SM,FEATURES MEMORY &
U5	5164015H55	IC,RF AMPLIFIER,UPC8211TK,SM,18.
U6	5114000B39	IC 1 GATE 2-INPUT NOR
VR1	4813977C23	DIODE 13V 'H3' MMSZ5243BT1
Y1	4809718L20	OSC,TCXO,26MHZ,SM,MDL 3.2x2.5x1
Y2	NOTPLACED	GCAM DUMMY PART NUMBER
	3066540B01	CBL ASSY, RF, .53MMDIA, 1COND, DOUBLE S

Reference	Motorola PN	Value
	8466576A01	PCB,DAUGHTER, GPS SUB-MODUL
	3066541B01	CBL,FLT,.3MMDIA,24COND,UNS HLD,80MML

Note: For optimum performance, diodes, transistors and integrated circuits must be ordered by MOTOROLA part numbers.

CHAPTER 8.2

ENHANCED CONTROL HEADS: SCHEMATICS, PCBs and PARTS LISTS

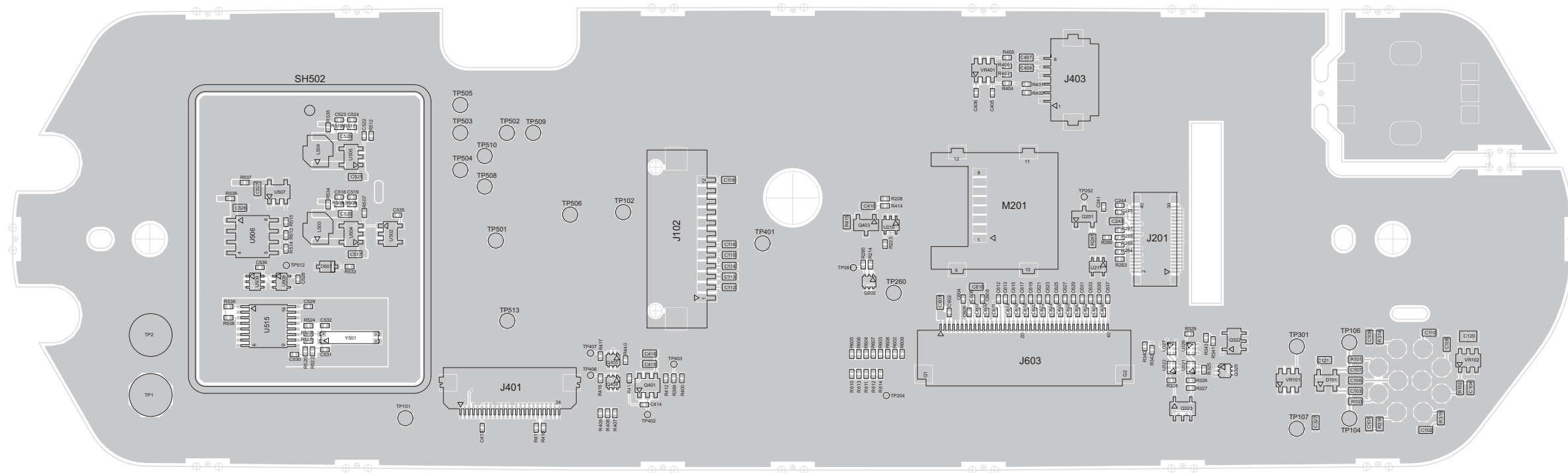
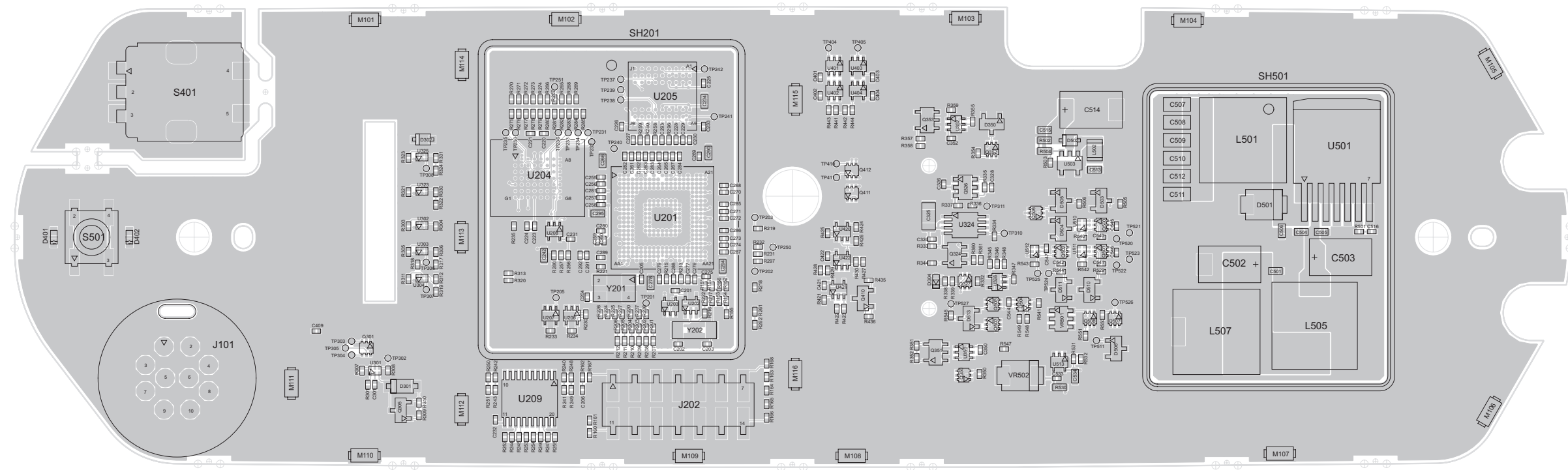
**Enhanced Control Head**

**Data Expansion Head Enhanced**

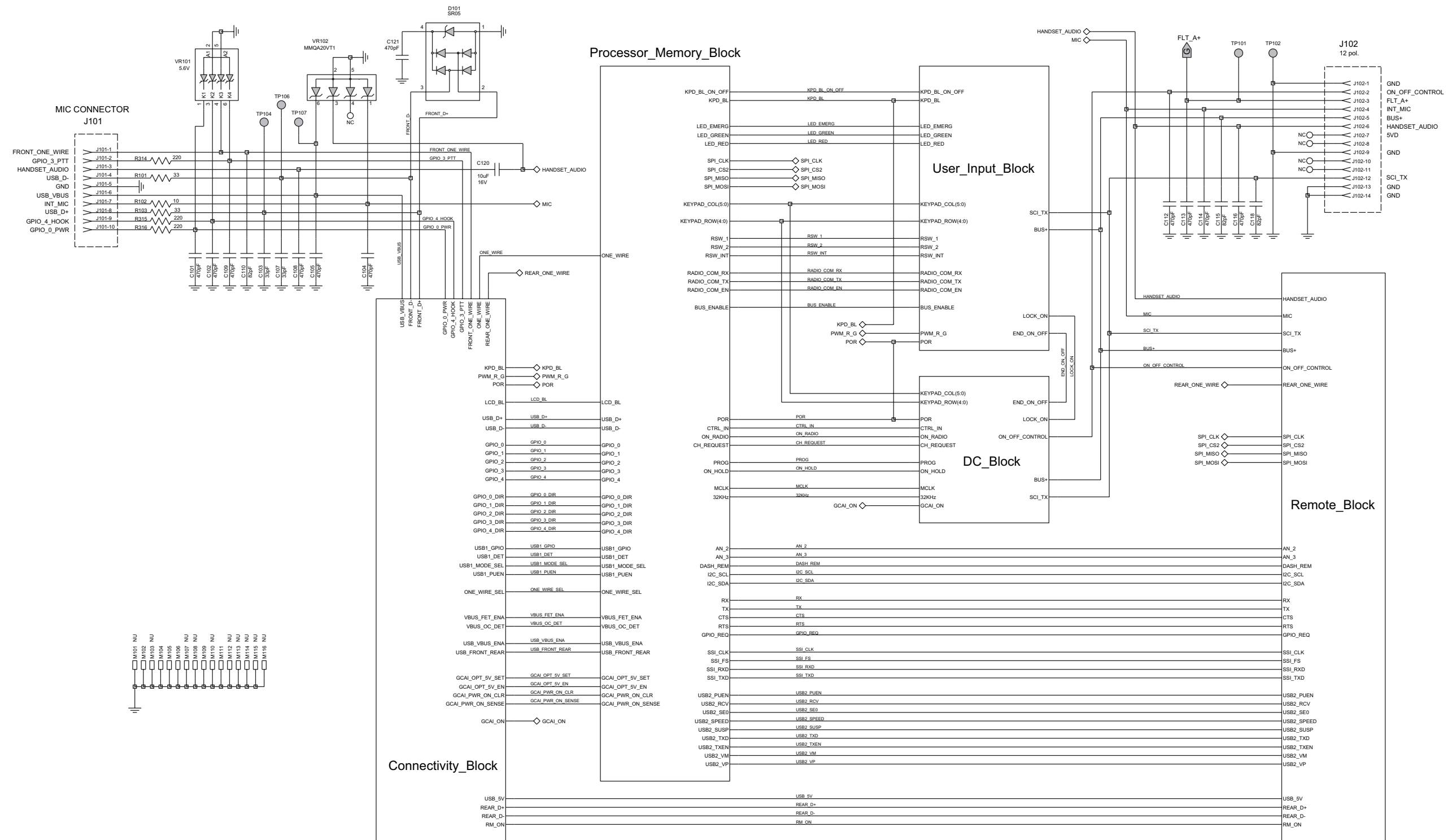
**Remote Head Enhanced**

**Remote Back Head Enhanced**

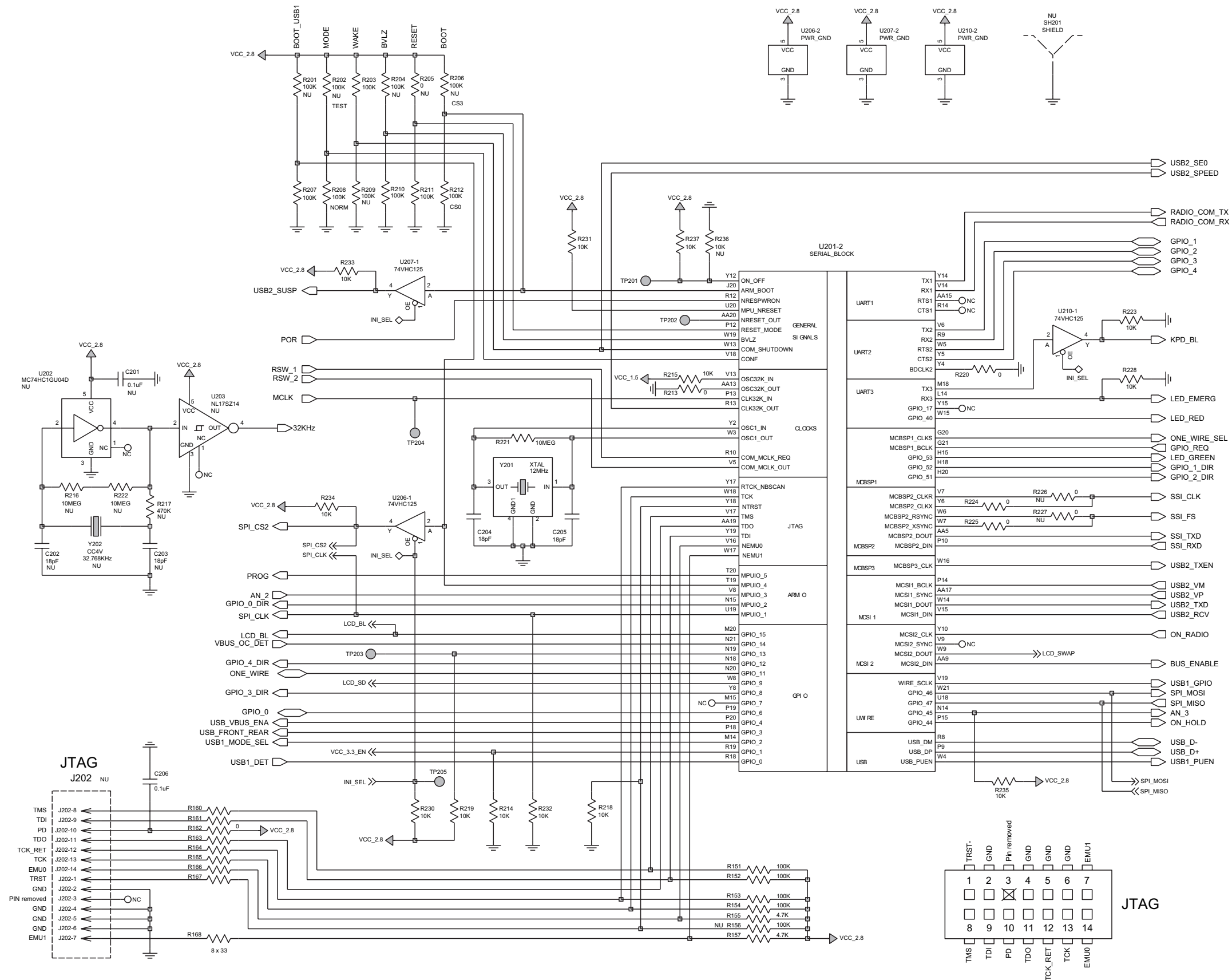
**Keypad Board**



PCB/ Enhanced Control Head Main Board - Bottom and Top Side (PCB: 8466580A01\_A)

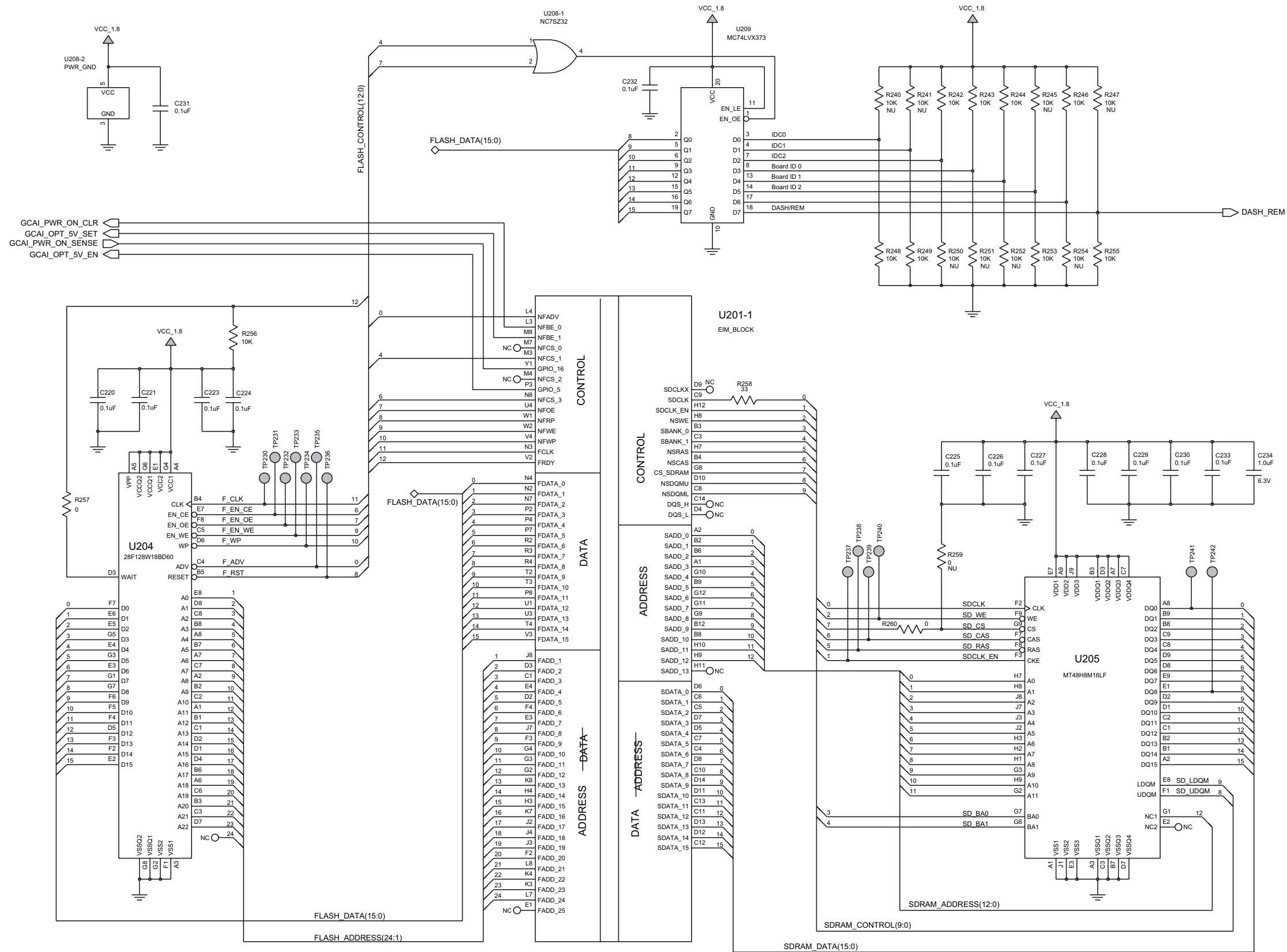


Enhanced Control Head Main Board - Control Head (PCB: 8466580A01\_A)

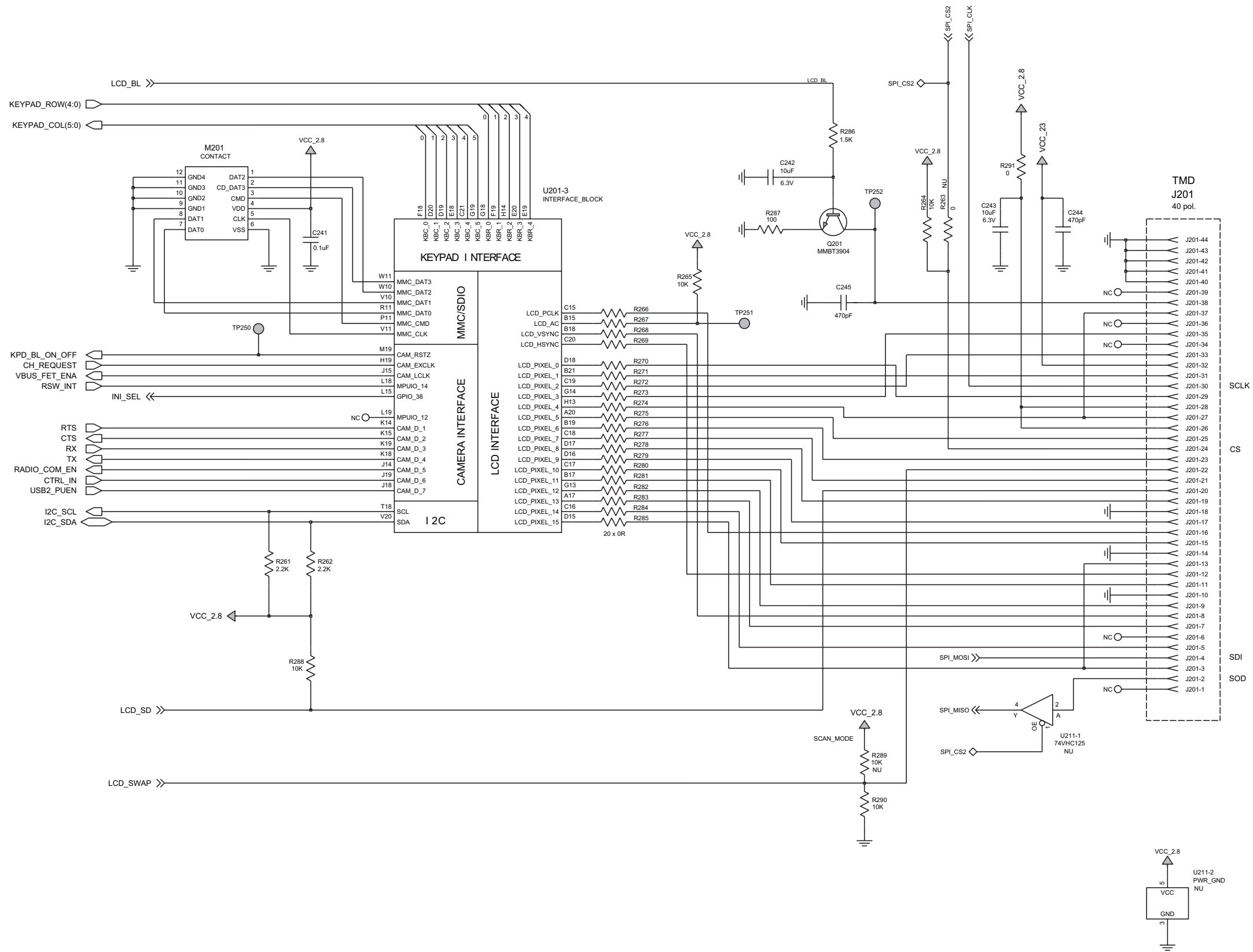


Enhanced Control Head Main Board - Processor Memory Block: Main CPU (PCB: 8466580A01\_A)

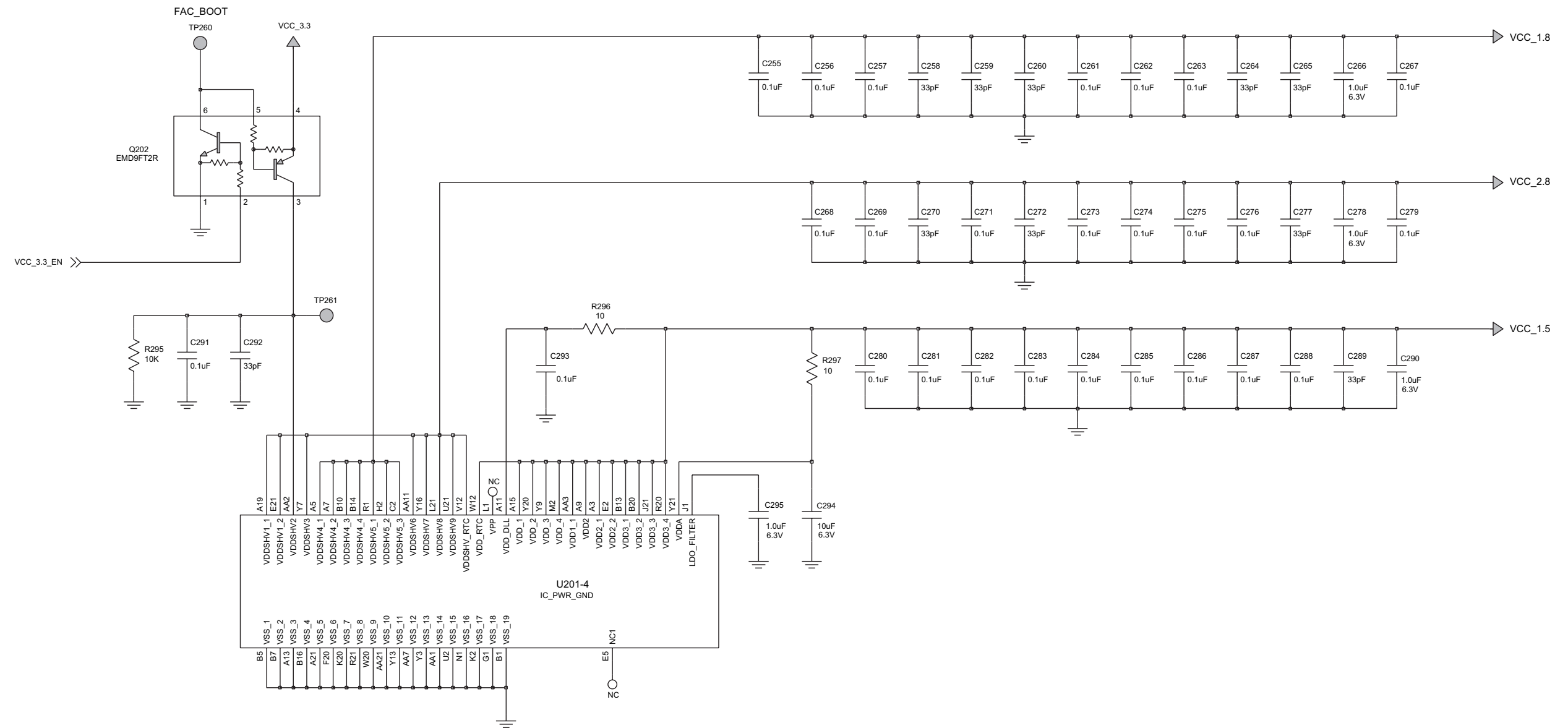




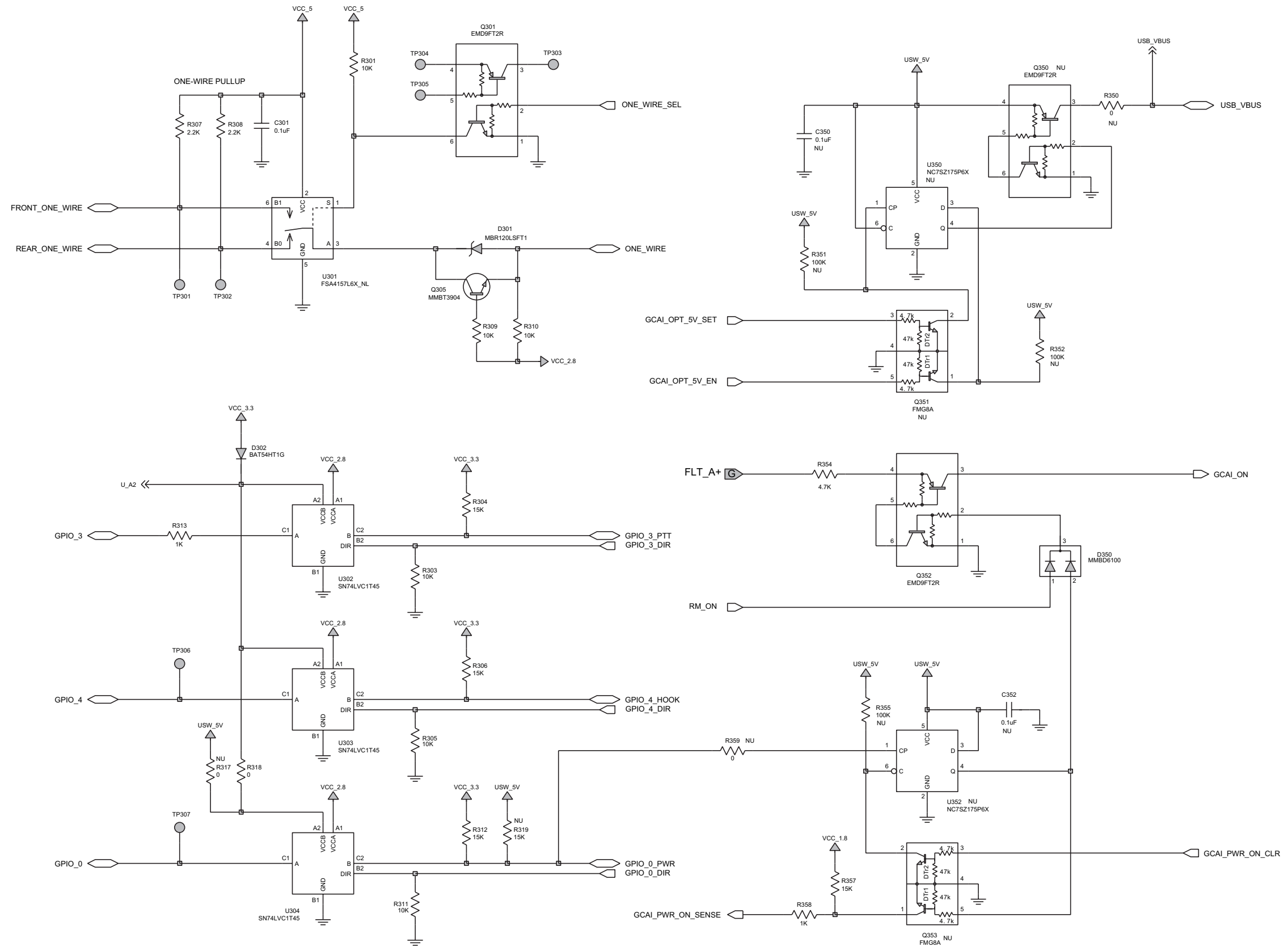
Enhanced Control Head Main Board - Processor Memory Block: Memory (PCB: 8466580A01\_A)



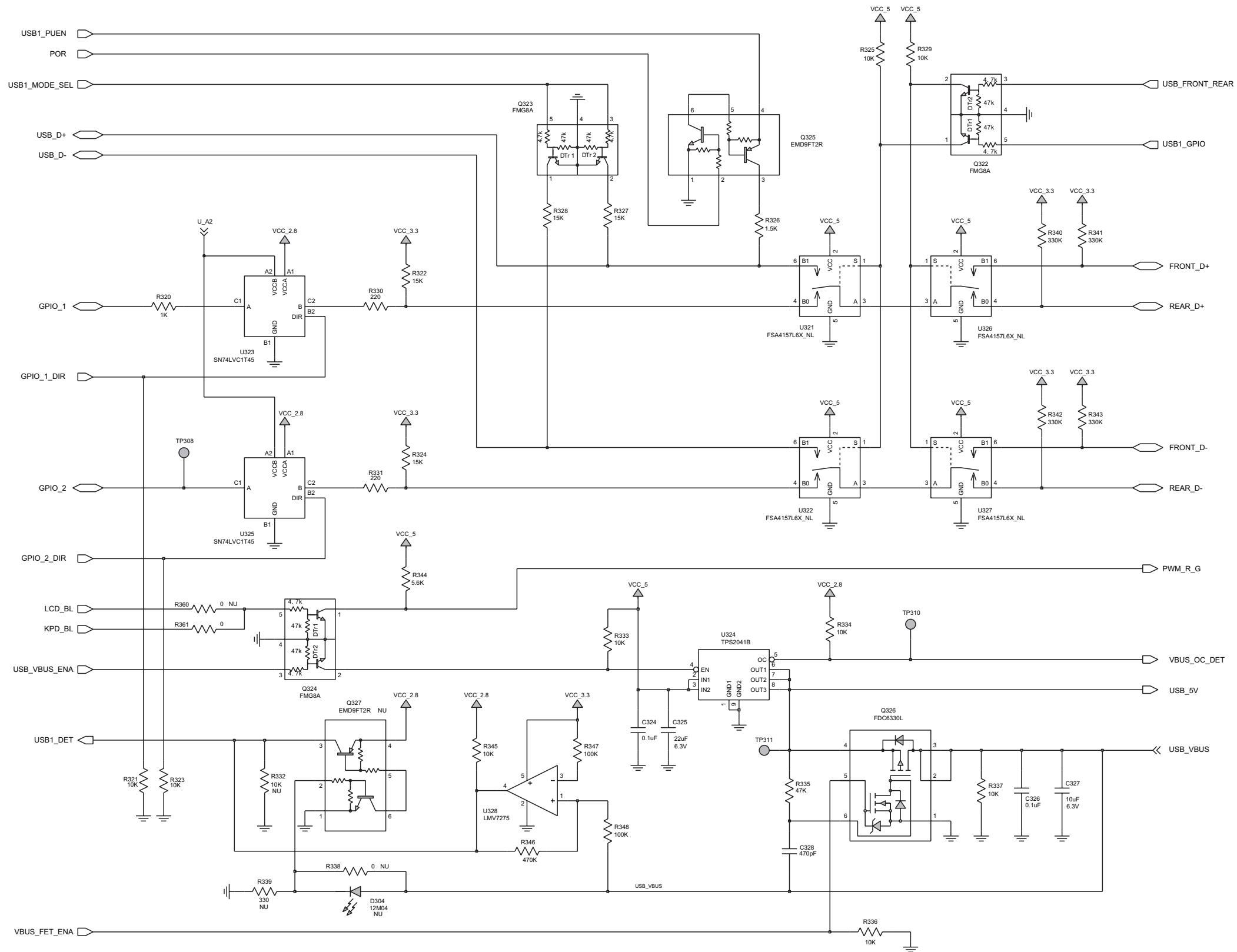
Enhanced Control Head Main Board - Processor Memory Block: LCD (PCB: 8466580A01\_A)



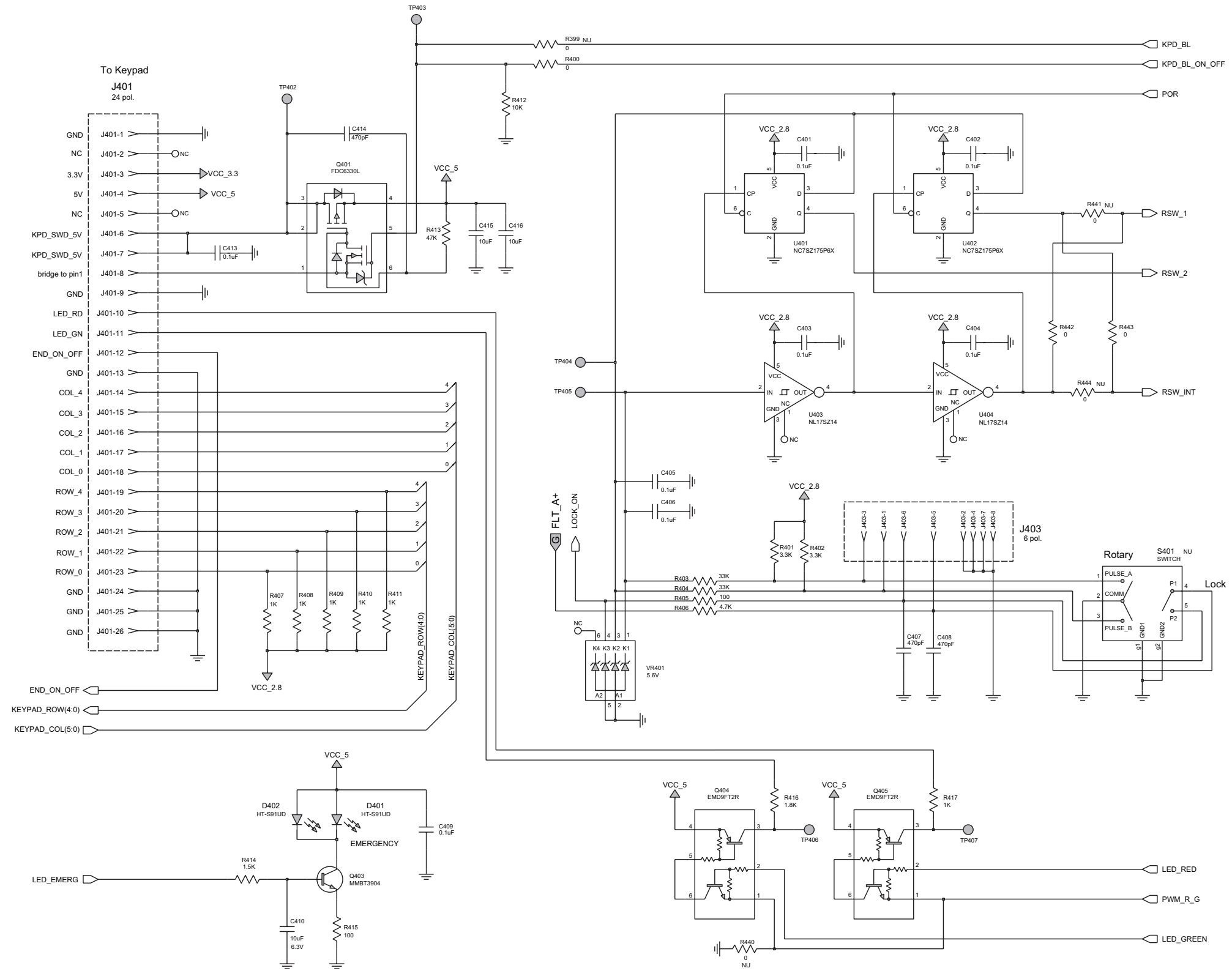
Enhanced Control Head Main Board - Processor Memory Block: Supply (PCB: 8466580A01\_A)



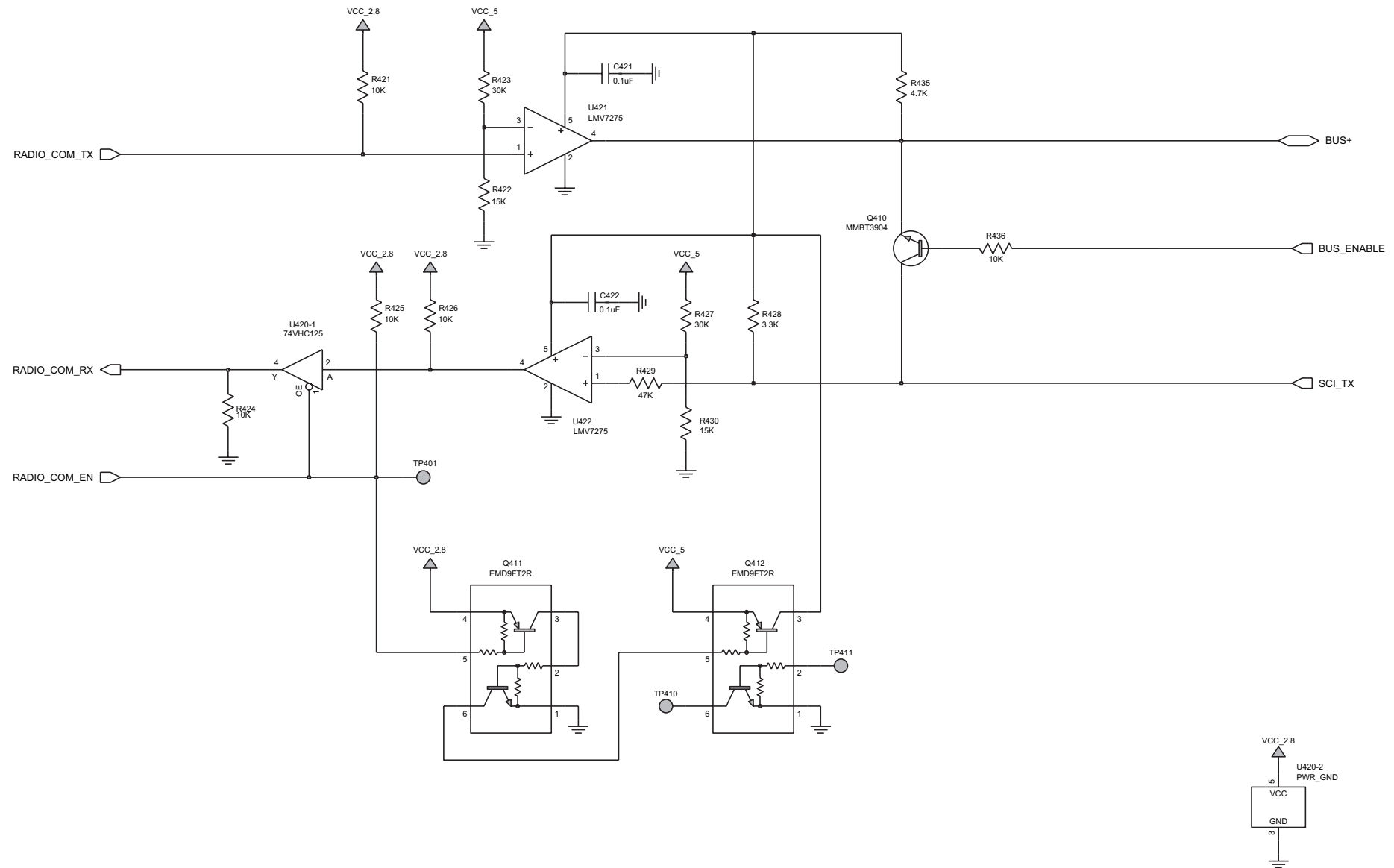
Enhanced Control Head Main Board - Connectivity Block: GPIO (PCB: 8466580A01\_A)



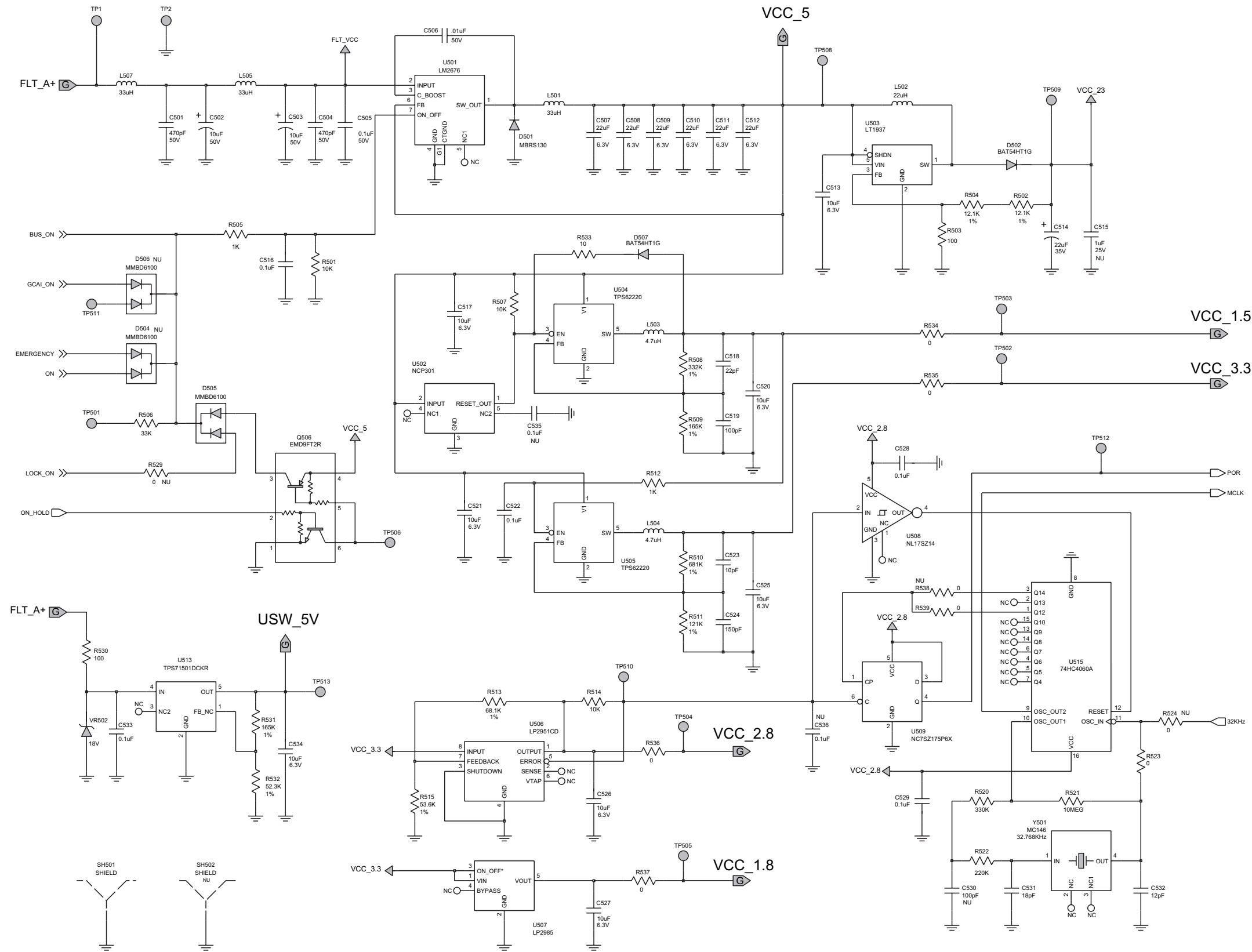
Enhanced Control Head Main Board - Connectivity Block: USB Block (PCB: 8466580A01\_A)



Enhanced Control Head Main Board - User Input Block: Keypad (PCB: 8466580A01\_A)

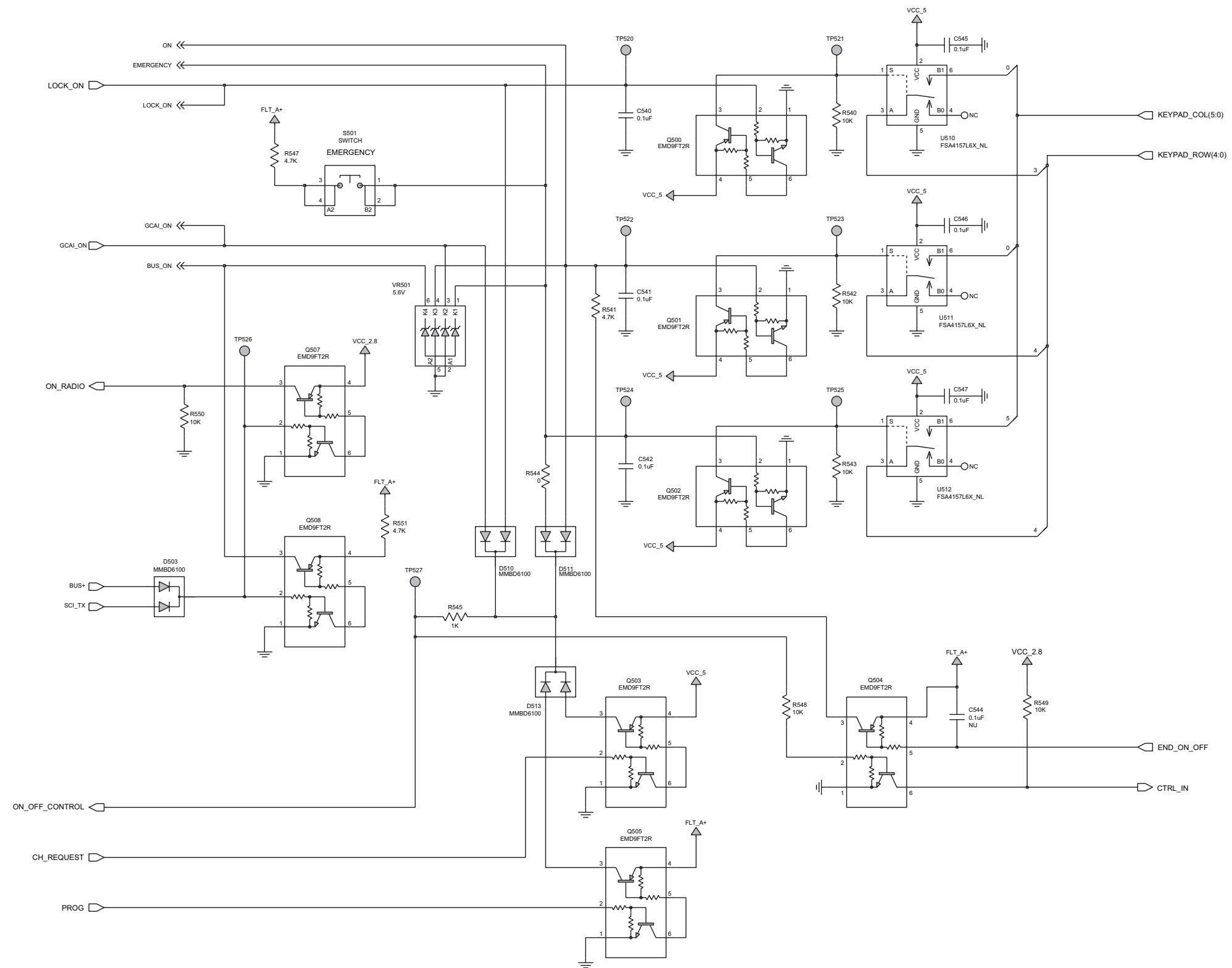


Enhanced Control Head Main Board - User Input Block: SBEP (PCB: 8466580A01\_A)

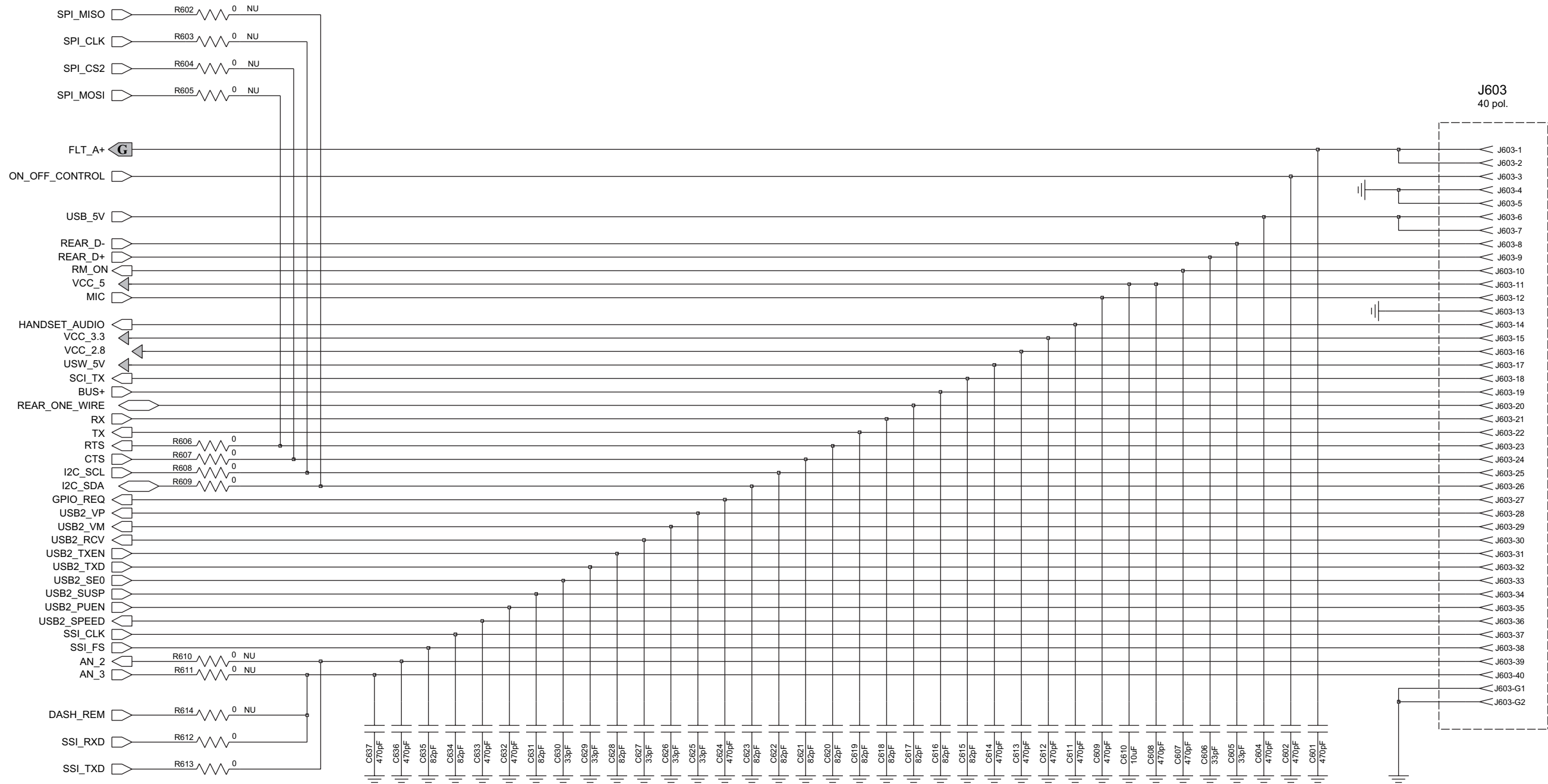


Enhanced Control Head Main Board - DC Block: Power Supply (PCB: 8466580A01\_A)

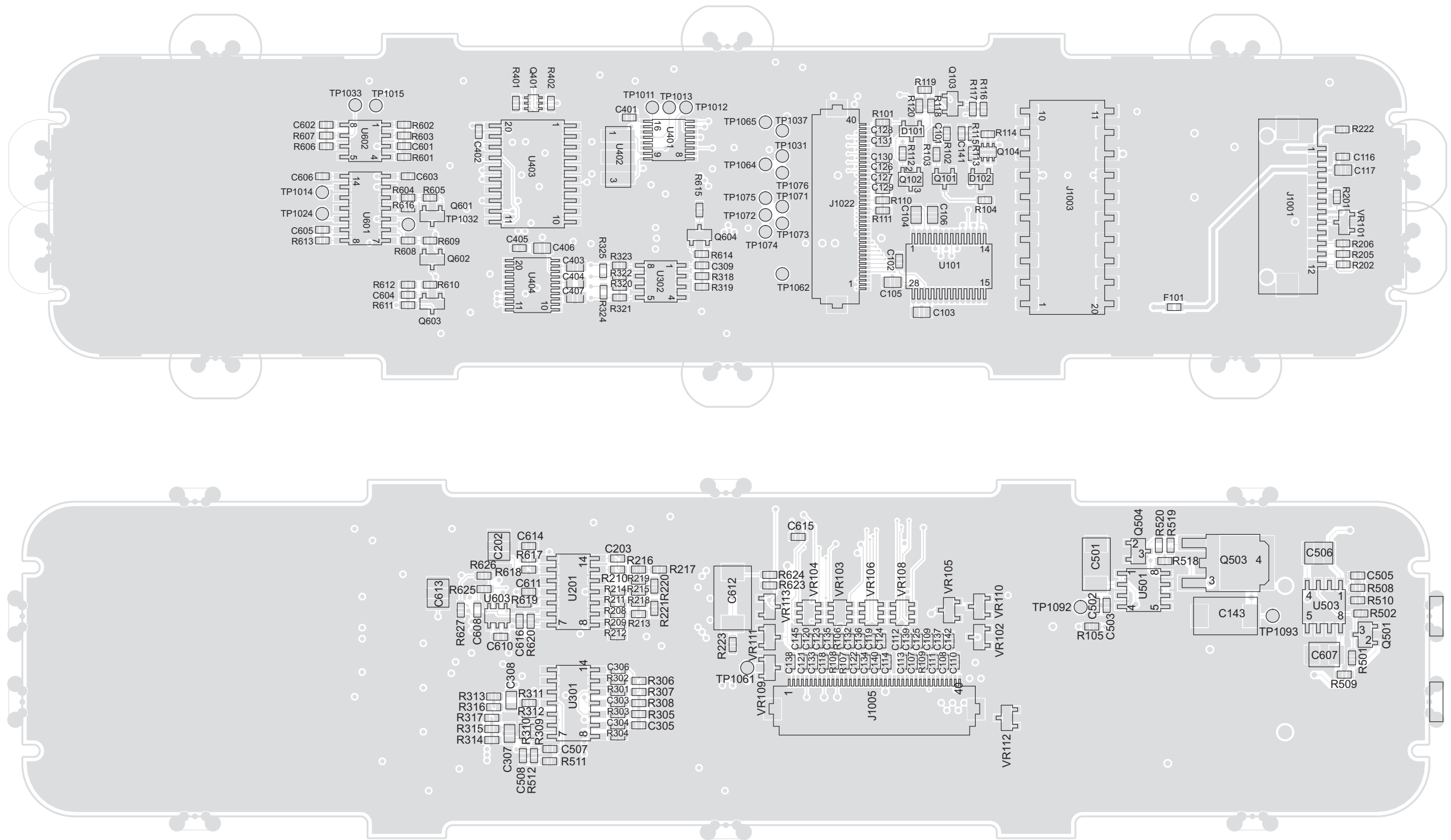




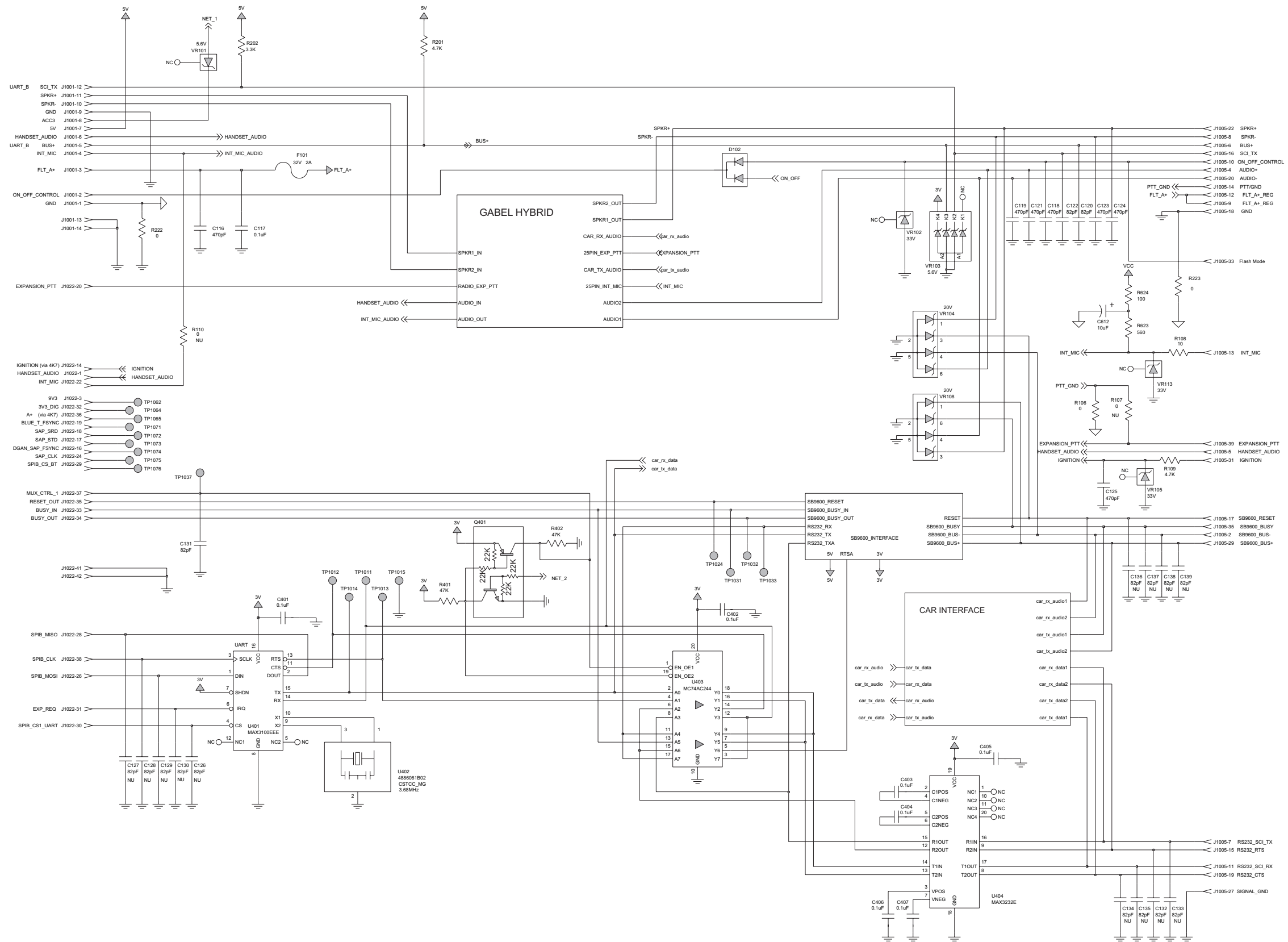
Enhanced Control Head Main Board - DC Block: Power On/ Off (PCB: 8466580A01\_A)



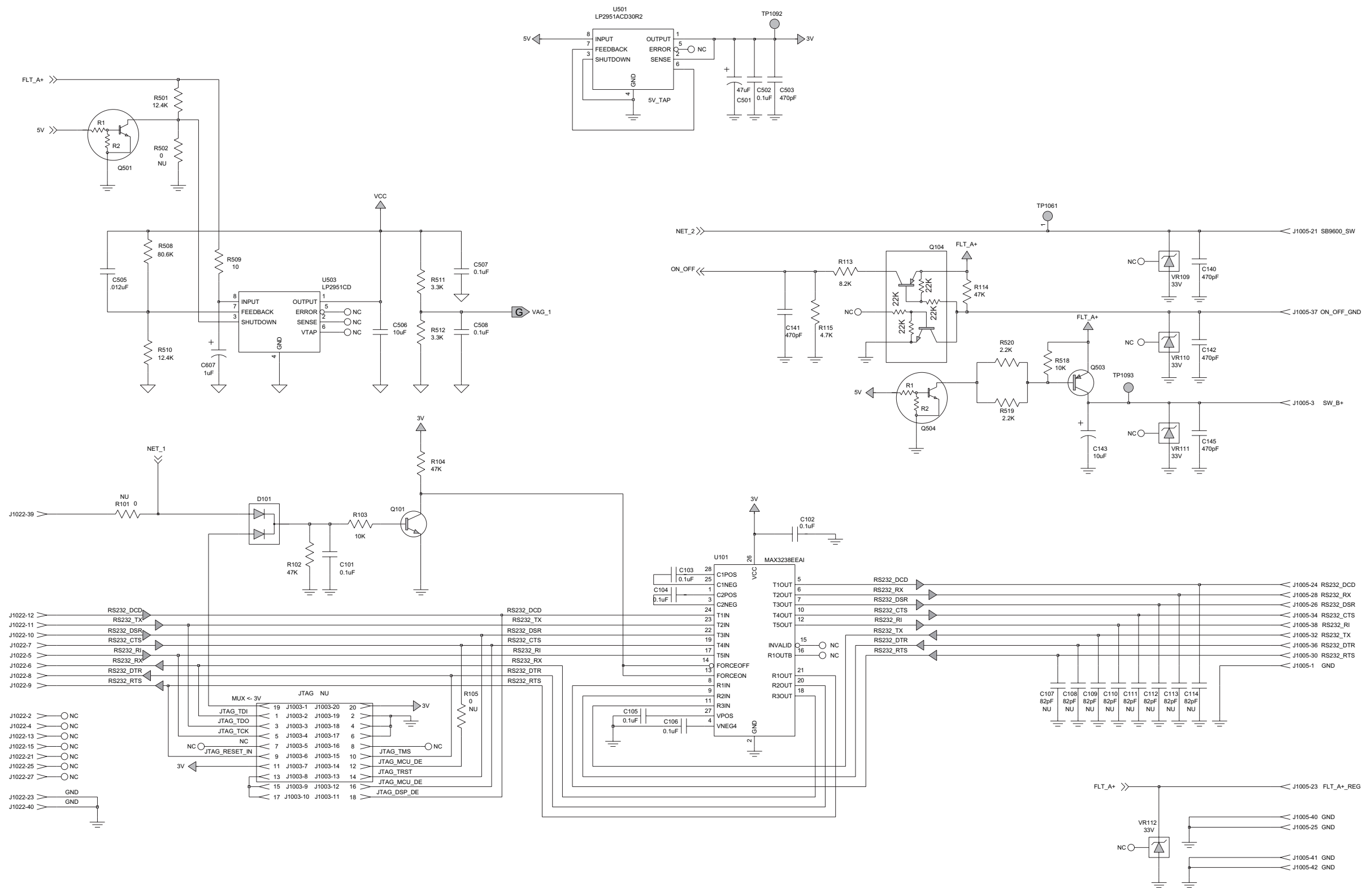
Enhanced Control Head Main Board - Remote Block (PCB: 8466580A01\_A)



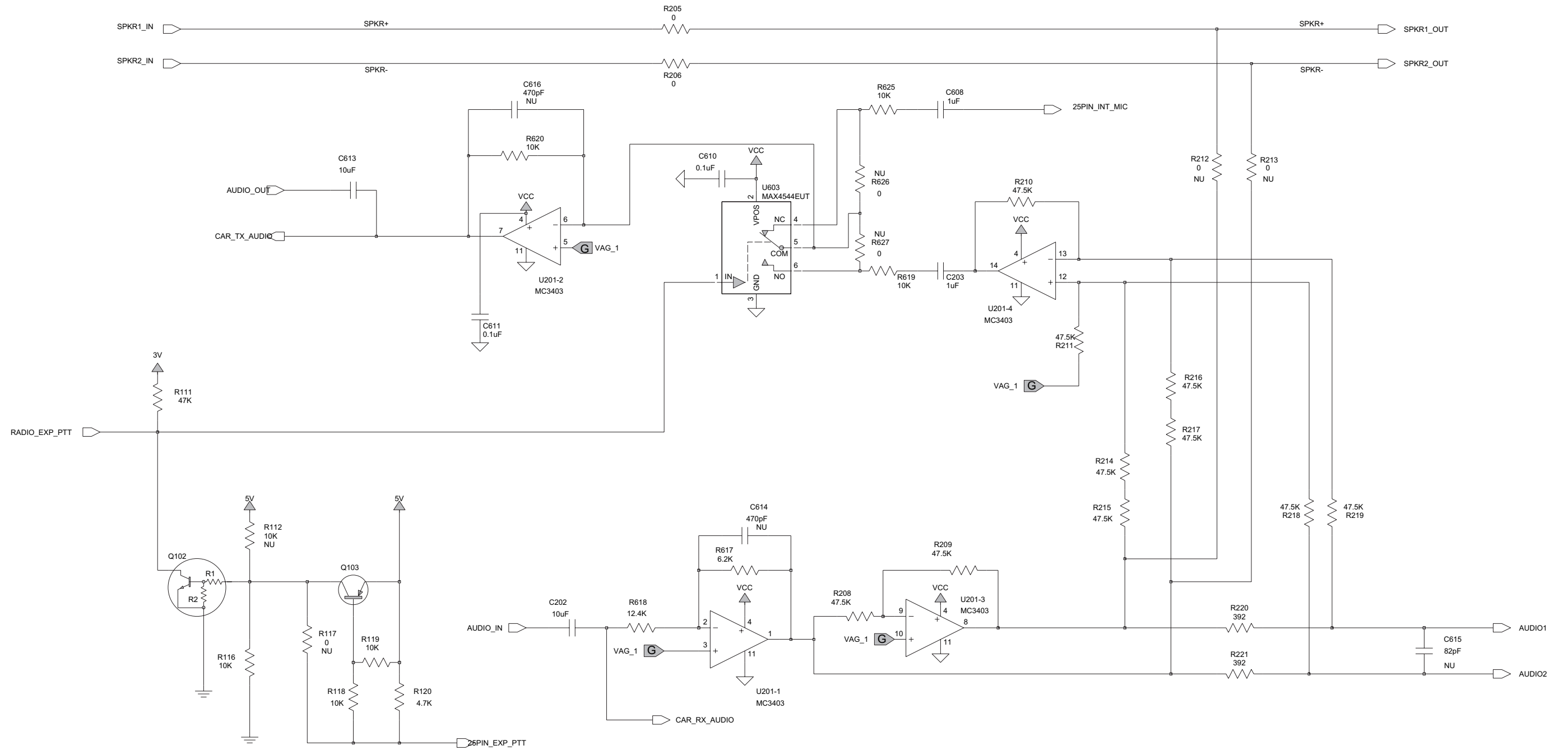
PCB/ Data Expansion Head Enhanced Main Board - Bottom and Top Side (PCB: 8466586A01\_A)



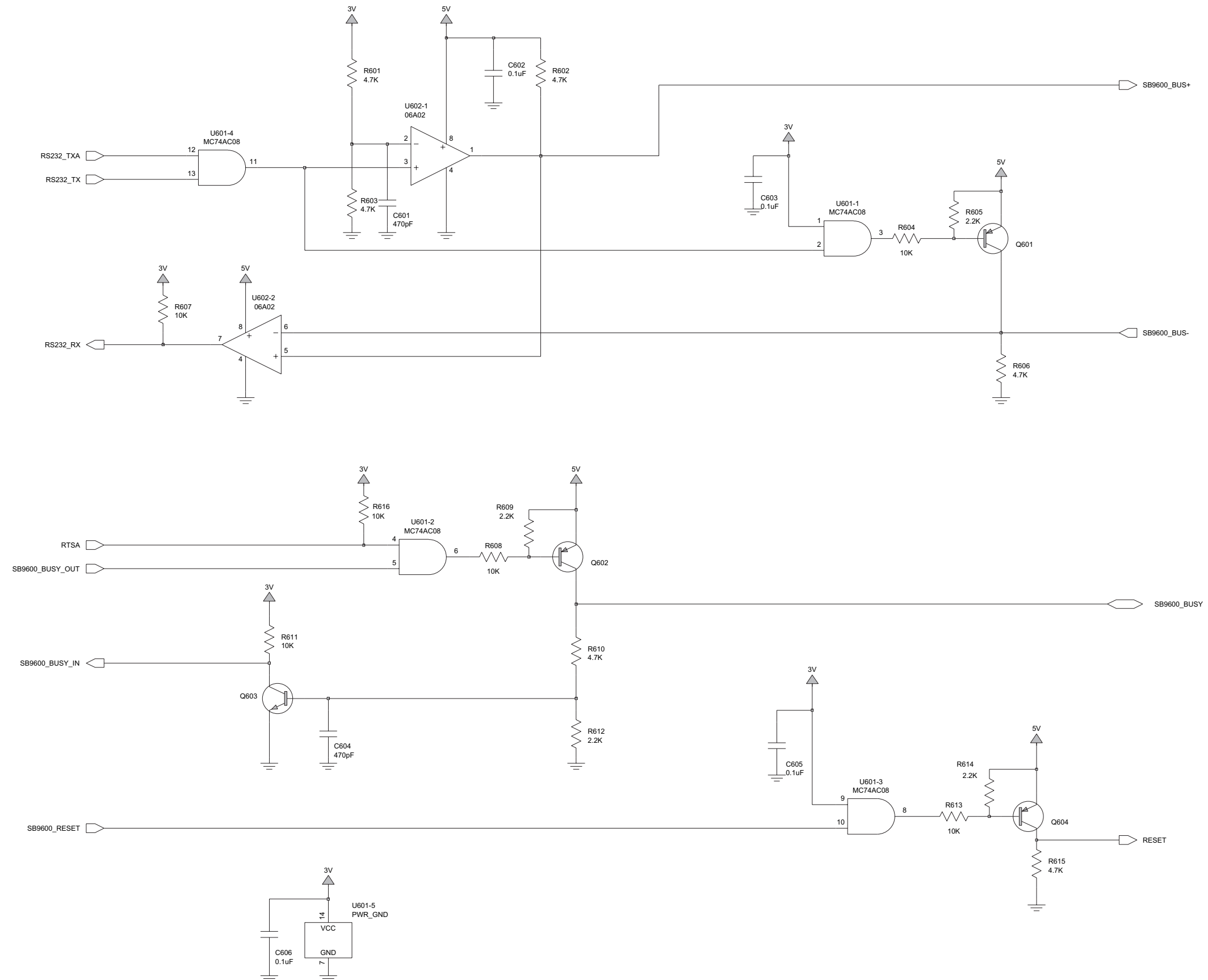
Data Expansion Head Enhanced Main Board - Main PCB (PCB: 8466586A01\_A)



Data Expansion Head Enhanced Main Board - DC Power (PCB: 8466586A01\_A)



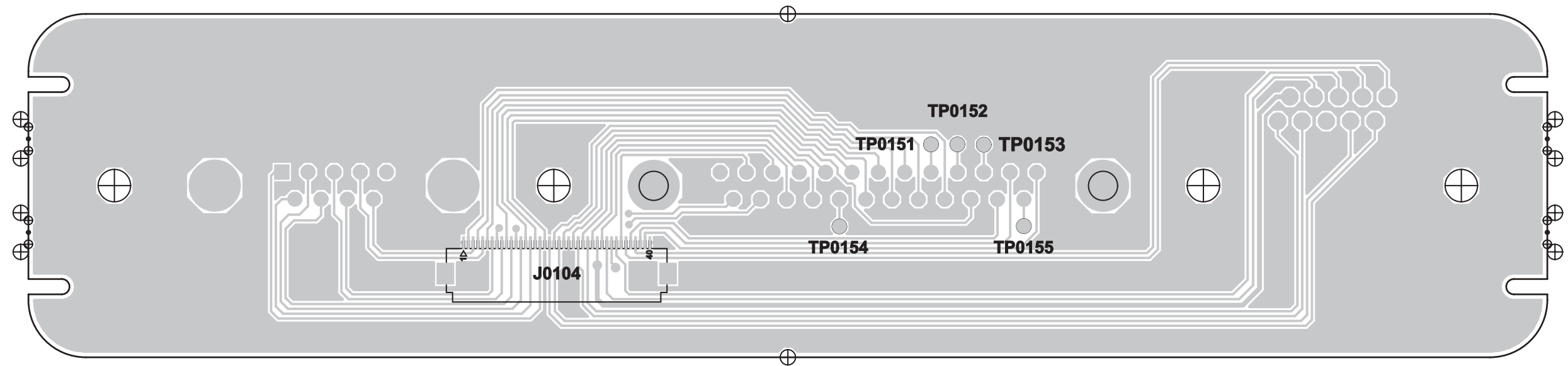
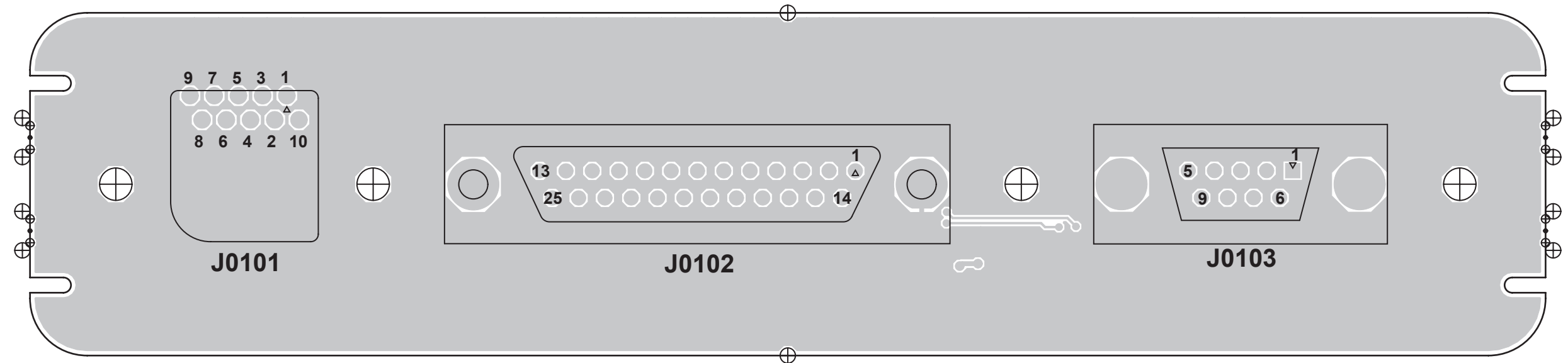
Data Expansion Head Enhanced Main Board - Gabel Hybrid (PCB: 8466586A01\_A)



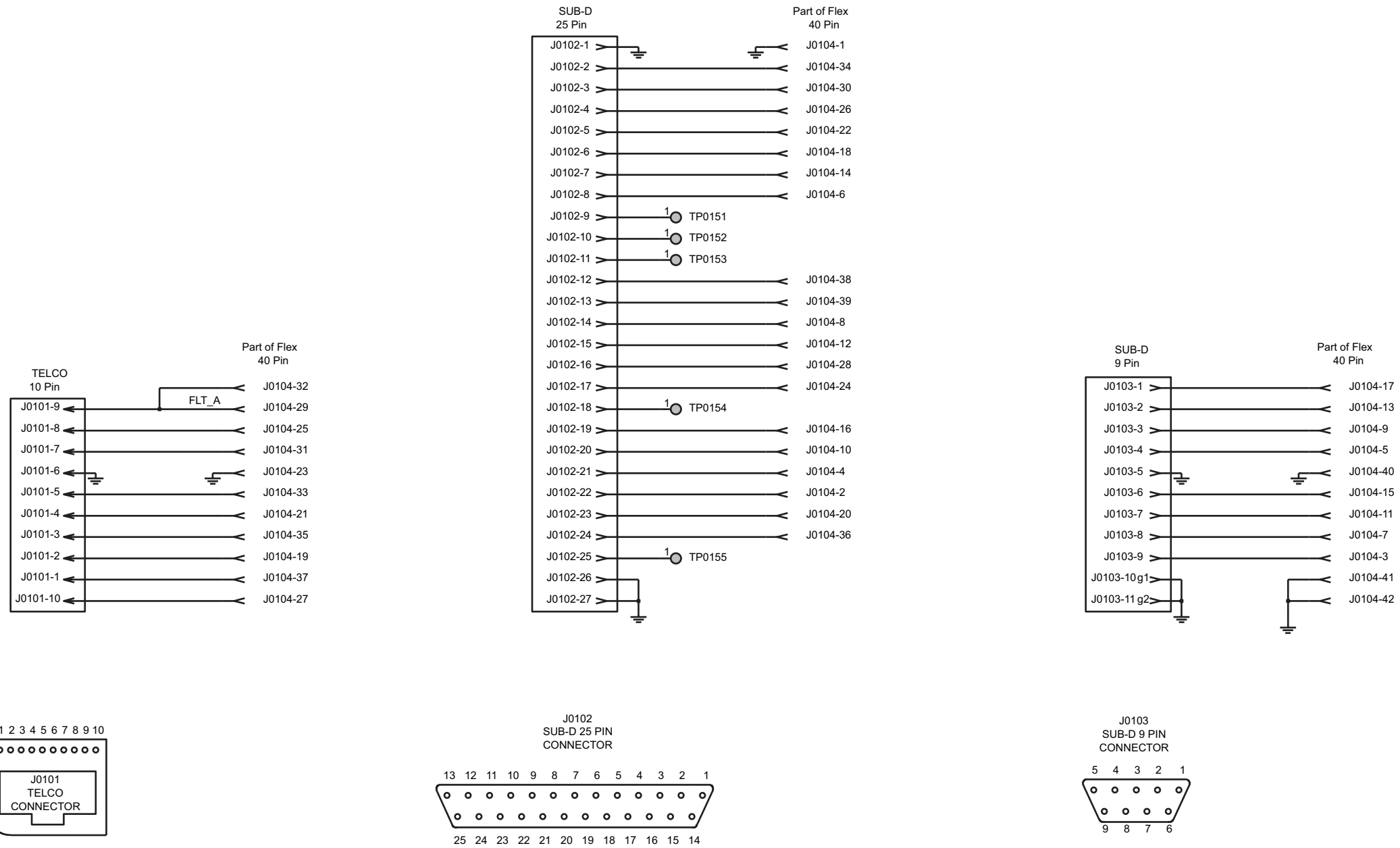
Data Expansion Head Enhanced Main Board - SB9600 Interface (PCB: 8466586A01\_A)





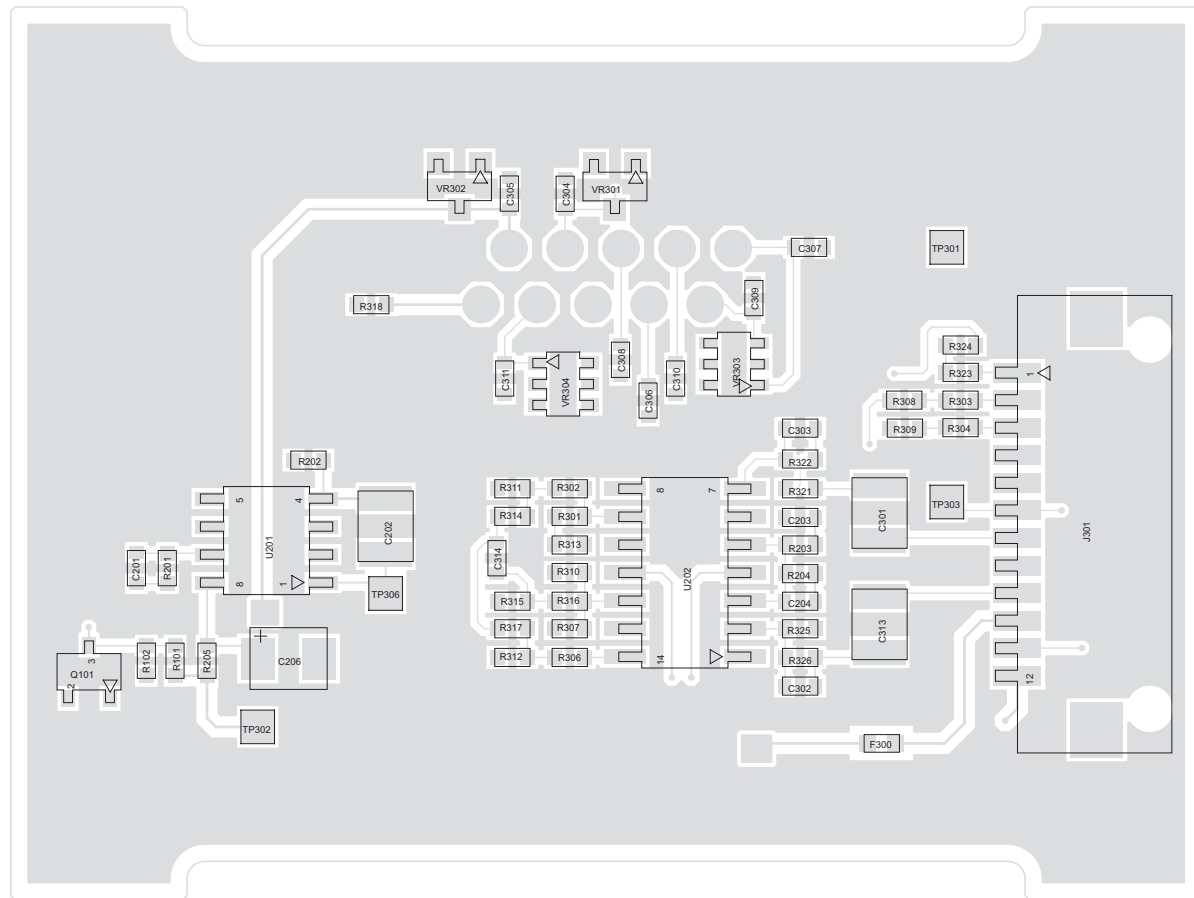


PCB/ Data Expansion Head Enhanced Connector Board - Bottom and Top Side (PCB: 8464300B06\_A)

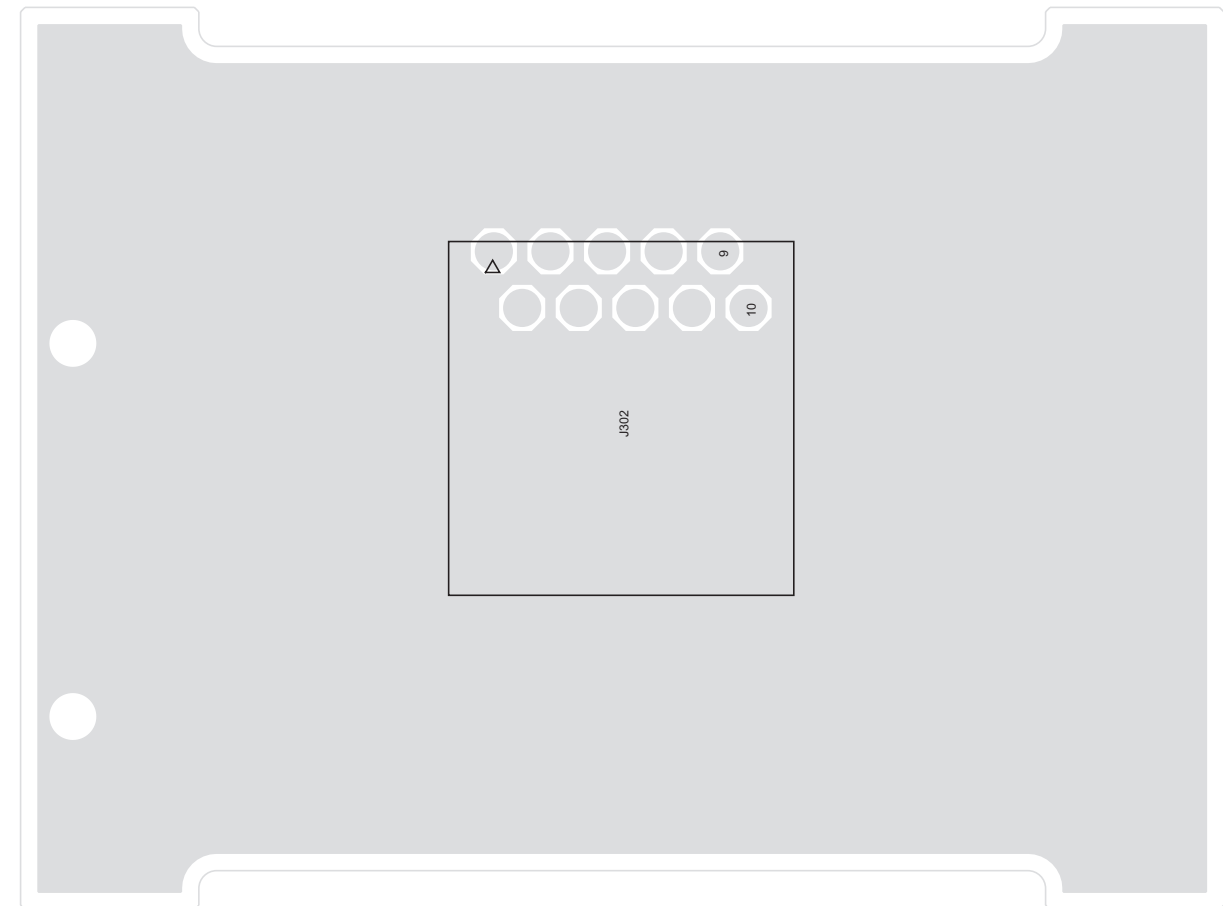


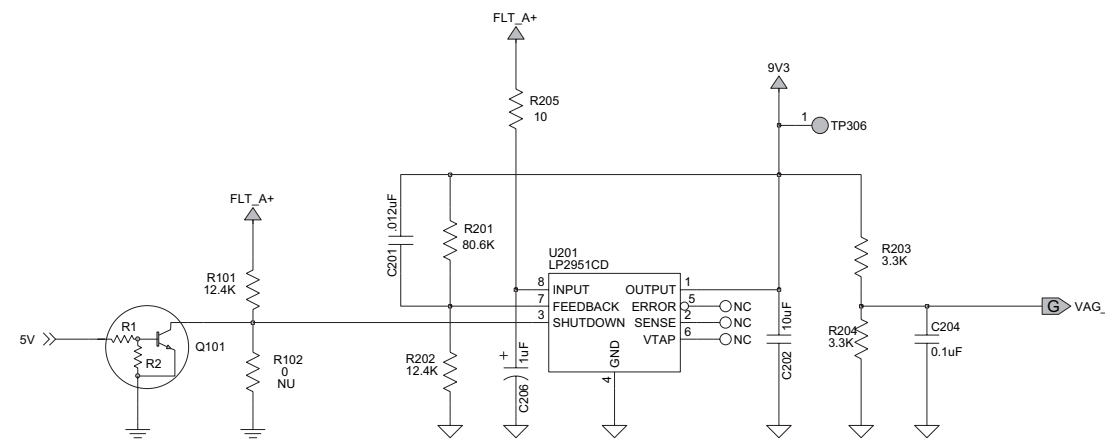
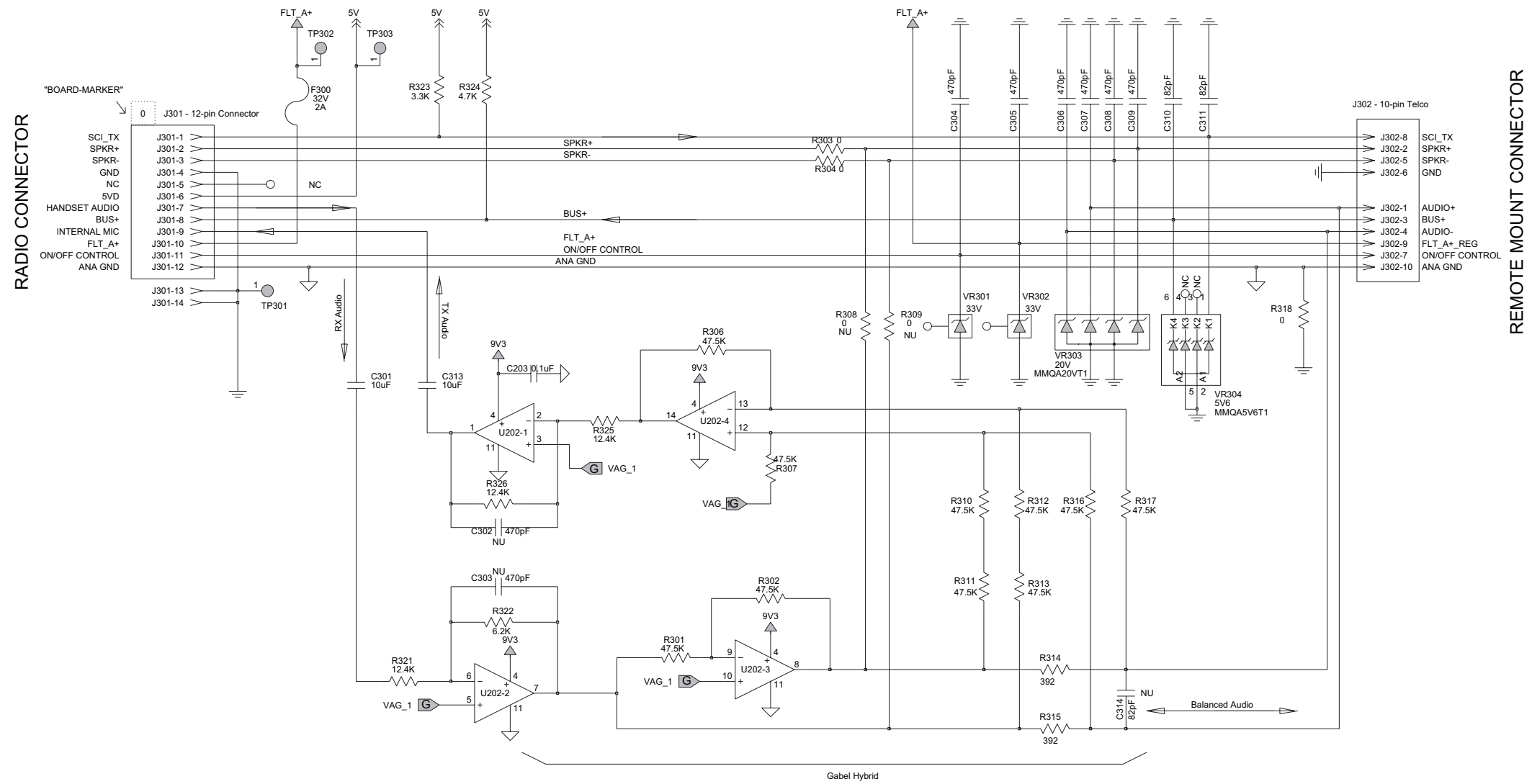
Data Expansion Head Enhanced Connector Board - Connector Board (PCB: 8464300B06\_A)

**Top View**

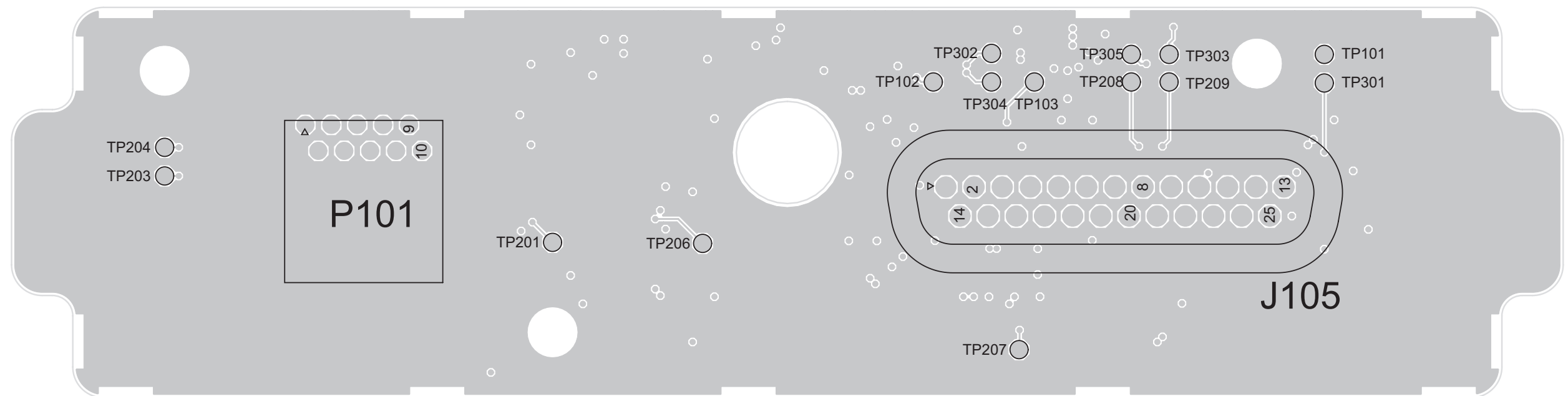
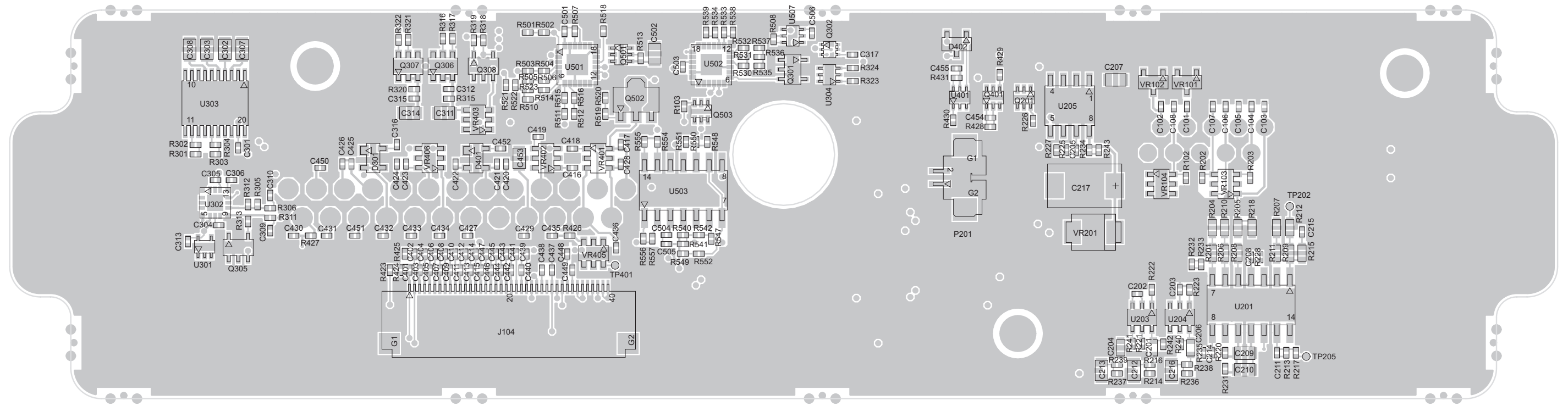


**Bottom View**

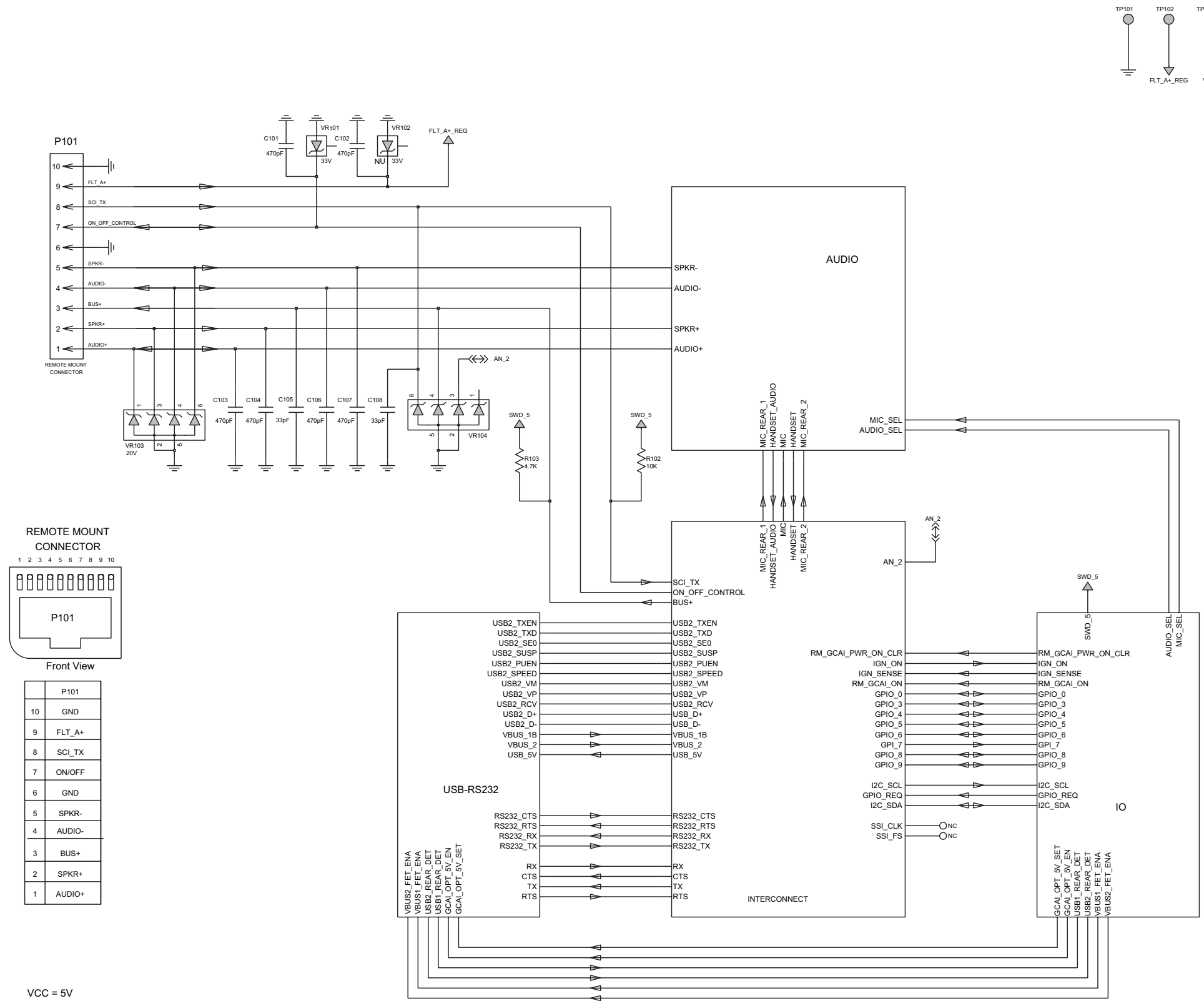




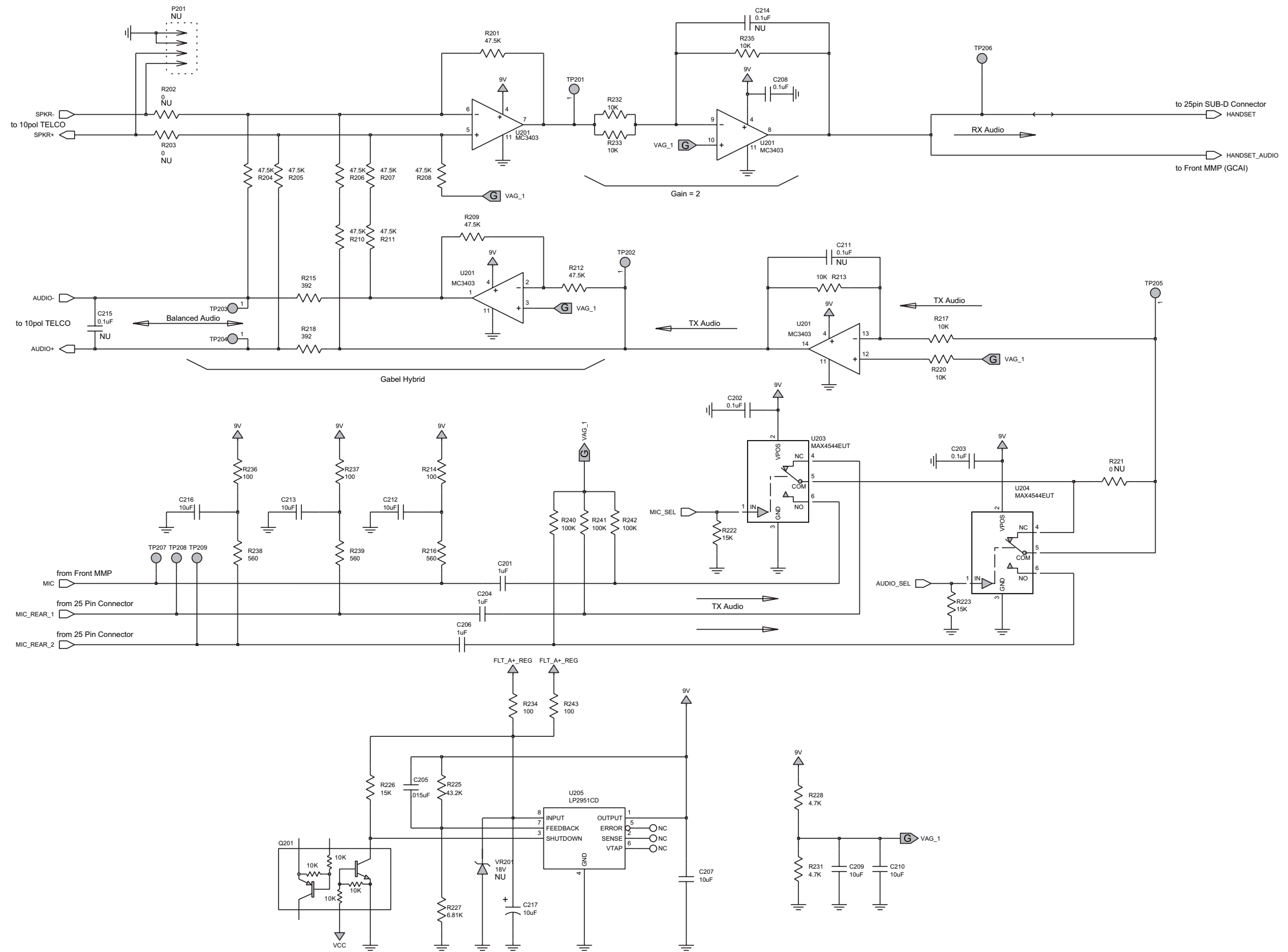
Remote Head Enhanced Main Board (PCB: 8471016L01\_A)



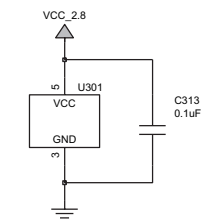
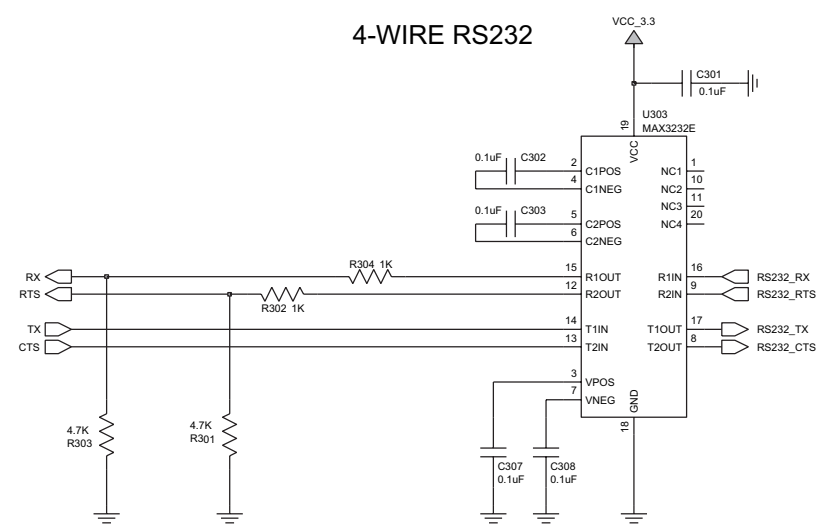
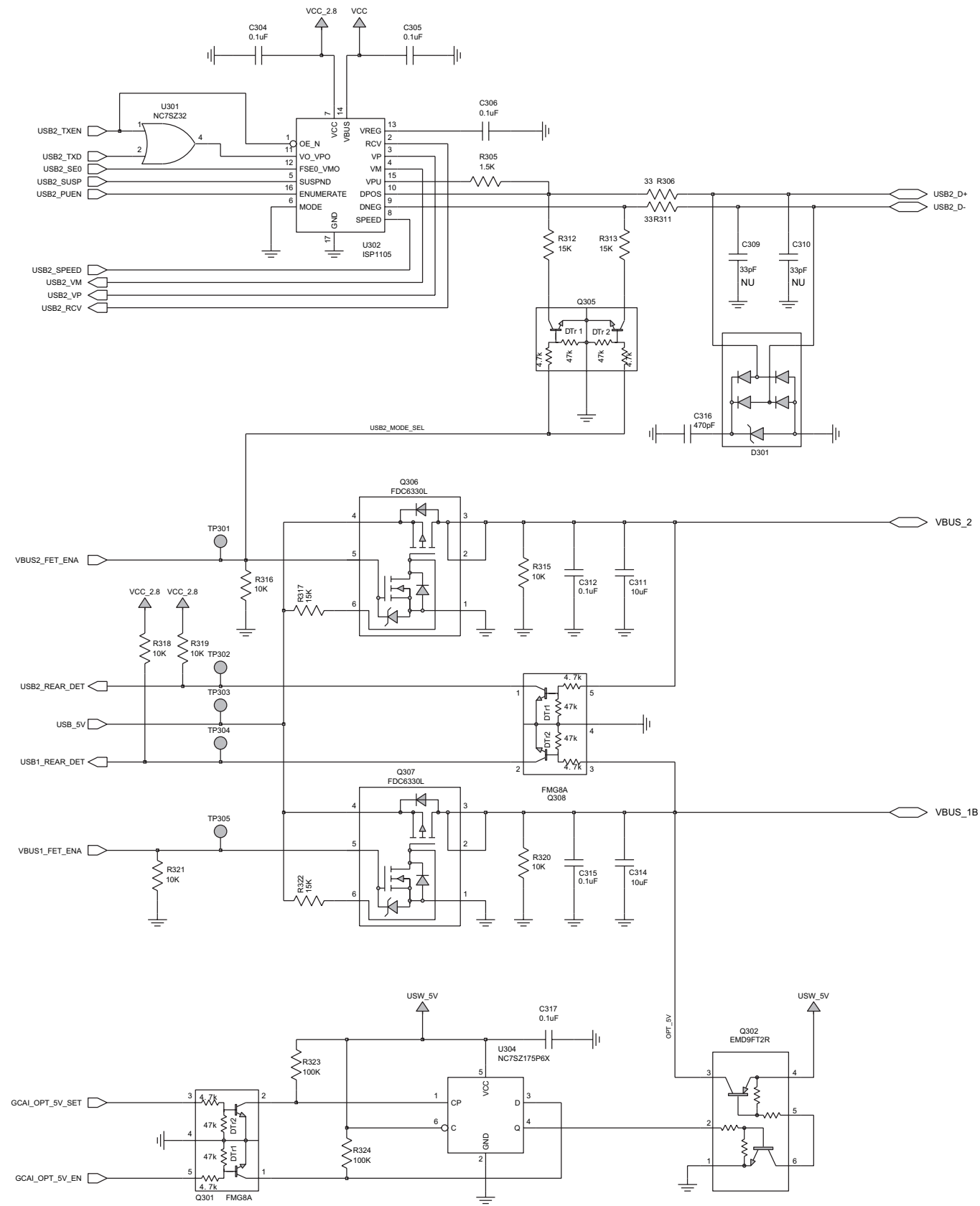
PCB/ Remote Back Head Enhanced Main Board - Bottom and Top Side (PCB: 8466583A01\_A)



Remote Back Head Enhanced Main Board - Block Diagram (PCB: 8466583A01\_A)

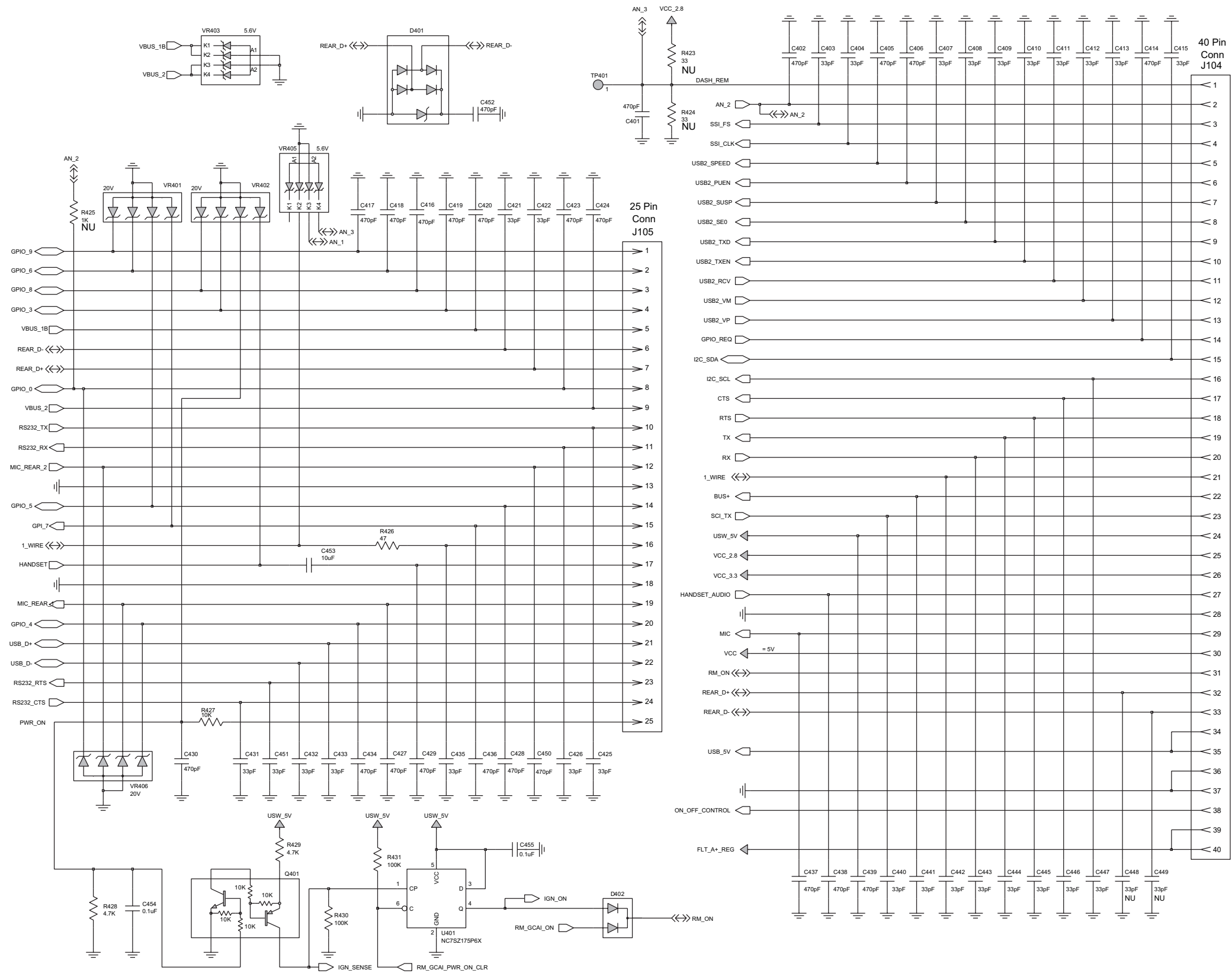


Remote Back Head Enhanced Main Board - Audio (PCB: 8466583A01\_A)

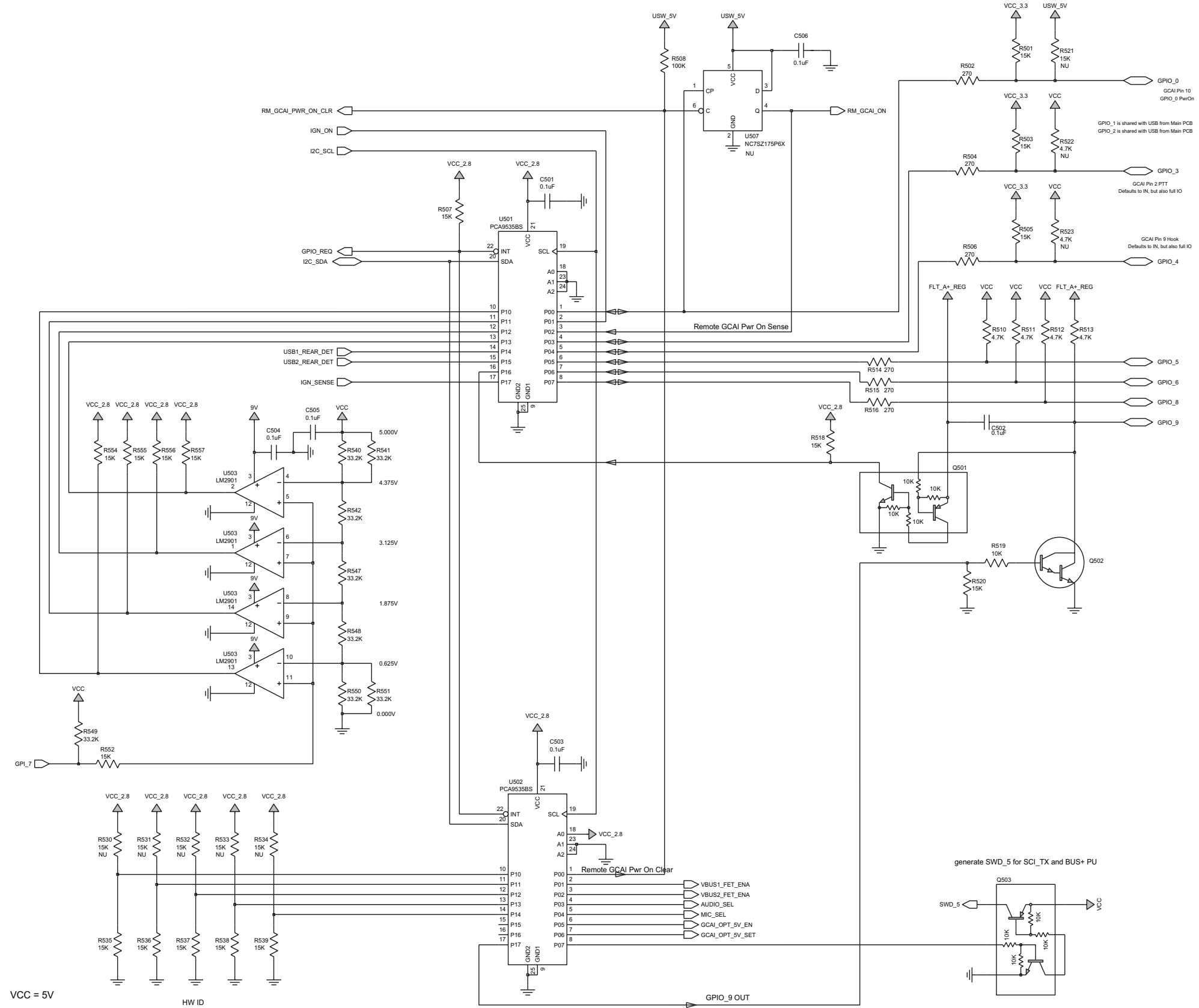


Remote Back Head Enhanced Main Board - USB/ RS232 (PCB: 8466583A01\_A)



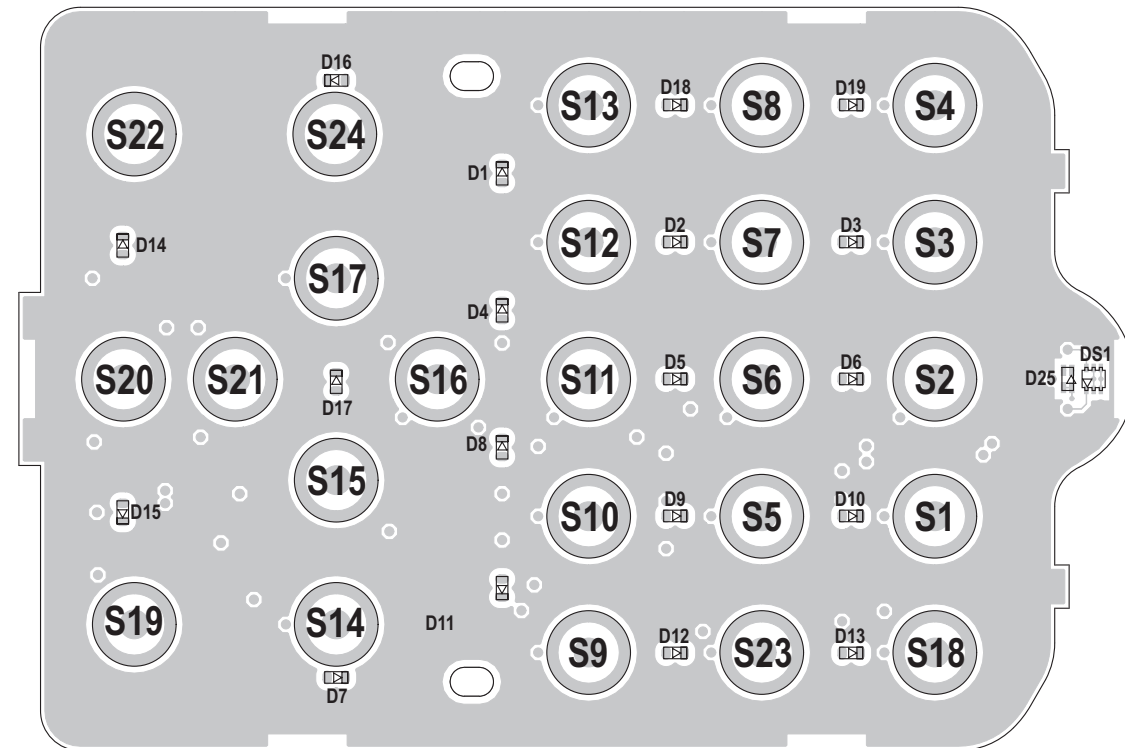


Remote Back Head Enhanced Main Board - Interconnect (PCB: 8466583A01\_A)

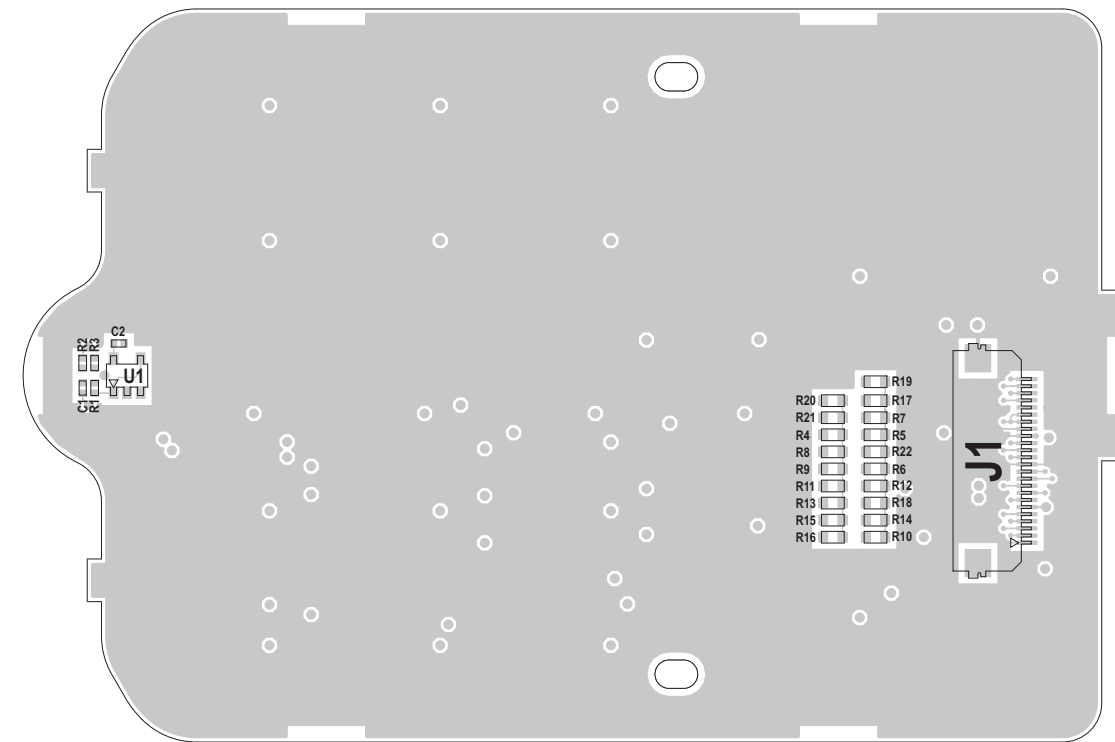


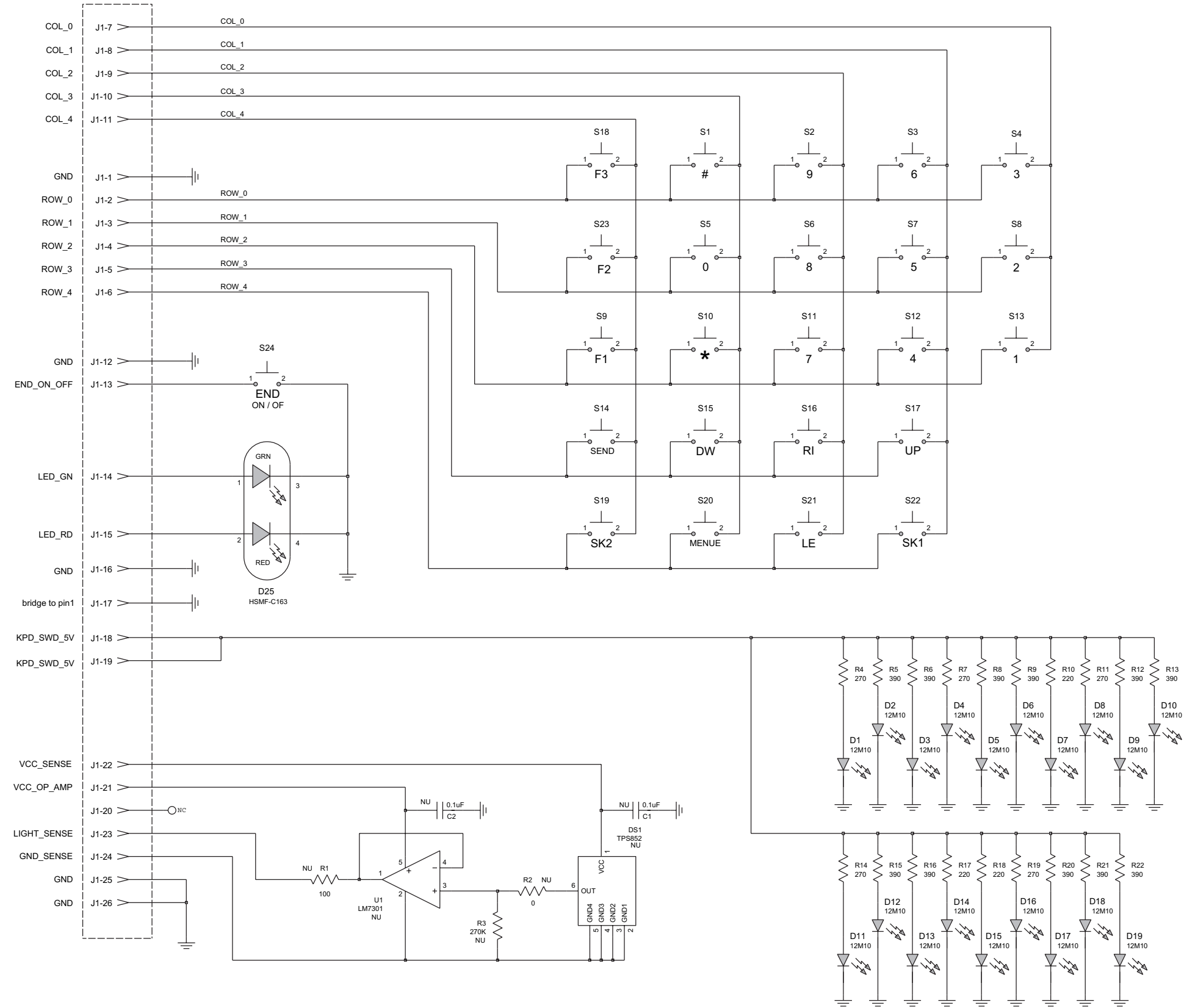
Remote Back Head Enhanced Main Board - IO (PCB: 8466583A01\_A)

**Top View**



**Bottom View**





Enhanced Control Head Keypad Board - Keypad Board (PCB: 8466581A01\_A)

**Parts List**

**Enhanced Control Head (PCB: 8466580A01)**

Reference	Motorola PN	Value
C101	2113944C06	CAP, 470pF
C102	2113944C06	CAP, 470pF
C103	2113944C36	CAP, 33pF
C104	2113944C06	CAP, 470pF
C105	2113944C06	CAP, 470pF
C107	2113944C36	CAP, 33pF
C108	2113944C06	CAP, 470pF
C109	2113944C06	CAP, 470pF
C110	2113944C43	CAP, 82pF
C112	2113944C06	CAP, 470pF
C113	2113944C06	CAP, 470pF
C114	2113944C06	CAP, 470pF
C115	2113944C43	CAP, 82pF
C116	2113944C06	CAP, 470pF
C118	2113944C43	CAP, 82pF
C120	2113956C37	CAP, 10uF
C121	2113944C06	CAP, 470pF
C201	NOT PLACED	GCAM DUMMY PART NUMBER
C202	NOT PLACED	GCAM DUMMY PART NUMBER
C203	NOT PLACED	GCAM DUMMY PART NUMBER
C204	2113944A28	CAP, 18pF
C205	2113944A28	CAP, 18pF
C206	2113946B04	CAP, 0.1uF
C220	2113946B04	CAP, 0.1uF
C221	2113946B04	CAP, 0.1uF
C223	2113946B04	CAP, 0.1uF
C224	2113946B04	CAP, 0.1uF
C225	2113946B04	CAP, 0.1uF
C226	2113946B04	CAP, 0.1uF
C227	2113946B04	CAP, 0.1uF
C228	2113946B04	CAP, 0.1uF
C229	2113946B04	CAP, 0.1uF
C230	2113946B04	CAP, 0.1uF
C231	2113946B04	CAP, 0.1uF
C232	2113946B04	CAP, 0.1uF
C233	2113946B04	CAP, 0.1uF
C234	2113946D02	CAP, 1.0uF
C241	2113946B04	CAP, 0.1uF
C242	2113956B54	CAP, 10uF
C243	2113956B54	CAP, 10uF
C244	2113945A05	CAP, 470pF

Reference	Motorola PN	Value
C245	2113945A05	CAP, 470pF
C255	2113946B04	CAP, 0.1uF
C256	2113946B04	CAP, 0.1uF
C257	2113946B04	CAP, 0.1uF
C258	2113944A31	CAP, 33pF
C259	2113944A31	CAP, 33pF
C260	2113944A31	CAP, 33pF
C261	2113946B04	CAP, 0.1uF
C262	2113946B04	CAP, 0.1uF
C263	2113946B04	CAP, 0.1uF
C264	2113944A31	CAP, 33pF
C265	2113944A31	CAP, 33pF
C266	2113946D02	CAP, 1.0uF
C267	2113946B04	CAP, 0.1uF
C268	2113946B04	CAP, 0.1uF
C269	2113946B04	CAP, 0.1uF
C270	2113944A31	CAP, 33pF
C271	2113946B04	CAP, 0.1uF
C272	2113944A31	CAP, 33pF
C273	2113946B04	CAP, 0.1uF
C274	2113946B04	CAP, 0.1uF
C275	2113946B04	CAP, 0.1uF
C276	2113946B04	CAP, 0.1uF
C277	2113944A31	CAP, 33pF
C278	2113946D02	CAP, 1.0uF
C279	2113946B04	CAP, 0.1uF
C280	2113946B04	CAP, 0.1uF
C281	2113946B04	CAP, 0.1uF
C282	2113946B04	CAP, 0.1uF
C283	2113946B04	CAP, 0.1uF
C284	2113946B04	CAP, 0.1uF
C285	2113946B04	CAP, 0.1uF
C286	2113946B04	CAP, 0.1uF
C287	2113946B04	CAP, 0.1uF
C288	2113946B04	CAP, 0.1uF
C289	2113944A31	CAP, 33pF
C290	2113946D02	CAP, 1.0uF
C291	2113946B04	CAP, 0.1uF
C292	2113944A31	CAP, 33pF
C293	2113946B04	CAP, 0.1uF
C294	2113956B54	CAP, 10uF
C295	2113946D02	CAP, 1.0uF
C301	2113946B04	CAP, 0.1uF
C324	2113946B04	CAP, 0.1uF
C325	2113956D58	CAP, 22uF
C326	2113946B04	CAP, 0.1uF

Reference	Motorola PN	Value
C327	2113956B54	CAP, 10uF
C328	2113945A05	CAP, 470pF
C350	NOT PLACED	GCAM DUMMY PART NUMBER
C352	NOT PLACED	GCAM DUMMY PART NUMBER
C401	2113946B04	CAP, 0.1uF
C402	2113946B04	CAP, 0.1uF
C403	2113946B04	CAP, 0.1uF
C404	2113946B04	CAP, 0.1uF
C405	2113946B04	CAP, 0.1uF
C406	2113946B04	CAP, 0.1uF
C407	2113944C06	CAP, 470pF
C408	2113944C06	CAP, 470pF
C409	2113946B04	CAP, 0.1uF
C410	2113956B54	CAP, 10uF
C413	2113946B04	CAP, 0.1uF
C414	2113945A05	CAP, 470pF
C415	2113956B54	CAP, 10uF
C416	2113956B54	CAP, 10uF
C421	2113946B04	CAP, 0.1uF
C422	2113946B04	CAP, 0.1uF
C501	2113944C06	CAP, 470pF
C502	2313960J01	CAP, 10uF
C503	2313960J01	CAP, 10uF
C504	2113944C06	CAP, 470pF
C505	2113945C31	CAP, 0.1uF
C506	2113945C02	CAP, .01uF
C507	2113956D58	CAP, 22uF
C508	2113956D58	CAP, 22uF
C509	2113956D58	CAP, 22uF
C510	2113956D58	CAP, 22uF
C511	2113956D58	CAP, 22uF
C512	2113956D58	CAP, 22uF
C513	2113956B54	CAP, 10uF
C514	2314030J28	CAP, 22uF
C515	NOT PLACED	GCAM DUMMY PART NUMBER
C516	2113946B04	CAP, 0.1uF
C517	2113956B54	CAP, 10uF
C518	2113944A29	CAP, 22pF
C519	2113944A40	CAP, 100pF
C520	2113956B54	CAP, 10uF
C521	2113956B54	CAP, 10uF
C522	2113946B04	CAP, 0.1uF
C523	2113944A25	CAP, 10pF
C524	2113944A42	CAP, 150pF

Reference	Motorola PN	Value
C525	2113956B54	CAP, 10uF
C526	2113956B54	CAP, 10uF
C527	2113956B54	CAP, 10uF
C528	2113946B04	CAP, 0.1uF
C529	2113946B04	CAP, 0.1uF
C530	NOT PLACED	GCAM DUMMY PART NUMBER
C531	2113944A28	CAP, 18pF
C532	2113944A26	CAP, 12pF
C533	2113946B04	CAP, 0.1uF
C534	2113956B54	CAP, 10uF
C535	NOT PLACED	GCAM DUMMY PART NUMBER
C536	NOT PLACED	GCAM DUMMY PART NUMBER
C540	2113946B04	CAP, 0.1uF
C541	2113946B04	CAP, 0.1uF
C542	2113946B04	CAP, 0.1uF
C544	NOT PLACED	GCAM DUMMY PART NUMBER
C545	2113946B04	CAP, 0.1uF
C546	2113946B04	CAP, 0.1uF
C547	2113946B04	CAP, 0.1uF
C601	2113944C06	CAP, 470pF
C602	2113945A05	CAP, 470pF
C604	2113945A05	CAP, 470pF
C605	2113944A31	CAP, 33pF
C606	2113944A31	CAP, 33pF
C607	2113945A05	CAP, 470pF
C608	2113945A05	CAP, 470pF
C609	2113945A05	CAP, 470pF
C610	2113956B54	CAP, 10uF
C611	2113945A05	CAP, 470pF
C612	2113945A05	CAP, 470pF
C613	2113945A05	CAP, 470pF
C614	2113945A05	CAP, 470pF
C615	2113944A38	CAP, 82pF
C616	2113944A38	CAP, 82pF
C617	2113944A38	CAP, 82pF
C618	2113944A38	CAP, 82pF
C619	2113944A38	CAP, 82pF
C620	2113944A38	CAP, 82pF
C621	2113944A38	CAP, 82pF
C622	2113944A38	CAP, 82pF
C623	2113944A38	CAP, 82pF
C624	2113945A05	CAP, 470pF
C625	2113944A31	CAP, 33pF

Reference	Motorola PN	Value
C626	2113944A31	CAP, 33pF
C627	2113944A31	CAP, 33pF
C628	2113944A38	CAP, 82pF
C629	2113944A31	CAP, 33pF
C630	2113944A31	CAP, 33pF
C631	2113944A38	CAP, 82pF
C632	2113945A05	CAP, 470pF
C633	2113945A05	CAP, 470pF
C634	2113944A38	CAP, 82pF
C635	2113944A38	CAP, 82pF
C636	2113945A05	CAP, 470pF
C637	2113945A05	CAP, 470pF
D101	4866544A01	SR05
D301	4813978A19	MBR120LSFT1
D302	4813978A25	BAT54HT1G
D304	NOT PLACED	GCAM DUMMY PART NUMBER
D350	4813978C02	MMBD6100
D401	4815814H01	HT-S91UD
D402	4815814H01	HT-S91UD
D501	4813978N08	MBRS130
D502	4813978A25	BAT54HT1G
D503	4813978C02	MMBD6100
D504	NOT PLACED	GCAM DUMMY PART NUMBER
D505	4813978C02	MMBD6100
D506	NOT PLACED	GCAM DUMMY PART NUMBER
D507	4813978A25	BAT54HT1G
D510	4813978C02	MMBD6100
D511	4813978C02	MMBD6100
D513	4813978C02	MMBD6100
J101	0964501H02	CONN_J
J102	0916162H02	pin CONN_J
J201	0988866N01	pin CONN_J
J202	NOT PLACED	GCAM DUMMY PART NUMBER
J401	0916875H01	pin CONN_J
J403	0971315L01	CONN_J
J603	0971065L01	pin CONN_J
L501	2489932S02	IDCTR, 33uH
L502	2487956V01	IDCTR, 22uH
L503	2589195N04	IDCTR, 4.7uH
L504	2589195N04	IDCTR, 4.7uH
L505	2489932S02	IDCTR, 33uH
L507	2489932S02	IDCTR, 33uH

Reference	Motorola PN	Value
M101	NOT PLACED	GCAM DUMMY PART NUMBER
M102	3264646H01	CONTACT
M103	NOT PLACED	GCAM DUMMY PART NUMBER
M104	3264646H01	CONTACT
M105	3264646H01	CONTACT
M106	3264646H01	CONTACT
M107	NOT PLACED	GCAM DUMMY PART NUMBER
M108	NOT PLACED	GCAM DUMMY PART NUMBER
M109	3264646H01	CONTACT
M110	NOT PLACED	GCAM DUMMY PART NUMBER
M111	3264646H01	CONTACT
M112	NOT PLACED	GCAM DUMMY PART NUMBER
M113	NOT PLACED	GCAM DUMMY PART NUMBER
M114	NOT PLACED	GCAM DUMMY PART NUMBER
M115	NOT PLACED	GCAM DUMMY PART NUMBER
M116	NOT PLACED	GCAM DUMMY PART NUMBER
M201	3989655N03	CONTACT
Q201	4813973M07	MMBT3904
Q202	4815272H01	EMD9FT2R
Q301	4815272H01	EMD9FT2R
Q305	4813973M07	MMBT3904
Q322	4805921T28	FMG8A
Q323	4805921T28	FMG8A
Q324	4805921T28	FMG8A
Q325	4815272H01	EMD9FT2R
Q326	5166540A01	FDC6330L
Q327	NOT PLACED	GCAM DUMMY PART NUMBER
Q350	NOT PLACED	GCAM DUMMY PART NUMBER
Q351	NOT PLACED	GCAM DUMMY PART NUMBER
Q352	4815272H01	EMD9FT2R
Q353	NOT PLACED	GCAM DUMMY PART NUMBER
Q401	5166540A01	FDC6330L
Q403	4813973M07	MMBT3904
Q404	4815272H01	EMD9FT2R
Q405	4815272H01	EMD9FT2R
Q410	4813973M07	MMBT3904

Reference	Motorola PN	Value
Q411	4815272H01	EMD9FT2R
Q412	4815272H01	EMD9FT2R
Q500	4815272H01	EMD9FT2R
Q501	4815272H01	EMD9FT2R
Q502	4815272H01	EMD9FT2R
Q503	4815272H01	EMD9FT2R
Q504	4815272H01	EMD9FT2R
Q505	4815272H01	EMD9FT2R
Q506	4815272H01	EMD9FT2R
Q507	4815272H01	EMD9FT2R
Q508	4815272H01	EMD9FT2R
R101	0613952H37	RES, 33
R102	0613952H25	RES, 10
R103	0613952H37	RES, 33
R151	0613952R25	RES, 100K
R152	0613952R25	RES, 100K
R153	0613952R25	RES, 100K
R154	0613952R25	RES, 100K
R155	0613952Q89	RES, 4.7K
R156	NOT PLACED	GCAM DUMMY PART NUMBER
R157	0613952Q89	RES, 4.7K
R160	0613952Q37	RES, 33
R161	0613952Q37	RES, 33
R162	0613952R66	RES, 0
R163	0613952Q37	RES, 33
R164	0613952Q37	RES, 33
R165	0613952Q37	RES, 33
R166	0613952Q37	RES, 33
R167	0613952Q37	RES, 33
R168	0613952Q37	RES, 33
R201	NOT PLACED	GCAM DUMMY PART NUMBER
R202	NOT PLACED	GCAM DUMMY PART NUMBER
R203	0613952R25	RES, 100K
R204	NOT PLACED	GCAM DUMMY PART NUMBER
R205	NOT PLACED	GCAM DUMMY PART NUMBER
R206	NOT PLACED	GCAM DUMMY PART NUMBER
R207	0613952R25	RES, 100K
R208	0613952R25	RES, 100K
R209	NOT PLACED	GCAM DUMMY PART NUMBER
R210	0613952R25	RES, 100K
R211	0613952R25	RES, 100K

Reference	Motorola PN	Value
R212	0613952R25	RES, 100K
R213	0613952R66	RES, 0
R214	0613952R01	RES, 10K
R215	0613952R01	RES, 10K
R216	NOT PLACED	GCAM DUMMY PART NUMBER
R217	NOT PLACED	GCAM DUMMY PART NUMBER
R218	0613952R01	RES, 10K
R219	0613952R01	RES, 10K
R220	0613952R66	RES, 0
R221	0613952R74	RES, 10MEG
R222	NOT PLACED	GCAM DUMMY PART NUMBER
R223	0613952R01	RES, 10K
R224	0613952R66	RES, 0
R225	0613952R66	RES, 0
R226	NOT PLACED	GCAM DUMMY PART NUMBER
R227	NOT PLACED	GCAM DUMMY PART NUMBER
R228	0613952R01	RES, 10K
R230	0613952R01	RES, 10K
R231	0613952R01	RES, 10K
R232	0613952R01	RES, 10K
R233	0613952R01	RES, 10K
R234	0613952R01	RES, 10K
R235	0613952R01	RES, 10K
R236	NOT PLACED	GCAM DUMMY PART NUMBER
R237	0613952R01	RES, 10K
R240	NOT PLACED	GCAM DUMMY PART NUMBER
R241	NOT PLACED	GCAM DUMMY PART NUMBER
R242	0613952R01	RES, 10K
R243	0613952R01	RES, 10K
R244	0613952R01	RES, 10K
R245	NOT PLACED	GCAM DUMMY PART NUMBER
R246	0613952R01	RES, 10K
R247	NOT PLACED	GCAM DUMMY PART NUMBER
R248	0613952R01	RES, 10K
R249	0613952R01	RES, 10K
R250	NOT PLACED	GCAM DUMMY PART NUMBER
R251	NOT PLACED	GCAM DUMMY PART NUMBER

Reference	Motorola PN	Value
R252	NOT PLACED	GCAM DUMMY PART NUMBER
R253	0613952R01	RES, 10K
R254	NOT PLACED	GCAM DUMMY PART NUMBER
R255	0613952R01	RES, 10K
R256	0613952R01	RES, 10K
R257	0613952R66	RES, 0
R258	0613952Q37	RES, 33
R259	NOT PLACED	GCAM DUMMY PART NUMBER
R260	0613952R66	RES, 0
R261	0613952Q81	RES, 2.2K
R262	0613952Q81	RES, 2.2K
R263	NOT PLACED	GCAM DUMMY PART NUMBER
R264	0613952R01	RES, 10K
R265	0613952R01	RES, 10K
R266	0613952R66	RES, 0
R267	0613952R66	RES, 0
R268	0613952R66	RES, 0
R269	0613952R66	RES, 0
R270	0613952R66	RES, 0
R271	0613952R66	RES, 0
R272	0613952R66	RES, 0
R273	0613952R66	RES, 0
R274	0613952R66	RES, 0
R275	0613952R66	RES, 0
R276	0613952R66	RES, 0
R277	0613952R66	RES, 0
R278	0613952R66	RES, 0
R279	0613952R66	RES, 0
R280	0613952R66	RES, 0
R281	0613952R66	RES, 0
R282	0613952R66	RES, 0
R283	0613952R66	RES, 0
R284	0613952R66	RES, 0
R285	0613952R66	RES, 0
R286	0613952Q77	RES, 1.5K
R287	0613952H49	RES, 100
R288	0613952R01	RES, 10K
R289	NOT PLACED	GCAM DUMMY PART NUMBER
R290	0613952R01	RES, 10K
R291	0613952R66	RES, 0
R295	0613952R01	RES, 10K
R296	0613952Q25	RES, 10

Reference	Motorola PN	Value
R297	0613952Q25	RES, 10
R301	0613952R01	RES, 10K
R303	0613952R01	RES, 10K
R304	0613952R05	RES, 15K
R305	0613952R01	RES, 10K
R306	0613952R05	RES, 15K
R307	0613952Q81	RES, 2.2K
R308	0613952Q81	RES, 2.2K
R309	0613952R01	RES, 10K
R310	0613952R01	RES, 10K
R311	0613952R01	RES, 10K
R312	0613952R05	RES, 15K
R313	0613952Q73	RES, 1K
R314	0613952H37	RES, 33
R315	0613952H37	RES, 33
R316	0613952H37	RES, 33
R317	NOT PLACED	GCAM DUMMY PART NUMBER
R318	0613952R66	RES, 0
R319	NOT PLACED	GCAM DUMMY PART NUMBER
R320	0613952Q73	RES, 1K
R321	0613952R01	RES, 10K
R322	0613952R05	RES, 15K
R323	0613952R01	RES, 10K
R324	0613952R05	RES, 15K
R325	0613952R01	RES, 10K
R326	0613952Q77	RES, 1.5K
R327	0613952R05	RES, 15K
R328	0613952R05	RES, 15K
R329	0613952R01	RES, 10K
R330	0613952Q57	RES, 220
R331	0613952Q57	RES, 220
R332	NOT PLACED	GCAM DUMMY PART NUMBER
R333	0613952R01	RES, 10K
R334	0613952R01	RES, 10K
R335	0613952R17	RES, 47K
R336	0613952R01	RES, 10K
R337	0613952R01	RES, 10K
R338	NOT PLACED	GCAM DUMMY PART NUMBER
R339	NOT PLACED	GCAM DUMMY PART NUMBER
R340	0613952R37	RES, 330K
R341	0613952R37	RES, 330K
R342	0613952R37	RES, 330K

Reference	Motorola PN	Value
R343	0613952R37	RES, 330K
R344	0613952Q91	RES, 5.6K
R345	0613952R01	RES, 10K
R346	0613952R41	RES, 470K
R347	0613952R25	RES, 100K
R348	0613952R25	RES, 100K
R350	NOT PLACED	GCAM DUMMY PART NUMBER
R351	NOT PLACED	GCAM DUMMY PART NUMBER
R352	NOT PLACED	GCAM DUMMY PART NUMBER
R354	0613952Q89	RES, 4.7K
R355	NOT PLACED	GCAM DUMMY PART NUMBER
R357	0613952R05	RES, 15K
R358	0613952Q73	RES, 1K
R359	NOT PLACED	GCAM DUMMY PART NUMBER
R360	NOT PLACED	GCAM DUMMY PART NUMBER
R361	0613952R66	RES, 0
R399	NOT PLACED	GCAM DUMMY PART NUMBER
R400	0613952R66	RES, 0
R401	0613952Q85	RES, 3.3K
R402	0613952Q85	RES, 3.3K
R403	0613952R13	RES, 33K
R404	0613952R13	RES, 33K
R405	0613952Q49	RES, 100
R406	0613952Q89	RES, 4.7K
R407	0613952Q73	RES, 1K
R408	0613952Q73	RES, 1K
R409	0613952Q73	RES, 1K
R410	0613952Q73	RES, 1K
R411	0613952Q73	RES, 1K
R412	0613952R01	RES, 10K
R413	0613952R17	RES, 47K
R414	0613952Q77	RES, 1.5K
R415	0613952H49	RES, 100
R416	0613952Q79	RES, 1.8K
R417	0613952Q73	RES, 1K
R421	0613952R01	RES, 10K
R422	0613952R05	RES, 15K
R423	0613952R12	RES, 30K
R424	0613952R01	RES, 10K
R425	0613952R01	RES, 10K
R426	0613952R01	RES, 10K

Reference	Motorola PN	Value
R427	0613952R12	RES, 30K
R428	0613952Q85	RES, 3.3K
R429	0613952R17	RES, 47K
R430	0613952R05	RES, 15K
R435	0613952Q89	RES, 4.7K
R436	0613952R01	RES, 10K
R440	NOT PLACED	GCAM DUMMY PART NUMBER
R441	NOT PLACED	GCAM DUMMY PART NUMBER
R442	0613952R66	RES, 0
R443	0613952R66	RES, 0
R444	NOT PLACED	GCAM DUMMY PART NUMBER
R501	0613952R01	RES, 10K
R502	0613952E09	RES, 12.1K
R503	0613952Q49	RES, 100
R504	0613952E09	RES, 12.1K
R505	0613952Q73	RES, 1K
R506	0613952R13	RES, 33K
R507	0613952R01	RES, 10K
R508	0613952P51	RES, 332K
R509	0613952P22	RES, 165K
R510	0613952P81	RES, 681K
R511	0613952P09	RES, 121K
R512	0613952Q73	RES, 1K
R513	0613952N81	RES, 68.1K
R514	0613952R01	RES, 10K
R515	0613952N71	RES, 53.6K
R520	0613952R37	RES, 330K
R521	0613952R74	RES, 10MEG
R522	0613952R33	RES, 220K
R523	0613952R66	RES, 0
R524	NOT PLACED	GCAM DUMMY PART NUMBER
R529	NOT PLACED	GCAM DUMMY PART NUMBER
R530	0613952H49	RES, 100
R531	0613952P22	RES, 165K
R532	0613952N70	RES, 52.3K
R533	0613952Q25	RES, 10
R534	0613952R66	RES, 0
R535	0613952R66	RES, 0
R536	0613952R66	RES, 0
R537	0613952R66	RES, 0
R538	NOT PLACED	GCAM DUMMY PART NUMBER
R539	0613952R66	RES, 0

Reference	Motorola PN	Value
R540	0613952R01	RES, 10K
R541	0613952Q89	RES, 4.7K
R542	0613952R01	RES, 10K
R543	0613952R01	RES, 10K
R544	0613952R66	RES, 0
R545	0613952Q73	RES, 1K
R547	0613952Q89	RES, 4.7K
R548	0613952R01	RES, 10K
R549	0613952R01	RES, 10K
R550	0613952R01	RES, 10K
R551	0613952Q89	RES, 4.7K
R602	NOT PLACED	GCAM DUMMY PART NUMBER
R603	NOT PLACED	GCAM DUMMY PART NUMBER
R604	NOT PLACED	GCAM DUMMY PART NUMBER
R605	NOT PLACED	GCAM DUMMY PART NUMBER
R606	0613952R66	RES, 0
R607	0613952R66	RES, 0
R608	0613952R66	RES, 0
R609	0613952R66	RES, 0
R610	NOT PLACED	GCAM DUMMY PART NUMBER
R611	NOT PLACED	GCAM DUMMY PART NUMBER
R612	0613952R66	RES, 0
R613	0613952R66	RES, 0
R614	NOT PLACED	GCAM DUMMY PART NUMBER
S501	4015040C01	SWITCH
SH201	NOT PLACED	GCAM DUMMY PART NUMBER
SH501	2616535H01	SHIELD
SH502	NOT PLACED	GCAM DUMMY PART NUMBER
U201	5171423L01	IC OMAP 1621 GP DUAL CORE PROCESSOR
U202	NOT PLACED	GCAM DUMMY PART NUMBER
U203	NOT PLACED	GCAM DUMMY PART NUMBER
U204	5185956E43	IC,FLSH.,128MB,
U205	5185941F17	IC,SDRAM,128MB
U206	5114000B39	74VHC125
U207	5114000B39	74VHC125
U208	5114007A47	NC7SZ32
U209	5185941F65	IC LATCH, LVC, OCTAL

Reference	Motorola PN	Value
U210	5114000B39	74VHC125
U211	NOT PLACED	GCAM DUMMY PART NUMBER
U301	5102836C11	1 FSA4157L6X_NL
U302	5115007H01	0 SN74LVC1T45
U303	5115007H01	0 SN74LVC1T45
U304	5115007H01	0 SN74LVC1T45
U321	5102836C11	1 FSA4157L6X_NL
U322	5102836C11	1 FSA4157L6X_NL
U323	5115007H01	0 SN74LVC1T45
U324	5164015H50	TPS2041B
U325	5115007H01	0 SN74LVC1T45
U326	5102836C11	1 FSA4157L6X_NL
U327	5102836C11	1 FSA4157L6X_NL
U328	5109817F77	LMV7275
U350	NOT PLACED	GCAM DUMMY PART NUMBER
U401	5186311J07	D-FLIP-FLOP NC7SZ175
U402	5186311J07	D-FLIP-FLOP NC7SZ175
U403	5114007A43	NL17SZ14
U404	5114007A43	NL17SZ14
U420	5114000B39	74VHC125
U421	5109817F77	LMV7275
U422	5109817F77	LMV7275
U501	5185941F48	IC, VREG 5V NOPB
U502	5114004A35	NCP301
U503	5109920D44	LT1937
U504	5109920D39	TPS62220
U505	5109920D39	TPS62220
U506	5114014A22	LP2951CD
U507	5109512F66	LP2985
U508	5114007A43	NL17SZ14
U509	5186311J07	D-FLIP-FLOP NC7SZ175
U510	5102836C11	1 FSA4157L6X_NL
U511	5102836C11	1 FSA4157L6X_NL
U512	5102836C11	1 FSA4157L6X_NL
U513	5189263U10	LINEAR VOLTAGE REGULATOR
U515	5185319Y01	RIPPLE COUNTER, 14 STAGE, WITH OSC
VR101	4813979P10	MMQA5V6T1
VR102	4813979C11	MMQA20VT1
VR401	4813979P10	MMQA5V6T1
VR501	4813979P10	MMQA5V6T1
VR502	4814026A19	1SMB5931B
Y201	4802582S85	XTAL

Reference	Motorola PN	Value
Y202	NOT PLACED	GCAM DUMMY PART NUMBER
Y501	4809995L20	MC146

#### Data Expansion Head Enhanced/ Main Board (PCB 8466586A01)

Reference	Motorola PN	Value
C101	2113945C31	CAP 0.1uF
C102	2113945C31	CAP 0.1uF
C103	2113945G91	CAP, 0.1uF
C104	2113945G91	CAP, 0.1uF
C105	2113945G91	CAP, 0.1uF
C106	2113945G91	CAP, 0.1uF
C107	NOT PLACED	GCAM DUMMY PART NUMBER
C108	NOT PLACED	GCAM DUMMY PART NUMBER
C109	NOT PLACED	GCAM DUMMY PART NUMBER
C110	NOT PLACED	GCAM DUMMY PART NUMBER
C111	NOT PLACED	GCAM DUMMY PART NUMBER
C112	NOT PLACED	GCAM DUMMY PART NUMBER
C113	NOT PLACED	GCAM DUMMY PART NUMBER
C114	NOT PLACED	GCAM DUMMY PART NUMBER
C116	2113945L17	CAP 470pF
C117	2113945G91	CAP, 0.1uF
C118	2113945L17	CAP 470pF
C119	2113945L17	CAP 470pF
C120	2113944C43	CAP, 82pF
C121	2113945L17	CAP 470pF
C122	2113944C43	CAP, 82pF
C123	2113945L17	CAP 470pF
C124	2113945L17	CAP 470pF
C125	2113945L17	CAP 470pF
C126	NOT PLACED	GCAM DUMMY PART NUMBER
C127	NOT PLACED	GCAM DUMMY PART NUMBER
C128	NOT PLACED	GCAM DUMMY PART NUMBER
C129	NOT PLACED	GCAM DUMMY PART NUMBER

Reference	Motorola PN	Value
C130	NOT PLACED	GCAM DUMMY PART NUMBER
C131	2113944C43	CAP, 82pF
C132	NOT PLACED	GCAM DUMMY PART NUMBER
C133	NOT PLACED	GCAM DUMMY PART NUMBER
C134	NOT PLACED	GCAM DUMMY PART NUMBER
C135	NOT PLACED	GCAM DUMMY PART NUMBER
C136	NOT PLACED	GCAM DUMMY PART NUMBER
C137	NOT PLACED	GCAM DUMMY PART NUMBER
C138	NOT PLACED	GCAM DUMMY PART NUMBER
C139	NOT PLACED	GCAM DUMMY PART NUMBER
C140	2113945L17	CAP 470pF
C141	2113945L17	CAP 470pF
C142	2113945L17	CAP 470pF
C143	2313960G04	CAP,3.3UF,+
C145	2113945L17	CAP 470pF
C202	2113955E37	CAP,10UF
C203	2113946S35	CAP 1.0UF
C303	NOT PLACED	GCAM DUMMY PART NUMBER
C304	NOT PLACED	GCAM DUMMY PART NUMBER
C305	NOT PLACED	GCAM DUMMY PART NUMBER
C306	NOT PLACED	GCAM DUMMY PART NUMBER
C307	NOT PLACED	GCAM DUMMY PART NUMBER
C308	NOT PLACED	GCAM DUMMY PART NUMBER
C309	NOT PLACED	GCAM DUMMY PART NUMBER
C401	2113945C31	CAP 0.1uF
C402	2113945C31	CAP 0.1uF
C403	2113945G91	CAP, 0.1uF
C404	2113945G91	CAP, 0.1uF
C405	2113945C31	CAP 0.1uF
C406	2113945G91	CAP, 0.1uF
C407	2113945G91	CAP, 0.1uF
C501	2313960F30	CAP 47UF,
C502	2113945C31	CAP 0.1uF
C503	2113945L17	CAP 470pF



Reference	Motorola PN	Value
C505	2113945C18	CAP .012uF
C506	2113955E37	CAP,10UF
C507	2113945C31	CAP 0.1uF
C508	2113945C31	CAP 0.1uF
C601	2113945L17	CAP 470pF
C602	2113945C31	CAP 0.1uF
C603	2113945C31	CAP 0.1uF
C604	2113945L17	CAP 470pF
C605	2113945C31	CAP 0.1uF
C606	2113945C31	CAP 0.1uF
C607	2313960C26	CAP 1.0 UF
C608	2113946S35	CAP 1.0UF
C610	2113945C31	CAP 0.1uF
C611	2113945C31	CAP 0.1uF
C612	2313960G32	CAP, 10uF
C613	2113955E37	CAP,10UF
C614	NOT PLACED	GCAM DUMMY PART NUMBER
C615	NOT PLACED	GCAM DUMMY PART NUMBER
C616	NOT PLACED	GCAM DUMMY PART NUMBER
D101	4813978C02	MMBD6100
D102	4813978C02	MMBD6100
F101	6503566D15	FUSE, THIN FILM,2A,32V,
J1001	0916162H02	12 POS, FLEX CONNECTOR,
J1003	NOT PLACED	GCAM DUMMY PART NUMBER
J1005	0915064H03	CONNECTOR, ZIF (40 PINS)
J1022	0915064H03	CONNECTOR, ZIF (40 PINS)
Q101	4813973M07	TRANSISTOR
Q102	4813973A42	XSTR,BIP GP SS,NPN,SM,SC-59,
Q103	4813973A13	XSTR,BIP GP SS,PNP,TO-236,SO
Q104	4813973A87	TRANSISTOR
Q401	4813973A87	TRANSISTOR
Q501	4813973A42	XSTR,BIP GP SS,NPN,SM,SC-59,
Q503	4813971A08	TSTR PNP 25V 5A MJD210T4
Q504	4813973A42	XSTR,BIP GP SS,NPN,SM,SC-59,
Q601	4813973A13	XSTR,BIP GP SS,PNP,TO-236,SO
Q602	4813973A13	XSTR,BIP GP SS,PNP,TO-236,SO
Q603	4813973M07	TRANSISTOR

Reference	Motorola PN	Value
Q604	4813973A13	XSTR,BIP GP SS,PNP,TO-236,SO
R101	NOT PLACED	GCAM DUMMY PART NUMBER
R102	0613952J17	RES 47K
R103	0613952J01	RES 10K
R104	0613952J17	RES 47K
R105	NOT PLACED	GCAM DUMMY PART NUMBER
R106	0613952G67	RES 0
R107	NOT PLACED	GCAM DUMMY PART NUMBER
R108	0613952H25	RES, 10
R109	0613952H89	RES 4.7K
R110	NOT PLACED	GCAM DUMMY PART NUMBER
R111	0613952J17	RES 47K
R112	NOT PLACED	GCAM DUMMY PART NUMBER
R113	0613952H95	RES 8.2K
R114	0613952J17	RES 47K
R115	0613952H89	RES 4.7K
R116	0613952J01	RES 10K
R117	NOT PLACED	GCAM DUMMY PART NUMBER
R118	0613952J01	RES 10K
R119	0613952J01	RES 10K
R120	0613952H89	RES 4.7K
R201	0613952H89	RES 4.7K
R202	0613952H85	RES 3.3K
R205	0613952G67	RES 0
R206	0613952G67	RES 0
R208	0614033G66	RES, 47.5K
R209	0614033G66	RES, 47.5K
R210	0614033G66	RES, 47.5K
R211	0614033G66	RES, 47.5K
R212	NOT PLACED	GCAM DUMMY PART NUMBER
R213	NOT PLACED	GCAM DUMMY PART NUMBER
R214	0614033G66	RES, 47.5K
R215	0614033G66	RES, 47.5K
R216	0614033G66	RES, 47.5K
R217	0614033G66	RES, 47.5K
R218	0614033G66	RES, 47.5K
R219	0614033G66	RES, 47.5K
R220	0614033E58	RES, 392
R221	0614033E58	RES, 392

Reference	Motorola PN	Value
R222	0613952G67	RES 0
R223	0613952G67	RES 0
R301	NOT PLACED	GCAM DUMMY PART NUMBER
R302	NOT PLACED	GCAM DUMMY PART NUMBER
R303	NOT PLACED	GCAM DUMMY PART NUMBER
R304	NOT PLACED	GCAM DUMMY PART NUMBER
R305	NOT PLACED	GCAM DUMMY PART NUMBER
R306	NOT PLACED	GCAM DUMMY PART NUMBER
R307	NOT PLACED	GCAM DUMMY PART NUMBER
R308	NOT PLACED	GCAM DUMMY PART NUMBER
R309	NOT PLACED	GCAM DUMMY PART NUMBER
R310	NOT PLACED	GCAM DUMMY PART NUMBER
R311	NOT PLACED	GCAM DUMMY PART NUMBER
R312	NOT PLACED	GCAM DUMMY PART NUMBER
R313	NOT PLACED	GCAM DUMMY PART NUMBER
R314	NOT PLACED	GCAM DUMMY PART NUMBER
R315	NOT PLACED	GCAM DUMMY PART NUMBER
R316	NOT PLACED	GCAM DUMMY PART NUMBER
R317	NOT PLACED	GCAM DUMMY PART NUMBER
R318	NOT PLACED	GCAM DUMMY PART NUMBER
R319	NOT PLACED	GCAM DUMMY PART NUMBER
R320	NOT PLACED	GCAM DUMMY PART NUMBER
R321	NOT PLACED	GCAM DUMMY PART NUMBER
R322	NOT PLACED	GCAM DUMMY PART NUMBER
R323	NOT PLACED	GCAM DUMMY PART NUMBER
R324	NOT PLACED	GCAM DUMMY PART NUMBER
R325	NOT PLACED	GCAM DUMMY PART NUMBER
R401	0613952J17	RES 47K

Reference	Motorola PN	Value
R402	0613952J17	RES 47K
R501	0613952E10	RES 12.4K
R502	NOT PLACED	GCAM DUMMY PART NUMBER
R508	0613952E88	RES 80.6K
R509	0613952H25	RES, 10
R510	0613952E10	RES 12.4K
R511	0613952H85	RES 3.3K
R512	0613952H85	RES 3.3K
R518	0613952J01	RES 10K
R519	0613952H81	RES 2.2K
R520	0613952H81	RES 2.2K
R601	0613952H89	RES 4.7K
R602	0613952H89	RES 4.7K
R603	0613952H89	RES 4.7K
R604	0613952J01	RES 10K
R605	0613952H81	RES 2.2K
R606	0613952H89	RES 4.7K
R607	0613952J01	RES 10K
R608	0613952J01	RES 10K
R609	0613952H81	RES 2.2K
R610	0613952H89	RES 4.7K
R611	0613952J01	RES 10K
R612	0613952H81	RES 2.2K
R613	0613952J01	RES 10K
R614	0613952H81	RES 2.2K
R615	0613952H89	RES 4.7K
R616	0613952J01	RES 10K
R617	0613952H92	RES 6.2K
R618	0613952E10	RES 12.4K
R619	0613952J01	RES 10K
R620	0613952J01	RES 10K
R623	0613952H67	RES 560
R624	0613952H49	RES, 100
R625	0613952J01	RES 10K
R626	NOT PLACED	GCAM DUMMY PART NUMBER
R627	NOT PLACED	GCAM DUMMY PART NUMBER
U101	5186988J61	IC,XCVR,5 DRIVER 3 RECEIVER
U201	5114016A18	IC,OP AMP,4PER PKG,GP,SOIC,PB
U301	NOT PLACED	GCAM DUMMY PART NUMBER
U302	NOT PLACED	GCAM DUMMY PART NUMBER
U401	5166552A01	UART MAX3100EEE+

Reference	Motorola PN	Value
U402	4886061B02	RESONATOR,CERAMIC,3.68 MHZ
U403	5114009A35	IC,XCVR,8PER PKG,74AC244
U404	5188462T01	MAX3232E
U501	5114014M39	IC,LINEAR VOLTAGE REGULATOR,
U503	5114014A22	LP2951CD
U601	5114009A07	IC,AND,74AC08,4PER PKG,SOIC14,6
U602	5114006A02	PB-FREE, NOTCOMPLETELYENRICHE D
U603	5175771A10	MAX4544EUT
VR101	4813977M11	DIODE,ZEN,MBZ5232,SM,S OT-23,5.
VR102	4813977M36	MMBZ5257BLT1G
VR103	4813979P10	MMQA5V6T1
VR104	4813979C11	MMQA20VT1
VR105	4813977M36	MMBZ5257BLT1G
VR106	NOT PLACED	GCAM DUMMY PART NUMBER
VR108	4813979C11	MMQA20VT1
VR109	4813977M36	MMBZ5257BLT1G
VR110	4813977M36	MMBZ5257BLT1G
VR111	4813977M36	MMBZ5257BLT1G
VR112	4813977M36	MMBZ5257BLT1G
VR113	4813977M36	MMBZ5257BLT1G

### Data Expansion Head Enhanced/ Connector Board (PCB: 8464300B06\_A)

Reference	Motorola PN	Value
J0101	2864287B01	CONN 10 MODULAR JACK
J0102	0909760D04	D SUB JACK RT ANGLE PC MT
J0103	0909760D02	D SUB JACK RT ANGLE PC MT
J0104	0915064H03	CONNECTOR, ZIF (40 PINS)

### Remote Head Enhanced (PCB 8471016L02)

Reference	Motorola PN	Value
C201	2113945C18	CAP .012uF
C202	2113955E37	CAP 1.0 UF
C203	2113945C31	CAP 0.1uF
C204	2113945C31	CAP 0.1uF
C206	2313960C26	CAP 1.0 UF

Reference	Motorola PN	Value
C301	2113955E37	CAP 1.0 UF
C302	NOT PLACED	GCAM DUMMY PART NUMBER
C303	NOT PLACED	GCAM DUMMY PART NUMBER
C304	2113945L17	CAP 470pF
C305	2113945L17	CAP 470pF
C306	2113945L17	CAP 470pF
C307	2113945L17	CAP 470pF
C308	2113945L17	CAP 470pF
C309	2113945L17	CAP 470pF
C310	2113944C43	CAP 82pF
C311	2113944C43	CAP 82pF
C313	2113955E37	CAP 1.0 UF
C314	NOT PLACED	GCAM DUMMY PART NUMBER
F300	6503566D15	FUSE,THIN FILM,2A,32V,
J301	0916162H02	CONNECTOR,FEMALE,12C ONT,12
J302	2864287B01	CONN_P
Q101	4813973A42	XSTR,BIP GP SS,NPN,SM,SC-59,
R101	0613952E10	RES 12.4K
R102	NOT PLACED	GCAM DUMMY PART NUMBER
R201	0613952E88	RES 80.6K
R202	0613952E10	RES 12.4K
R203	0613952H85	CER CHIP RES 3300 OHM 5% 0603
R204	0613952H85	CER CHIP RES 3300 OHM 5% 0603
R205	0613952H25	CER CHIP RES 10.0 OHM 5% 0603
R301	0614033G66	RES 47.5K
R302	0614033G66	RES 47.5K
R303	0613952G67	RES 0
R304	0613952G67	RES 0
R306	0614033G66	RES 47.5K
R307	0614033G66	RES 47.5K
R308	NOT PLACED	GCAM DUMMY PART NUMBER
R309	NOT PLACED	GCAM DUMMY PART NUMBER
R310	0614033G66	RES 47.5K
R311	0614033G66	RES 47.5K
R312	0614033G66	RES 47.5K
R313	0614033G66	RES 47.5K
R314	0614033E58	RES 392
R315	0614033E58	RES 392

Reference	Motorola PN	Value
R316	0614033G66	RES 47.5K
R317	0614033G66	RES 47.5K
R318	0613952G67	RES 0
R321	0613952E10	RES 12.4K
R322	0613952H92	RES 6.2K
R323	0613952H85	CER CHIP RES 3300 OHM 5% 0603
R324	0613952H89	CER CHIP RES 4700 OHM 5% 0603
R325	0613952E10	RES 12.4K
R326	0613952E10	RES 12.4K
U201	5114014A22	LP2951CD
U202	5114016A18	MC3403
VR301	4813977M36	MMBZ5257BLT1G
VR302	4813977M36	MMBZ5257BLT1G
VR303	4813979C11	MMQA20VT1
VR304	4813979P10	MMQA5V6T1

### Remote Back Head Enhanced (PCB 84966583A01)

Reference	Motorola PN	Value
C101	2113945A05	CAP 470PF
C102	2113945A05	CAP 470PF
C103	2113945A05	CAP 470PF
C104	2113945A05	CAP 470PF
C105	2113944A31	CAP 33.0PF
C106	2113945A05	CAP 470PF
C107	2113945A05	CAP 470PF
C108	2113944A31	CAP 33.0PF
C201	2113946S35	CAP 1.0UF
C202	2113946B04	CAP0.10UF
C203	2113946B04	CAP0.10UF
C204	2113946S35	CAP 1.0UF
C205	2113946A01	CAP0.015UF
C206	2113946S35	CAP 1.0UF
C207	2113956C37	CAP, 10uF
C208	2113946B04	CAP0.10UF
C209	2113956C37	CAP, 10uF
C210	2113956C37	CAP, 10uF
C211	NOT PLACED	GCAM DUMMY PART NUMBER
C212	2113956C37	CAP, 10uF
C213	2113956C37	CAP, 10uF
C214	NOT PLACED	GCAM DUMMY PART NUMBER
C215	NOT PLACED	GCAM DUMMY PART NUMBER

Reference	Motorola PN	Value
C216	2113956C37	CAP, 10uF
C217	2313960G32	CAP,FXD,10UF,+10%,-10%,35VDC,
C301	2113946B04	CAP0.10UF
C302	2113945G91	CAP,1UF
C303	2113945G91	CAP,1UF
C304	2113946B04	CAP0.10UF
C305	2113946B04	CAP0.10UF
C306	2113946B04	CAP0.10UF
C307	2113945G91	CAP,1UF
C308	2113945G91	CAP,1UF
C309	NOT PLACED	GCAM DUMMY PART NUMBER
C310	NOT PLACED	GCAM DUMMY PART NUMBER
C311	2113956C37	CAP, 10uF
C312	2113946B04	CAP0.10UF
C313	2113946B04	CAP0.10UF
C314	2113956C37	CAP, 10uF
C315	2113946B04	CAP0.10UF
C316	2113945A05	CAP 470PF
C317	2113946B04	CAP0.10UF
C401	2113945A05	CAP 470PF
C402	2113945A05	CAP 470PF
C403	2113944A31	CAP 33.0PF
C404	2113944A31	CAP 33.0PF
C405	2113945A05	CAP 470PF
C406	2113945A05	CAP 470PF
C407	2113944A31	CAP 33.0PF
C408	2113944A31	CAP 33.0PF
C409	2113944A31	CAP 33.0PF
C410	2113944A31	CAP 33.0PF
C411	2113944A31	CAP 33.0PF
C412	2113944A31	CAP 33.0PF
C413	2113944A31	CAP 33.0PF
C414	2113945A05	CAP 470PF
C415	2113944A31	CAP 33.0PF
C416	2113945A05	CAP 470PF
C417	2113945A05	CAP 470PF
C418	2113945A05	CAP 470PF
C419	2113945A05	CAP 470PF
C420	2113945A05	CAP 470PF
C421	2113944A31	CAP 33.0PF
C422	2113944A31	CAP 33.0PF
C423	2113945A05	CAP 470PF
C424	2113945A05	CAP 470PF
C425	2113944A31	CAP 33.0PF

Reference	Motorola PN	Value
C426	2113944A31	CAP 33.0PF
C427	2113945A05	CAP 470PF
C428	2113945A05	CAP 470PF
C429	2113945A05	CAP 470PF
C430	2113945A05	CAP 470PF
C431	2113944A31	CAP 33.0PF
C432	2113944A31	CAP 33.0PF
C433	2113944A31	CAP 33.0PF
C434	2113945A05	CAP 470PF
C435	2113944A31	CAP 33.0PF
C436	2113945A05	CAP 470PF
C437	2113945A05	CAP 470PF
C438	2113945A05	CAP 470PF
C439	2113945A05	CAP 470PF
C440	2113944A31	CAP 33.0PF
C441	2113944A31	CAP 33.0PF
C442	2113944A31	CAP 33.0PF
C443	2113944A31	CAP 33.0PF
C444	2113944A31	CAP 33.0PF
C445	2113944A31	CAP 33.0PF
C446	2113944A31	CAP 33.0PF
C447	2113944A31	CAP 33.0PF
C448	NOT PLACED	GCAM DUMMY PART NUMBER
C449	NOT PLACED	GCAM DUMMY PART NUMBER
C450	2113945A05	CAP 470PF
C451	2113944A31	CAP 33.0PF
C452	2113945A05	CAP 470PF
C453	2113956C37	CAP, 10uF
C454	2113946B04	CAP0.10UF
C455	2113946B04	CAP0.10UF
C501	2113946B04	CAP0.10UF
C502	2113945G91	CAP,1UF
C503	2113946B04	CAP0.10UF
C504	2113946B04	CAP0.10UF
C505	2113946B04	CAP0.10UF
C506	2113946B04	CAP0.10UF
D301	4866544A01	SR05
D401	4866544A01	SR05
D402	4813978C02	MMBD6100
J104	0971065L01	in CONN_J
J105	2871067L01	CONN_P
P101	2864287B01	CONN_P
P201	NOT PLACED	GCAM DUMMY PART NUMBER
Q201	4813973A81	MUN5311DW1T1

Reference	Motorola PN	Value
Q301	4805921T28	FMG8A
Q302	4815272H01	EMD9FT2R
Q305	4805921T28	FMG8A
Q306	5166540A01	FDC6330L
Q307	5166540A01	FDC6330L
Q308	4805921T28	FMG8A
Q401	4813973A81	MUN5311DW1T1
Q501	4813973A81	MUN5311DW1T1
Q502	4816147H01	BCV49
Q503	4813973A81	MUN5311DW1T1
R102	0613952R01	RES 10K
R103	0613952Q89	RES 4.7K
R201	0614033G66	RES,47.5K
R202	NOT PLACED	GCAM DUMMY PART NUMBER
R203	NOT PLACED	GCAM DUMMY PART NUMBER
R204	0614033G66	RES,47.5K
R205	0614033G66	RES,47.5K
R206	0614033G66	RES,47.5K
R207	0614033G66	RES,47.5K
R208	0614033G66	RES,47.5K
R209	0614033G66	RES,47.5K
R210	0614033G66	RES,47.5K
R211	0614033G66	RES,47.5K
R212	0614033G66	RES,47.5K
R213	0613952R01	RES 10K
R214	0613952Q49	RES 100
R215	0614033E58	RES, 392
R216	0613952Q67	RES 560
R217	0613952R01	RES 10K
R218	0614033E58	RES, 392
R220	0613952R01	RES 10K
R221	NOT PLACED	GCAM DUMMY PART NUMBER
R222	0613952R05	RES 15K
R223	0613952R05	RES 15K
R225	0613952N62	RES 43.2K
R226	0613952R05	RES 15K
R227	0613952M81	RES 6,81K
R228	0613952Q89	RES 4.7K
R231	0613952Q89	RES 4.7K
R232	0613952R01	RES 10K
R233	0613952R01	RES 10K
R234	0613952Q49	RES 100
R235	0613952R01	RES 10K
R236	0613952Q49	RES 100

Reference	Motorola PN	Value
R237	0613952Q49	RES 100
R238	0613952Q67	RES 560
R239	0613952Q67	RES 560
R240	0613952R25	RES 100K
R241	0613952R25	RES 100K
R242	0613952R25	RES 100K
R243	0613952Q49	RES 100
R301	0613952Q89	RES 4.7K
R302	0613952Q73	RES 1K
R303	0613952Q89	RES 4.7K
R304	0613952Q73	
R305	0613952Q77	RES 1.5K
R306	0613952Q37	RES 33.0
R311	0613952Q37	RES 33.0
R312	0613952R05	RES 15K
R313	0613952R05	RES 15K
R315	0613952R01	RES 10K
R316	0613952R01	RES 10K
R317	0613952R05	RES 15K
R318	0613952R01	RES 10K
R319	0613952R01	RES 10K
R320	0613952R01	RES 10K
R321	0613952R01	RES 10K
R322	0613952R05	RES 15K
R323	0613952R25	RES 100K
R324	0613952R25	RES 100K
R423	NOT PLACED	GCAM DUMMY PART NUMBER
R424	NOT PLACED	GCAM DUMMY PART NUMBER
R425	NOT PLACED	GCAM DUMMY PART NUMBER
R426	0613952Q41	RES 47.0
R427	0613952R01	RES 10K
R428	0613952Q89	RES 4.7K
R429	0613952Q89	RES 4.7K
R430	0613952R25	RES 100K
R431	0613952R25	RES 100K
R501	0613952R05	RES 15K
R502	0613952Q59	RES 270
R503	0613952R05	RES 15K
R504	0613952Q59	RES 270
R505	0613952R05	RES 15K
R506	0613952Q59	RES 270
R507	0613952R05	RES 15K
R508	0613952R25	RES 100K
R510	0613952Q89	RES 4.7K

Reference	Motorola PN	Value
R511	0613952Q89	RES 4.7K
R512	0613952Q89	RES 4.7K
R513	0613952Q89	RES 4.7K
R514	0613952Q59	RES 270
R515	0613952Q59	RES 270
R516	0613952Q59	RES 270
R518	0613952R05	RES 15K
R519	0613952R01	RES 10K
R520	0613952R05	RES 15K
R521	NOT PLACED	GCAM DUMMY PART NUMBER
R522	NOT PLACED	GCAM DUMMY PART NUMBER
R523	NOT PLACED	GCAM DUMMY PART NUMBER
R530	NOT PLACED	GCAM DUMMY PART NUMBER
R531	NOT PLACED	GCAM DUMMY PART NUMBER
R532	NOT PLACED	GCAM DUMMY PART NUMBER
R533	NOT PLACED	GCAM DUMMY PART NUMBER
R534	NOT PLACED	GCAM DUMMY PART NUMBER
R535	0613952R05	RES 15K
R536	0613952R05	RES 15K
R537	0613952R05	RES 15K
R538	0613952R05	RES 15K
R539	0613952R05	RES 15K
R540	0613952N51	RES 33.2K
R541	0613952N51	RES 33.2K
R542	0613952N51	RES 33.2K
R547	0613952N51	RES 33.2K
R548	0613952N51	RES 33.2K
R549	0613952N51	RES 33.2K
R550	0613952N51	RES 33.2K
R551	0613952N51	RES 33.2K
R552	0613952R05	RES 15K
R554	0613952R05	RES 15K
R555	0613952R05	RES 15K
R556	0613952R05	RES 15K
R557	0613952R05	RES 15K
U201	5114016A18	MC3403
U203	5175771A10	MAX4544EUT
U204	5175771A10	MAX4544EUT
U205	5114014A22	LP2951CD
U301	5114007A47	NC7SZ32

Reference	Motorola PN	Value
U302	5187970L07	ISP1105
U303	5188462T01	MAX3232E
U304	5186311J07	NC7SZ175P6X
U401	5186311J07	NC7SZ175P6X
U501	5166555A01	PCA9535BS
U502	5166555A01	PCA9535BS
U503	5114006A03	LM2901
U507	NOT PLACED	GCAM DUMMY PART NUMBER
VR101	4813977M36	MMBZ5257BLT1G
VR102	NOT PLACED	GCAM DUMMY PART NUMBER
VR103	4813979C11	MMQA20VT1
VR104	4813979C11	MMQA20VT1
VR201	NOT PLACED	GCAM DUMMY PART NUMBER
VR401	4813979C11	MMQA20VT1
VR402	4813979C11	MMQA20VT1
VR403	4813979P10	MMQA5V6T1
VR405	4813979P10	MMQA5V6T1
VR406	4813979C11	MMQA20VT1

Reference	Motorola PN	Value
D25	4885102C20	LED, CHIP, BICLR, RED/GRN NOPB
J01	0916875H01	CONN, NON-ZIF, 24 CKT, BOTTOM CKT
R04	0613952H59	RES, 270
R05	0613952H69	RES, 680
R06	0613952H69	RES, 680
R07	0613952H59	RES, 270
R08	0613952H69	RES, 680
R09	0613952H69	RES, 680
R10	0613952H59	RES, 270
R11	0613952H59	RES, 270
R12	0613952H69	RES, 680
R13	0613952H69	RES, 680
R14	0613952H59	RES, 270
R15	0613952H69	RES, 680
R16	0613952H69	RES, 680
R17	0613952H59	RES, 270
R18	0613952H59	RES, 270
R19	0613952H63	RES, 390
R20	0613952H63	RES, 390
R21	0613952H69	RES, 680
R22	0613952H69	RES, 680

### Keypad (PCB 8466581A01)

Reference	Motorola PN	Value
D01	4888112M10	DIODE, WHITE LED
D02	4888112M10	DIODE, WHITE LED
D03	4888112M10	DIODE, WHITE LED
D04	4888112M10	DIODE, WHITE LED
D05	4888112M10	DIODE, WHITE LED
D06	4888112M10	DIODE, WHITE LED
D07	4888112M10	DIODE, WHITE LED
D08	4888112M10	DIODE, WHITE LED
D09	4888112M10	DIODE, WHITE LED
D10	4888112M10	DIODE, WHITE LED
D11	4888112M10	DIODE, WHITE LED
D12	4888112M10	DIODE, WHITE LED
D13	4888112M10	DIODE, WHITE LED
D14	4888112M10	DIODE, WHITE LED
D15	4888112M10	DIODE, WHITE LED
D16	4888112M10	DIODE, WHITE LED
D17	4888112M10	DIODE, WHITE LED
D18	4888112M10	DIODE, WHITE LED
D19	4888112M10	DIODE, WHITE LED

Note: For optimum performance, diodes, transistors and integrated circuits must be ordered by MOTOROLA part numbers.

## CHAPTER 9

# TROUBLESHOOTING

---

## Section Introduction

---

### General

Troubleshooting faults in the terminal require proper understanding of the different circuitry contained in the terminal. Since the terminal contains a highly integrated system, the software and hardware functions can not be separated easily. Thus, it is also necessary to understand the functioning of different ICs and the role of the software in the operation of the terminal. This service manual includes schematic diagrams, circuit board layouts, block diagrams, and troubleshooting procedures, which help a technician to troubleshoot a malfunctioning circuit and detect a defective component.

**NOTE:** The CPS has no capability to tune the terminal. Tuning the terminal can only be performed at the factory or at the appropriate Motorola Repair Centre. Components replacement can affect the terminal tuning and must only be performed by the appropriate Motorola Repair Centre.

The terminal is tuned and tested at the factory. The results of the tuning procedures are stored in a special area of the Flash PROM. This information includes tuning and other system parameters. The area of the memory in the terminal where the tuning information is stored is called the "codeplug". A terminal codeplug can be read using the CPS programme.

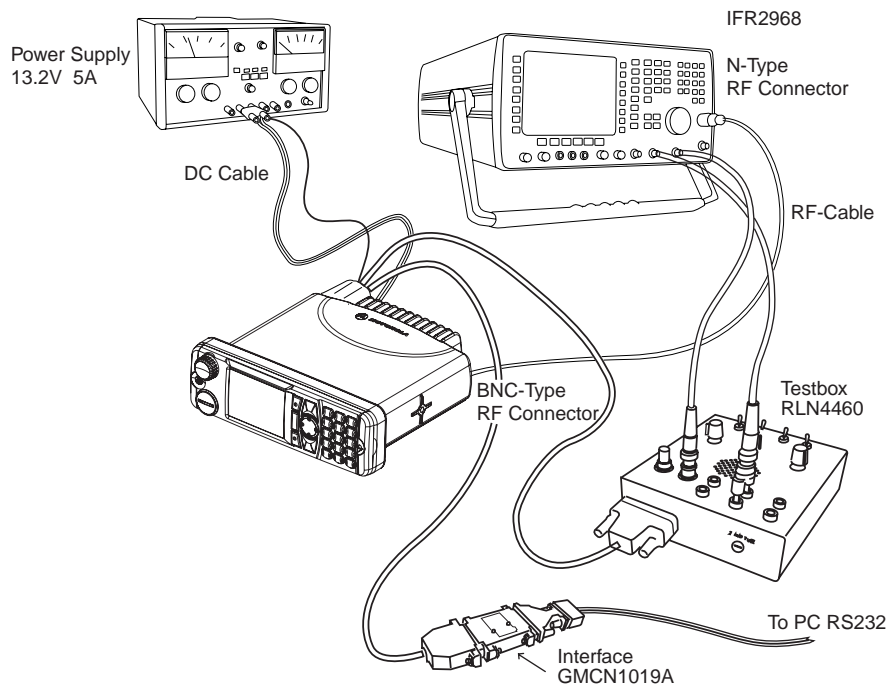
### Test Procedures

This section explains the procedures required to troubleshoot an MTM800 ENH terminal. Whenever possible the terminal should be tested and tuned using the automatic test system PATS before troubleshooting. The PATS result file can provide useful hints to determine the failing circuitry section. Alternatively, the Main Function Test Procedure can be performed to determine where to start troubleshooting. After disassembling the board from the chassis you should check the board visually for bad soldering or damaged components.

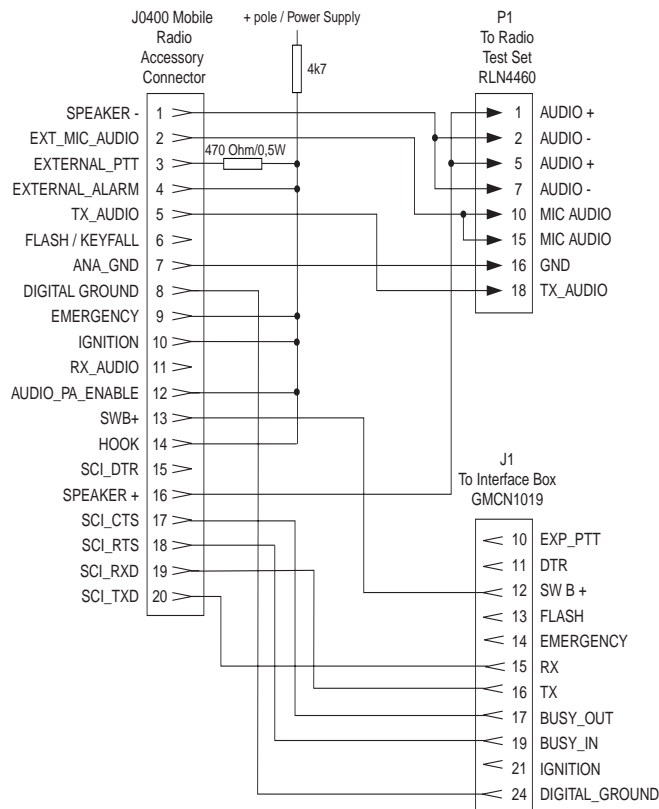
### Troubleshooting Setup

Some of the troubleshooting procedures require an audio signal input or measurement of the audio at the speaker output. The Test Set RLN4460 provides the correct microphone input and speaker output circuitry. Figure 1 shows the recommended setup for troubleshooting. Figure 2 shows the required connections between the terminal's accessory connector, the Test Set and the Interface Box. The Interface Box GMCN1019\_ connects the terminal to the RS232 interface of a PC and is required to control the terminal during troubleshooting.

If the terminal is connected to the power supply and the Interface Box the green LED at the Interface Box should light up only. If the red LED lights up as well toggle the switch at the Interface Box and restart the procedure.



**Figure 9-1** Troubleshooting Setup

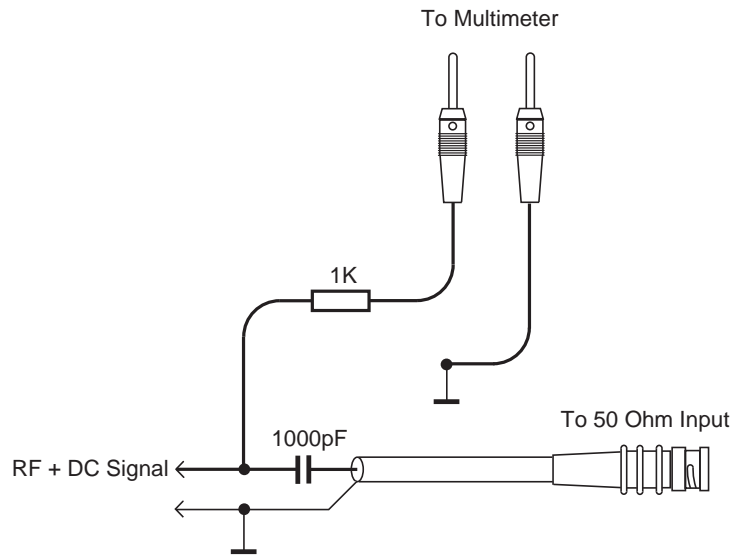


**Figure 9-2** Required Connections (Accessory Connector / Test Set / Interface Box)

**WARNING:** By proceeding the GPIO test (see following pages) the above connections must be set, otherwise the terminal can be damaged.



For RF levels, which should be measured with a 50 Ohm RF probe, you can use the following circuit.



**Figure 9-3** Example for 50 Ohm RF Probe

## Troubleshooting Flowcharts

Use the following flowcharts to troubleshoot the terminal.

**These flowcharts contain procedures which use the TETRA COM SW application to set the terminal into the appropriate test modes for troubleshooting terminals having digital, receiver, transmitter, or frequency generation failures.**

**The terminal performs most of the used TETRA COM commands only in test mode. If not in test mode, it ignores these commands.**

**To enter test mode you must enter the command "TEST\_ENTER" in TETRA COM.**

**After about 18 seconds the TETRA COM screen must show the message "Radio HW is READY" to indicate that the terminal has entered test mode.**

**Once in test mode, you don't have to use this command again until the test mode is terminated or the terminal performed a reset.**

## Notes



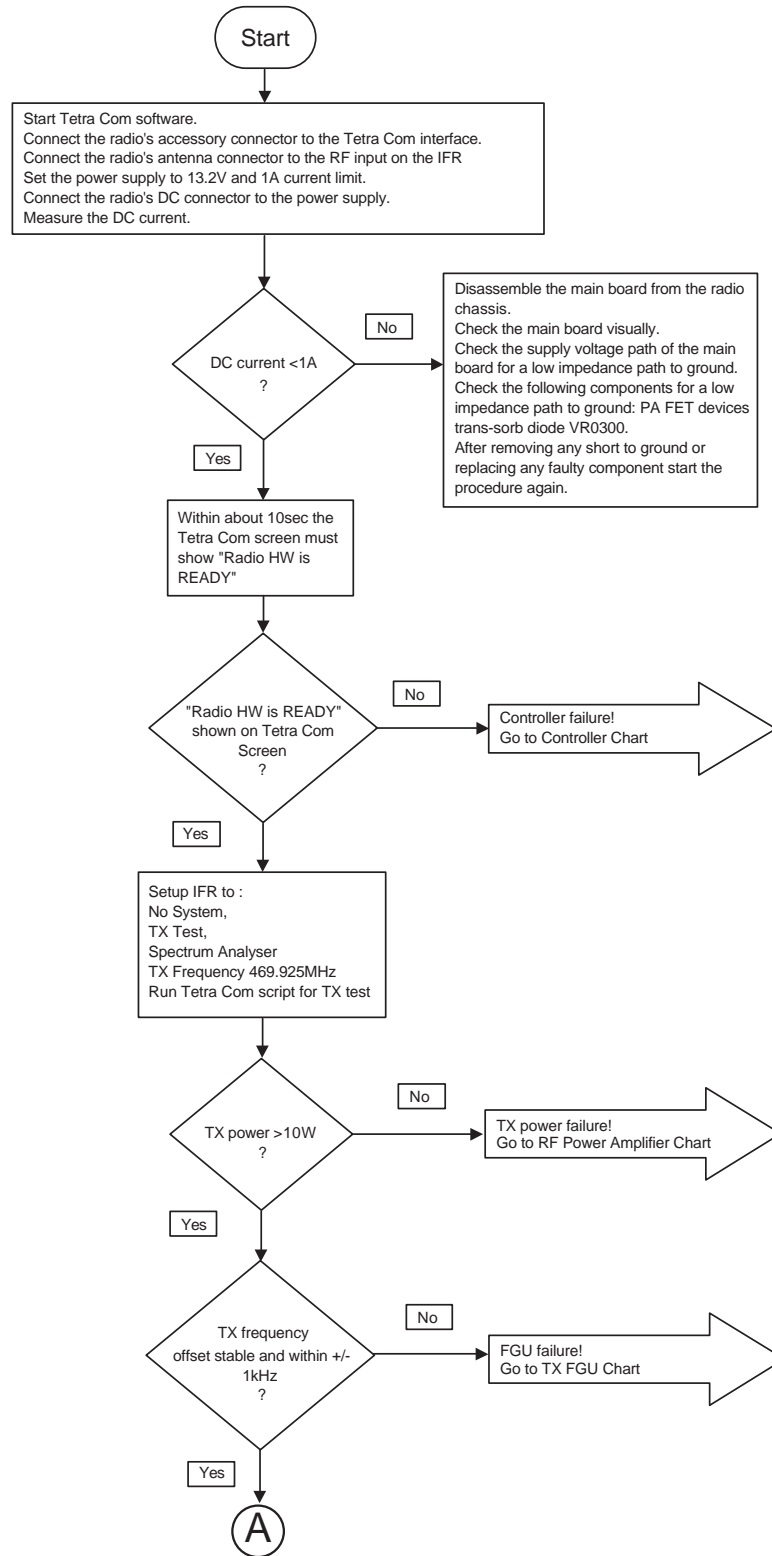
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# TROUBLESHOOTING CHARTS: 450-470MHz

### Main Function Test Chart (Sheet 1) >> Start-up Procedure <<

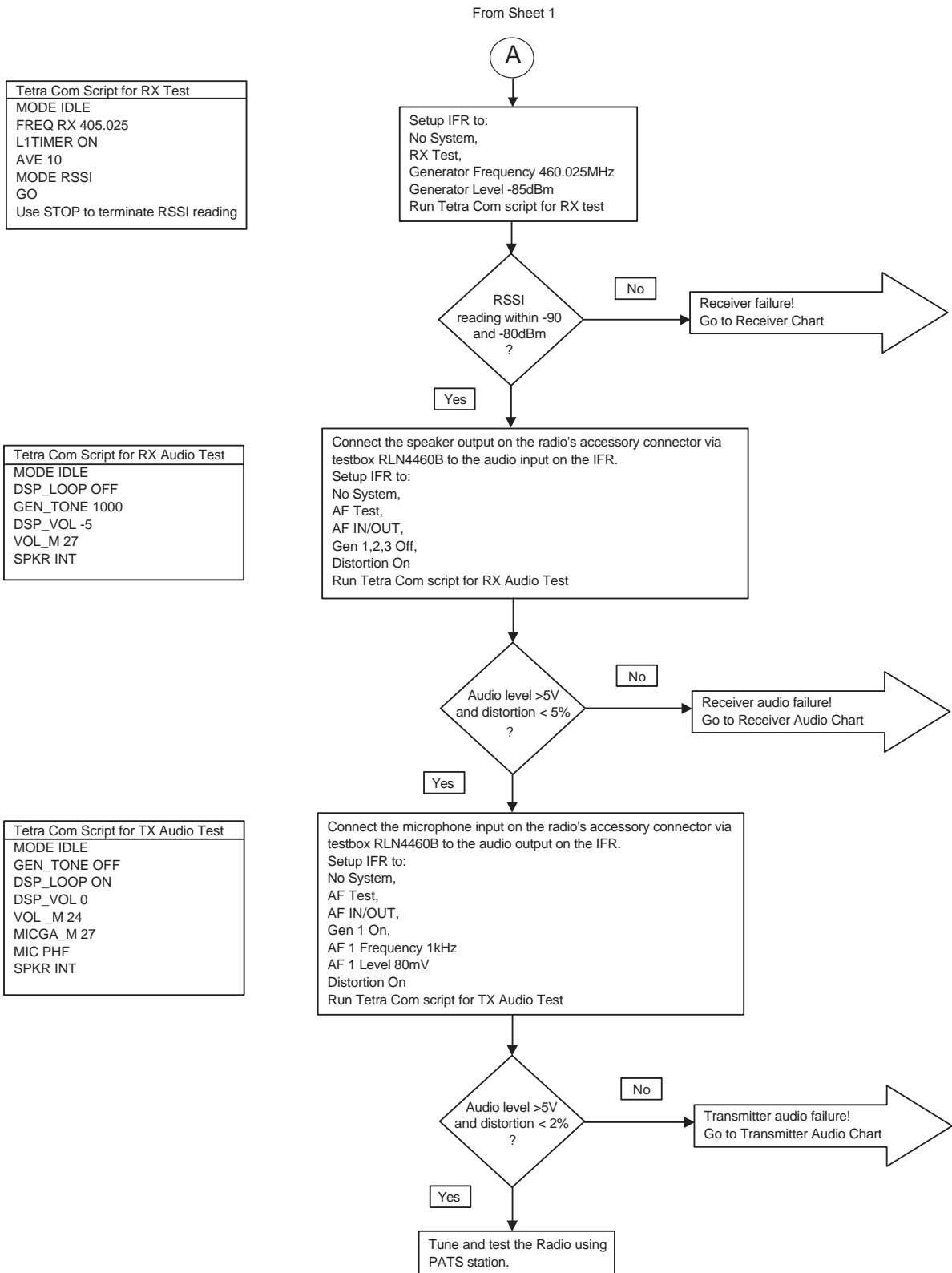
```

Tetra Com Script for TX Test
TEST_ENTER
DELAY 18
Check for "Radio HW is READY"
MODE_IDLE
PWR_TUNE_INTR_DIS
FREQ_TX 469.925
L1_TIMER_ON
TXPOW 6
TX_ATT 6
RFTON_FRQ_0
RFTON_CHN_IQ
RFTON_ATT_0.65
FEEDBACK_CLOSE
MODE_RFTONE
Use MODE_IDLE to terminate transmit mode
    
```

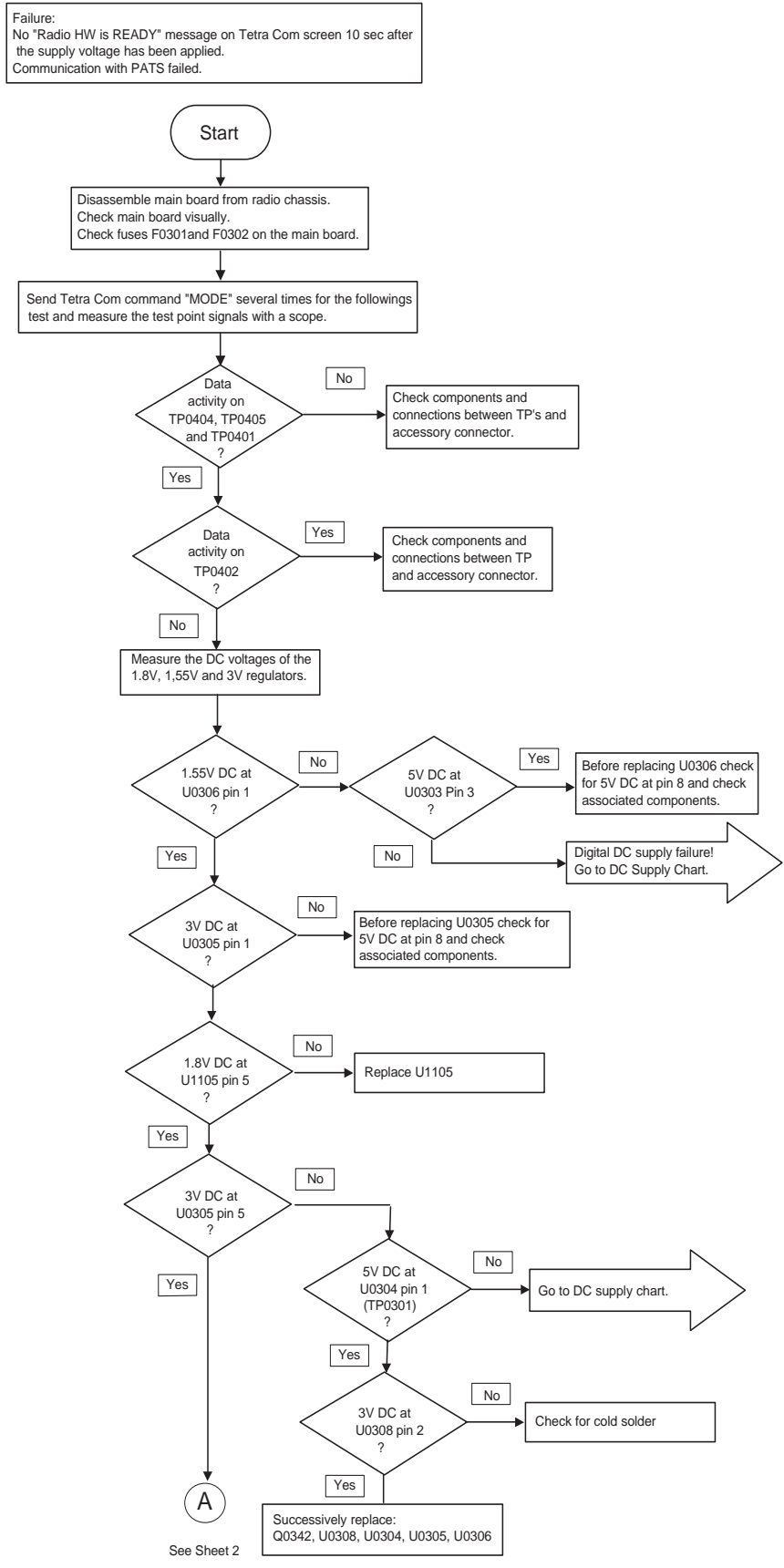


See Sheet 2

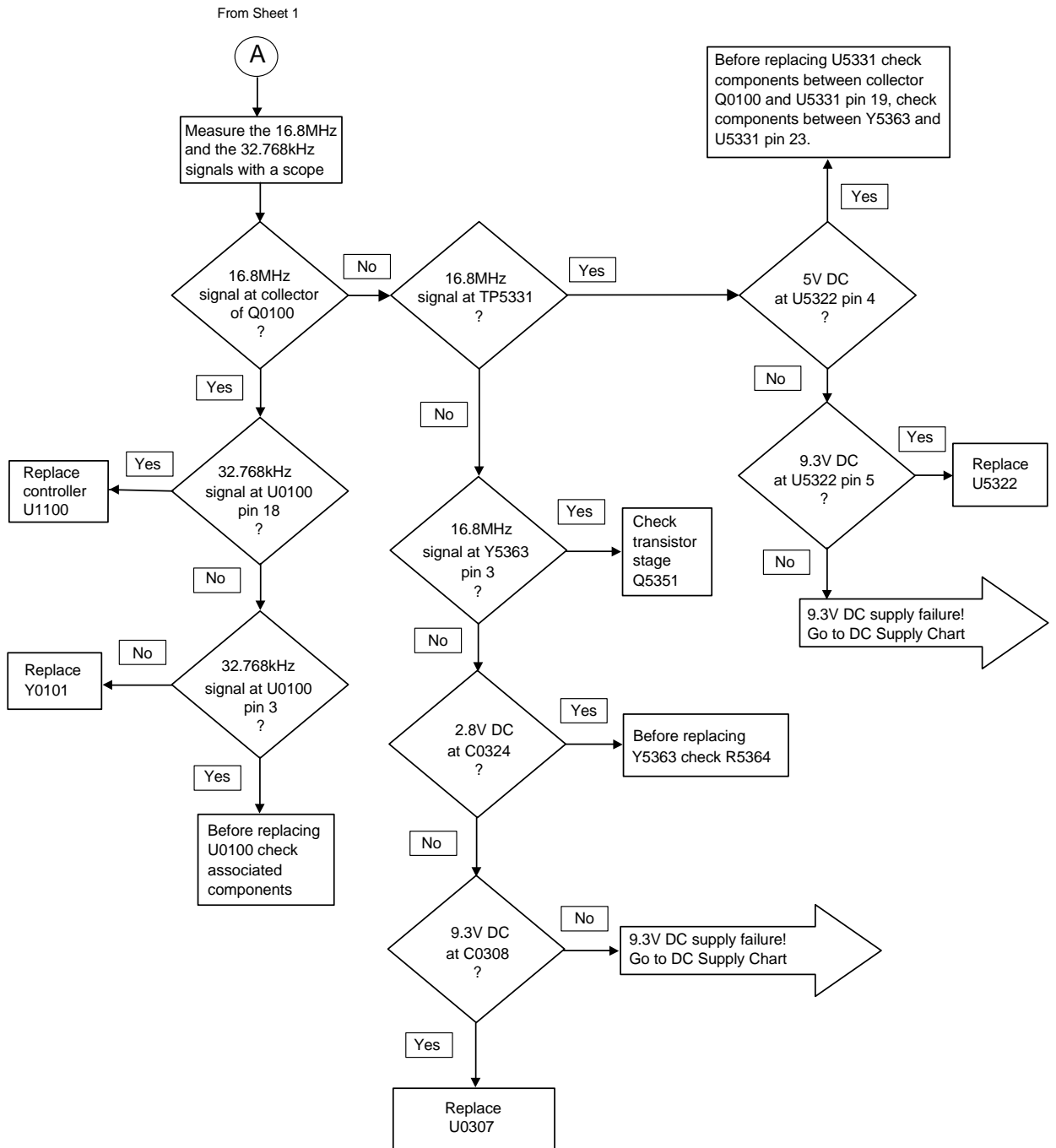
## Main Function Test Chart (Sheet 2)



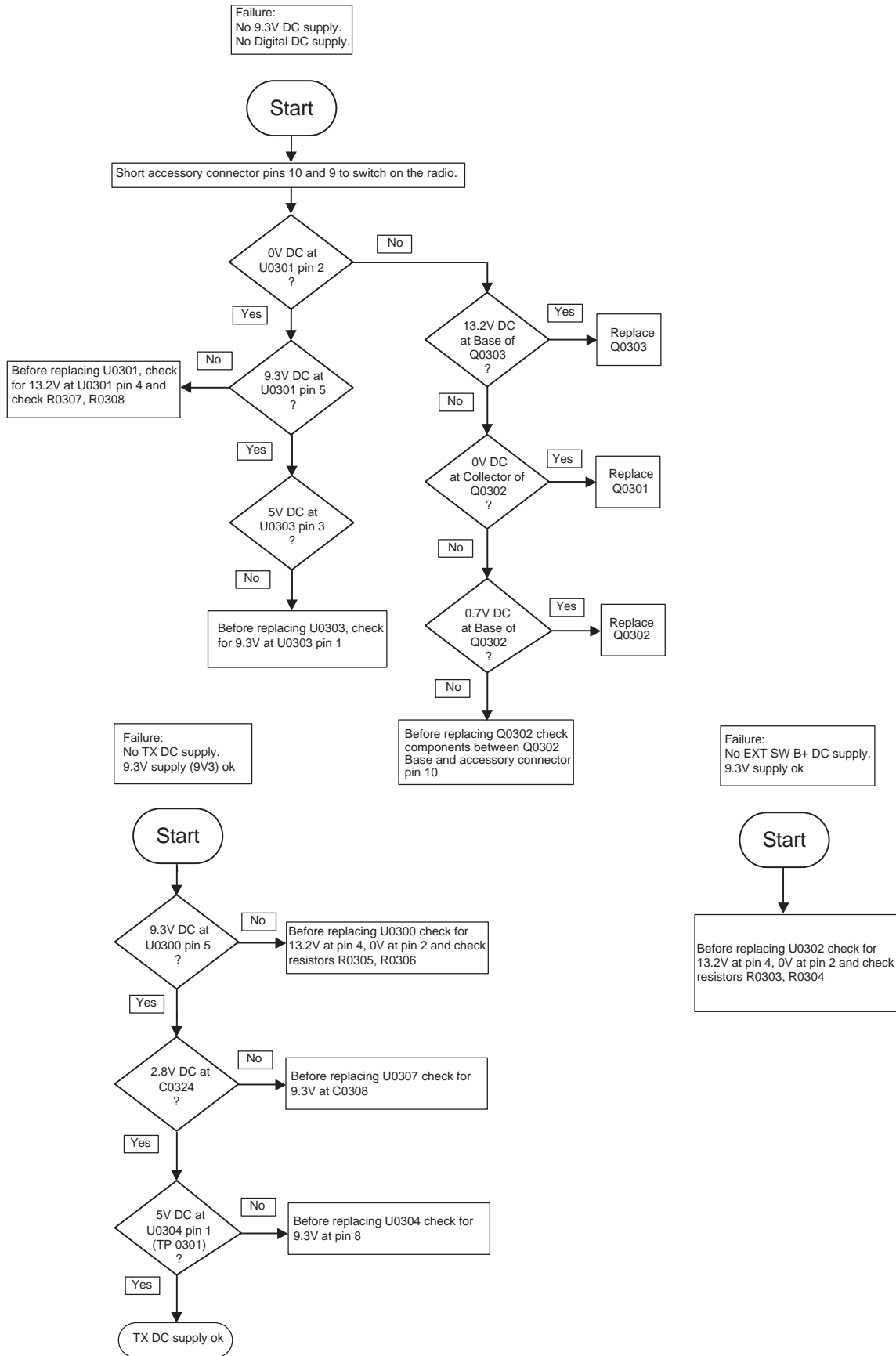
# Controller Troubleshooting (Sheet 1)



### Controller Troubleshooting (Sheet 2)



### DC Supply Troubleshooting

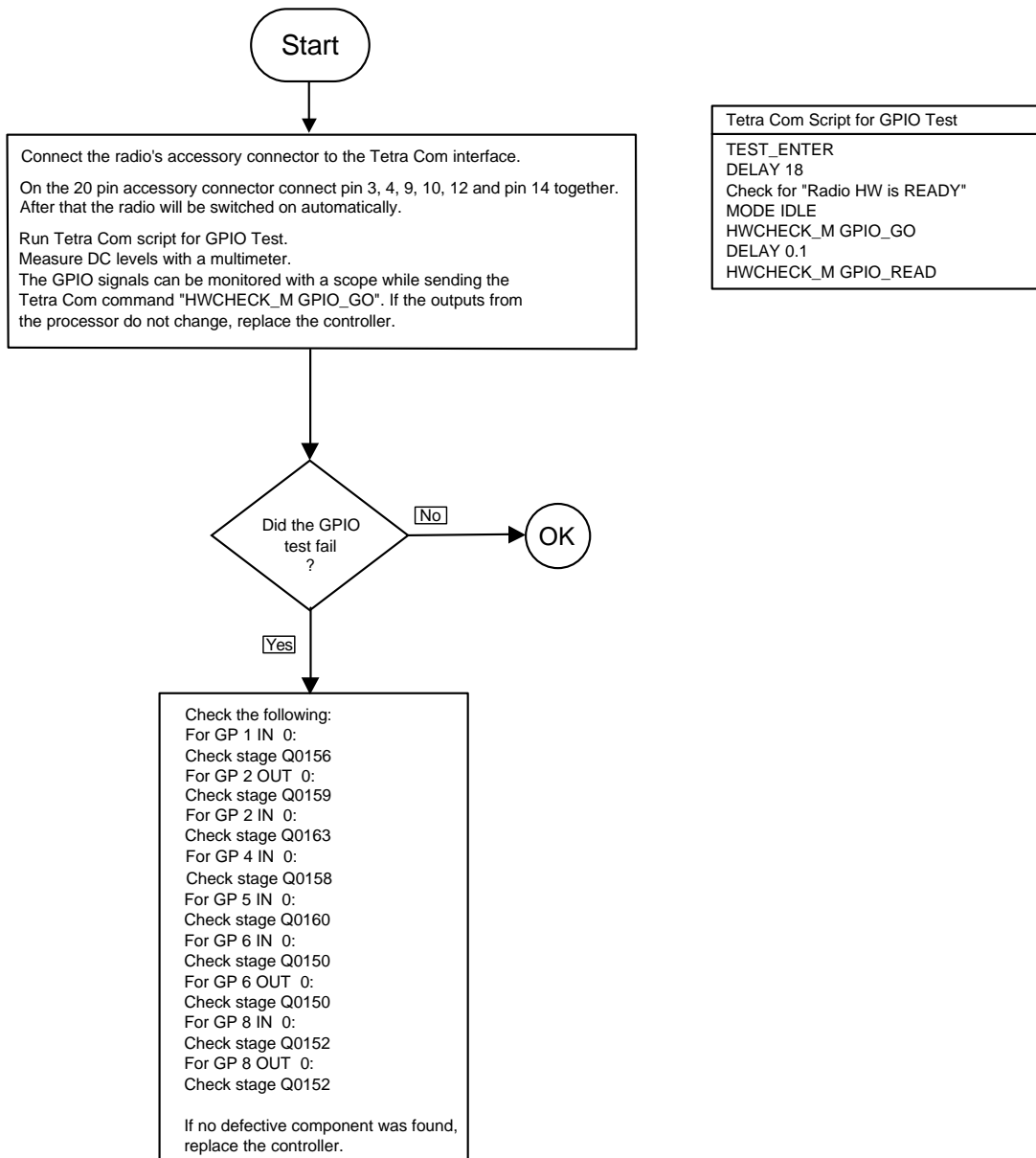


## GPIO Troubleshooting



**By proceeding the GPIO test, the connections as shown in the Troubleshooting Setup (see previous pages) must be set, otherwise the terminal can be damaged.**

Failure:  
PATS parameters HW\_CHECK\_GPIO failed



## Receiver Audio Troubleshooting

Failure:  
 No audio or low audio level at speaker output or handset audio output.  
 High distortion at speaker output or handset audio output.  
 PATS parameters AUD\_LBACK\_GAIN or AUD\_LBACK\_DIST failed.

Start

Connect the speaker output on the radio's accessory connector via testbox RLN4460B to the audio input on the IFR.  
 Setup IFR to:  
 No System,  
 AF Test,  
 AF IN/OUT,  
 Gen 1,2,3 Off,  
 Distortion On  
 Run Tetra Com script for RX audio test  
 Measure the 1kHz audio signal with a scope

Tetra Com Script for RX Audio Test  
 TEST\_ENTER  
 DELAY 18  
 Check for "Radio HW is READY"  
 MODE IDLE  
 DSP\_LOOP OFF  
 GEN\_TONE 1000  
 DSP\_VOL -5  
 VOL\_M 27  
 SPKR INT

1kHz signal at FL0200 pin 2 ?

No

Before replacing FL0200 check for activity on pin 7,8,11,13

Yes

If no 1kHz signal at accessory connector pin 11, check stage U0206-1

1kHz signal at U0201 pin 5 ?

No

Before replacing U0204 check resistors R0221, R0228 and 3V DC at pin 8

1kHz signal at U0201 pin 4 ?

No

0V DC at U0201 pin 9 ?

No

Check transistor Q0203

Yes

If no 1kHz signal at handset audio output, check stage U0206-2

Yes

> 8.5V DC at U0205 pin 8 ?

No

Check collector of transistor Q0200 and connected resistors. Before replacing check mute to low.

Yes

9.3V DC at U0201 pin 16 ?

No

9.3V DC supply failure! Go to DC Supply Chart

If no 1kHz signal at speaker output, check R0244, R0245, C0227, 13.2V at pin 7 before replacing U0205.

Yes

Replace U0201





# Transmitter Audio Troubleshooting

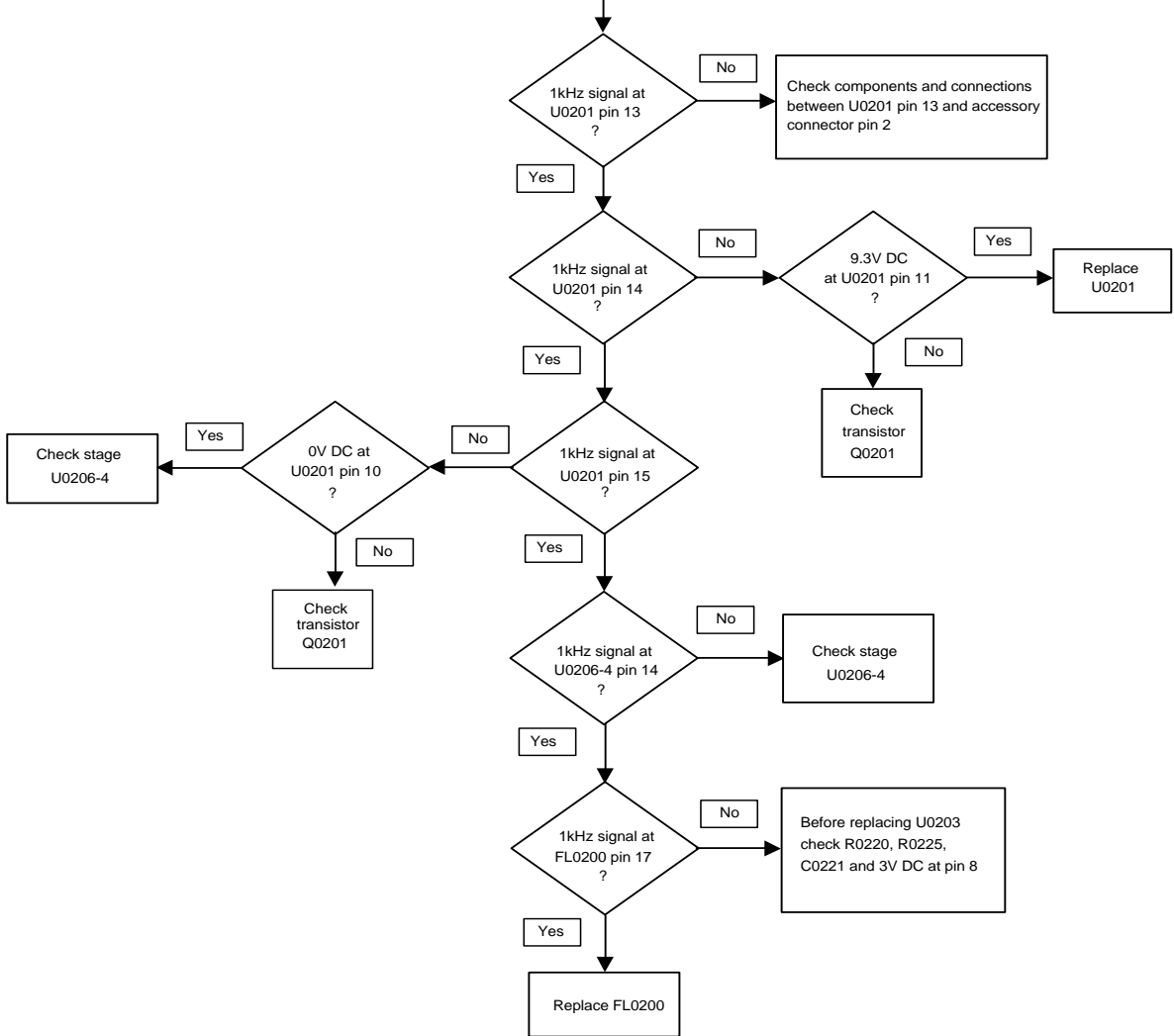
Failure:  
 No audio, low audio level or distortion > 2% at speaker output during transmitter audio test.  
 PATS parameters AUD\_LBACK\_GAIN or AUD\_LBACK\_DIST failed

Start

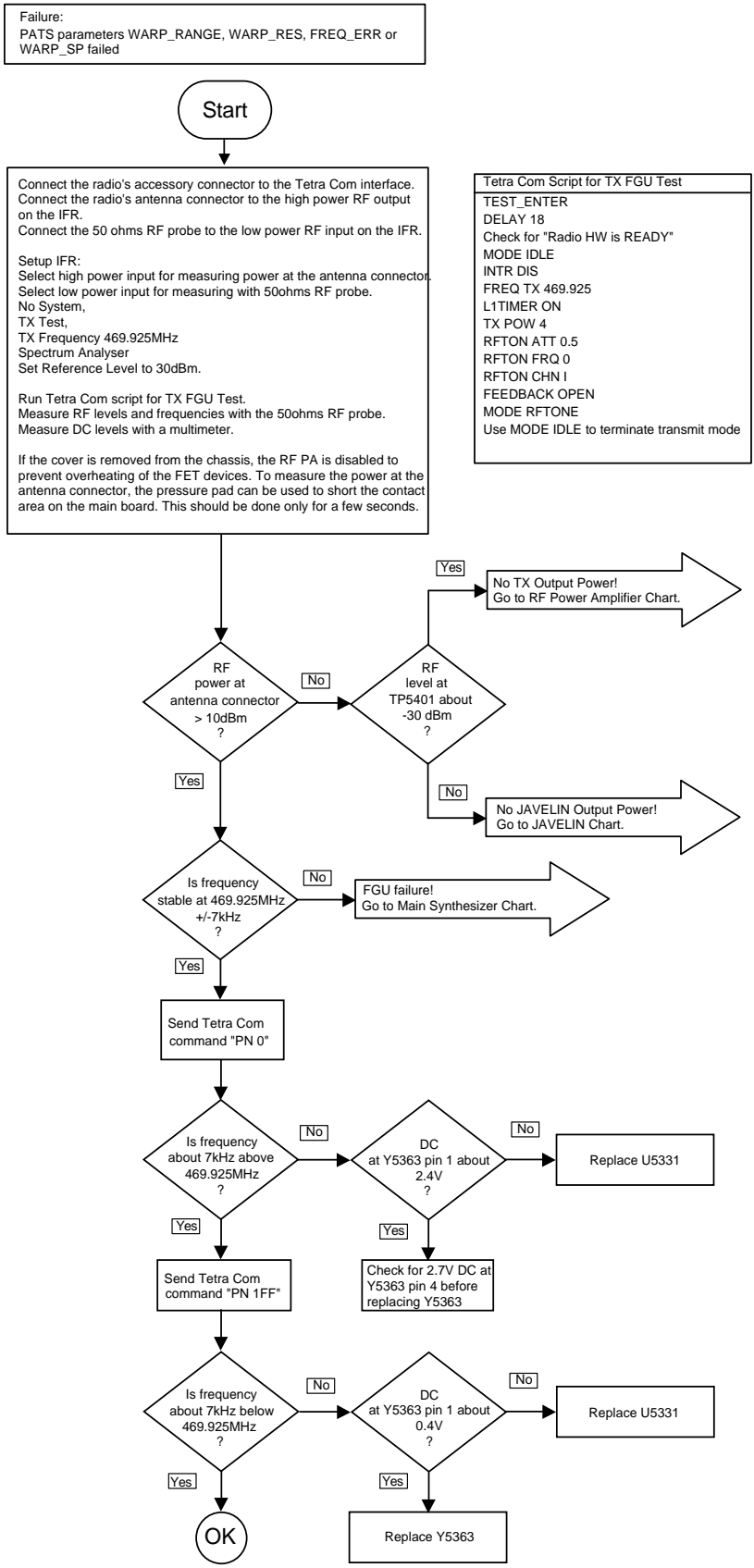
```

Tetra Com Script for TX Audio Test
TEST_ENTER
DELAY 18
Check for "Radio HW is READY"
MODE IDLE
GEN_TONE OFF
DSP_LOOP ON
DSP_VOL 0
VOL_M 24
MICGA_M 27
MIC PHF
SPKR INT
    
```

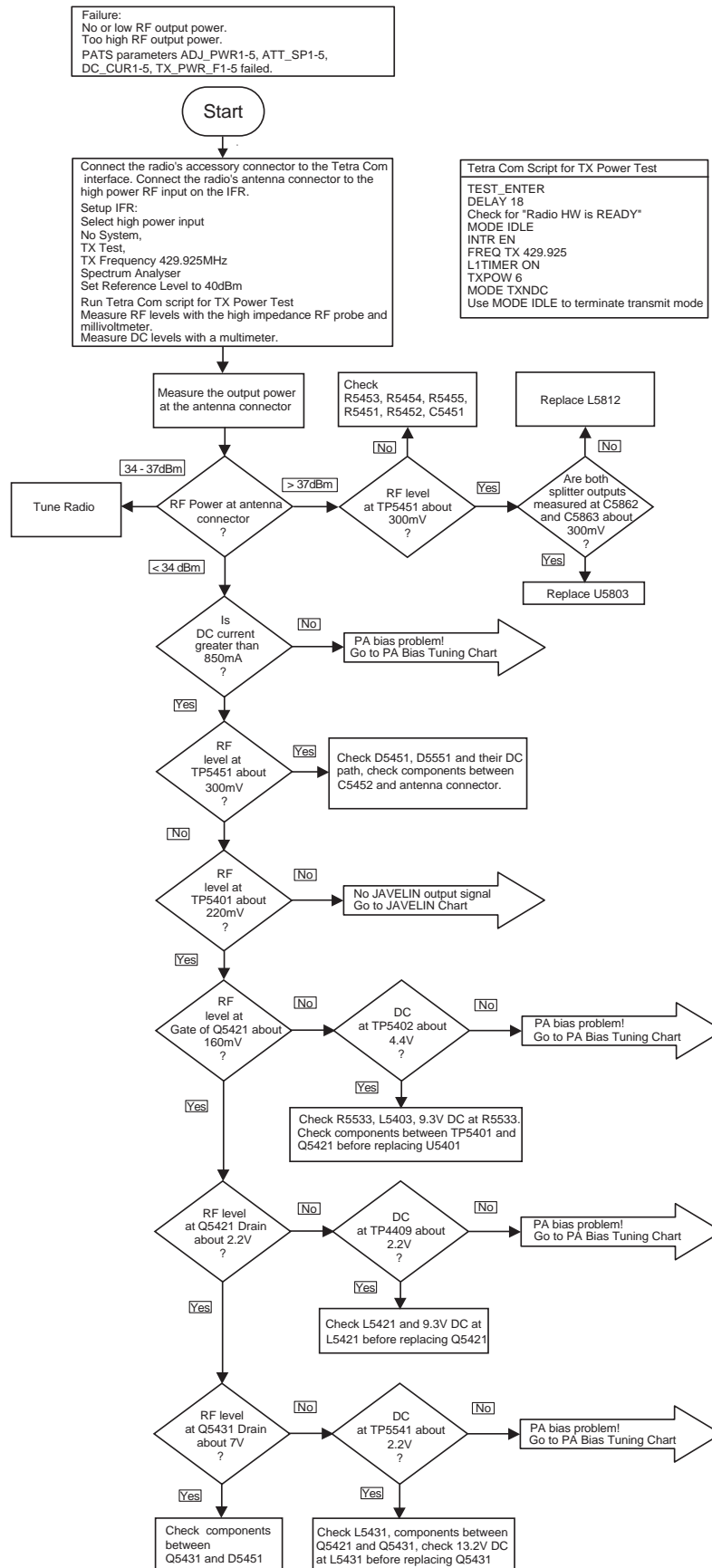
If receiver audio has not been checked, go to Receiver Audio Chart first.  
 Connect the speaker output on the radio's accessory connector via testbox RLN4460B to the audio input on the IFR.  
 Connect the microphone input on the radio's accessory connector via testbox RLN4460B to the audio output on the IFR.  
 Setup IFR to:  
 No System,  
 AF Test,  
 AF IN/OUT,  
 Gen 1 On,  
 AF 1 Frequency 1kHz  
 AF 1 Level 80mV  
 Distortion On  
 Run Tetra Com script for TX audio test  
 Measure the 1kHz audio signal with a scope



# Warping Failure Troubleshooting

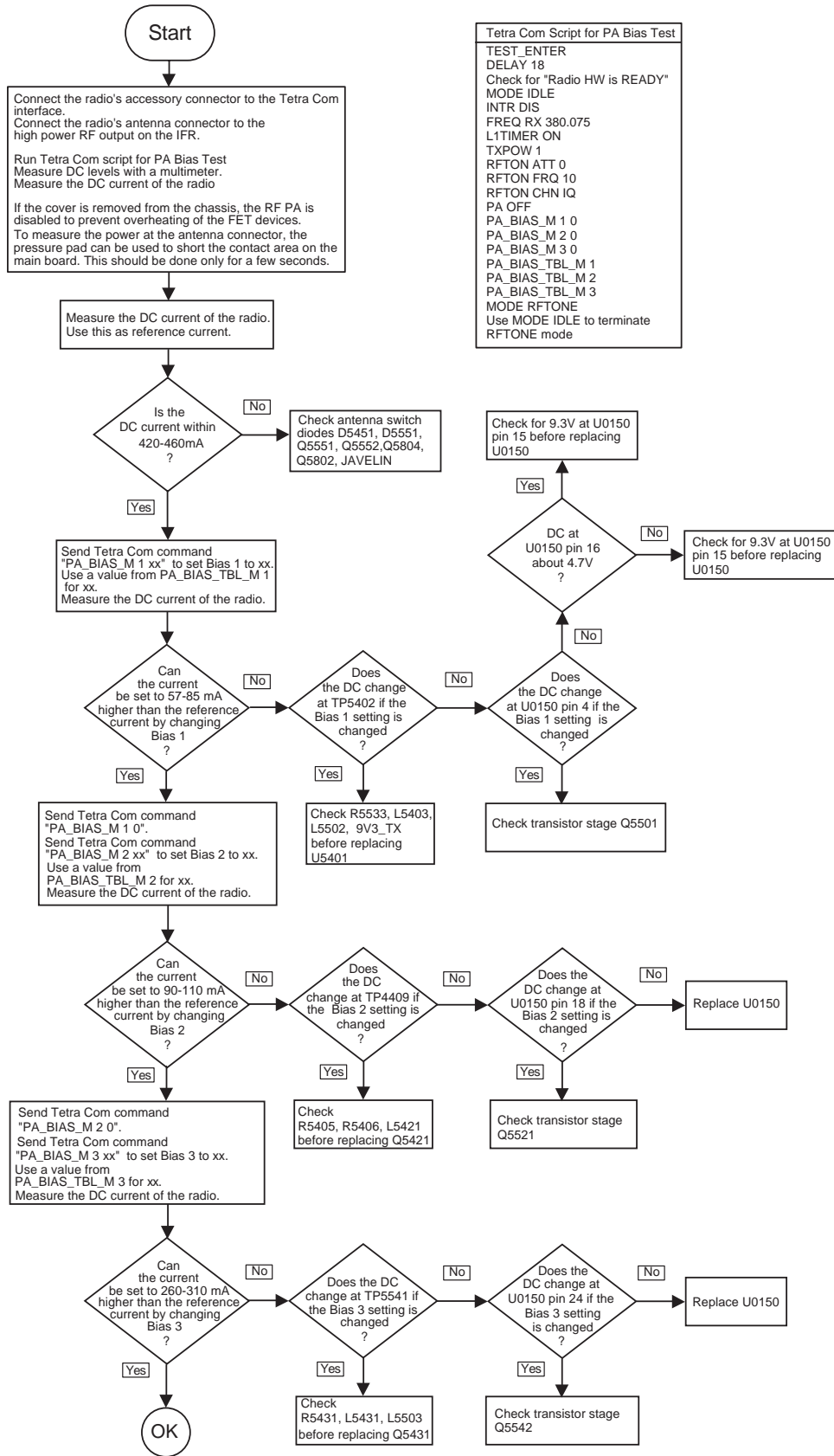


# RF Power Amplifier Troubleshooting



# PA Bias Failure Troubleshooting

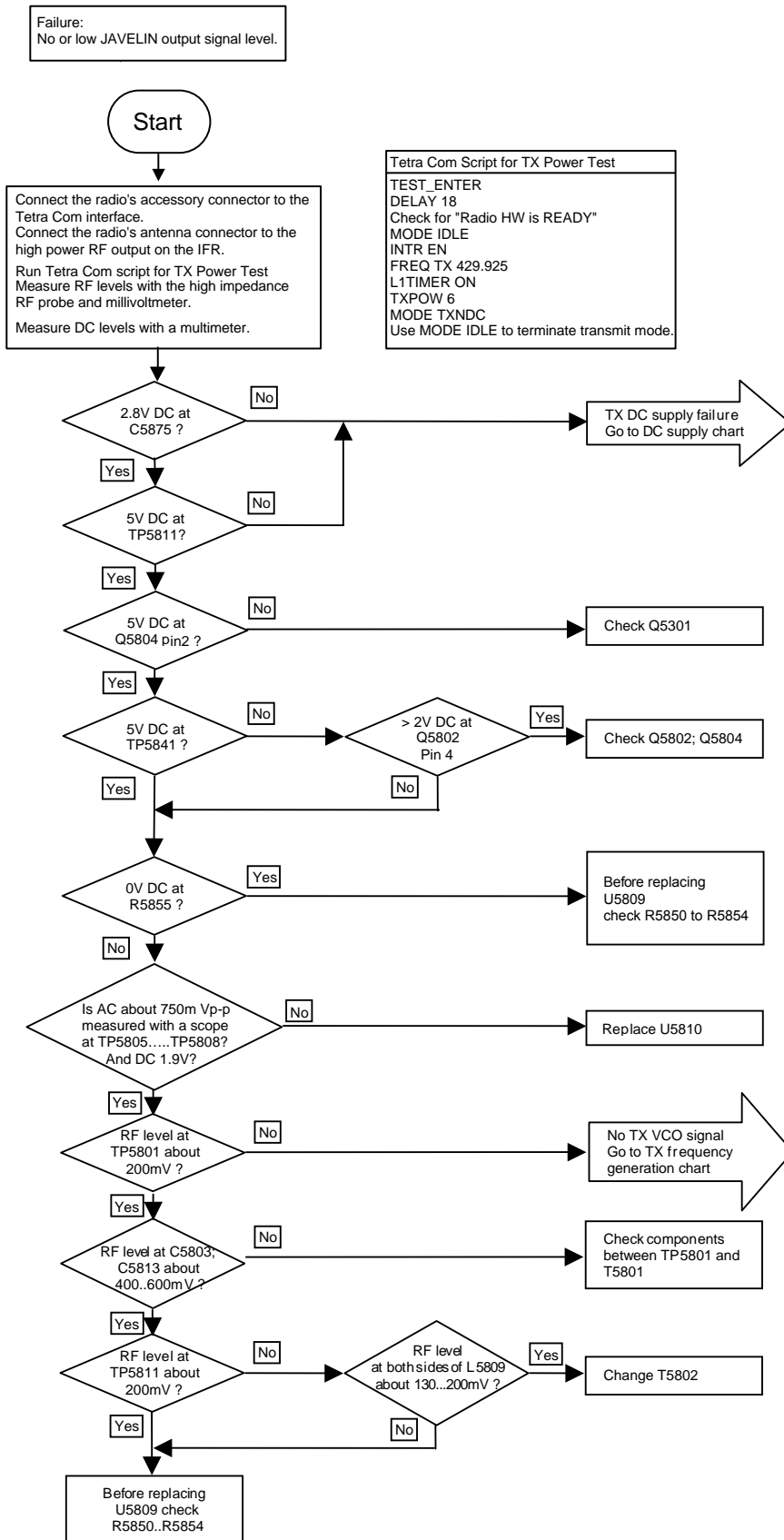
Failure:  
PATS parameters PA\_BIAS, BIAS1-3\_CUR, BIAS\_1-3\_SP failed



```

Tetra Com Script for PA Bias Test
TEST_ENTER
DELAY 18
Check for "Radio HW is READY"
MODE_IDLE
INTR_DIS
FREQ_RX 380.075
L1TIMER_ON
TXPOW 1
RFTON_ATT 0
RFTON_FRQ 10
RFTON_CHN IQ
PA_OFF
PA_BIAS_M 1 0
PA_BIAS_M 2 0
PA_BIAS_M 3 0
PA_BIAS_TBL_M 1
PA_BIAS_TBL_M 2
PA_BIAS_TBL_M 3
MODE_RFTONE
Use MODE_IDLE to terminate
RFTONE mode
    
```

# JAVELIN Troubleshooting



# Receiver Troubleshooting (Sheet 1)

Failure:  
 Bit Error Rate @ -114dBm >3.5%  
 RSSI error >+/- 5dB  
 PATS parameter GAIN\_OFF\_L, GAIN\_OFF\_H and AGC\_SLOPE failed.

Start

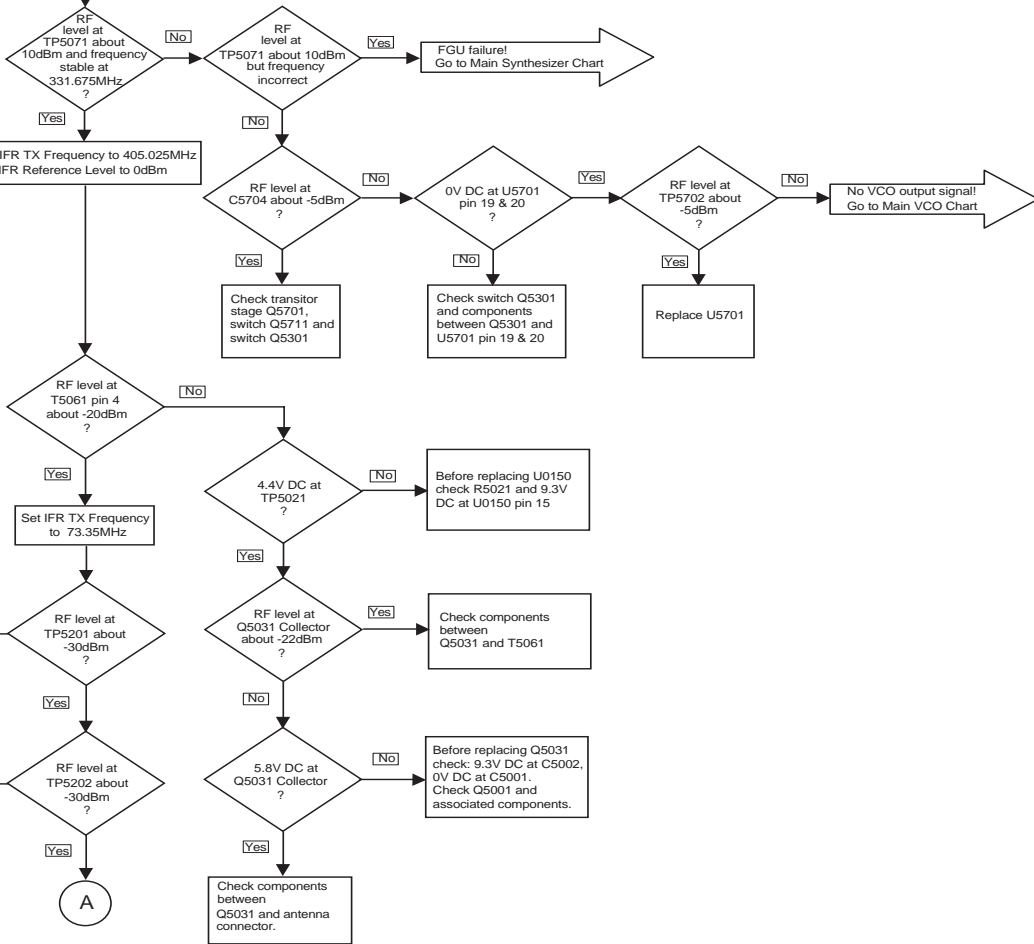
Connect the radio's accessory connector to the Tetra Com interface.  
 Connect the radio's antenna connector to the high power RF output on the IFR.  
 Connect the 50ohms RF probe to the low power RF input on the IFR

Setup IFR:  
 Select high power output and low power input  
 No System,  
 Duplex Test,  
 Generator Frequency 460.025MHz,  
 TX Frequency 386.675MHz  
 Generator Level -30dBm,  
 Duplex Test TX,  
 Spectrum Analyser  
 Set Reference Level to 10dBm

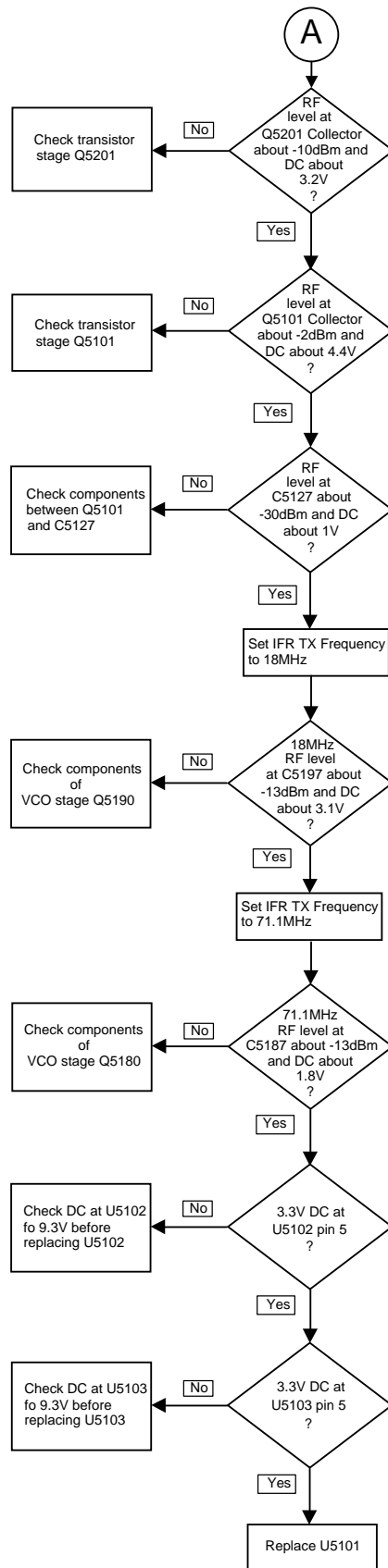
Run Tetra Com script for RX test  
 Measure RF levels and frequencies with the 50ohms RF probe.  
 Measure DC levels with a multimeter.

```

Tetra Com Script for RX Test
TEST_ENTER
DELAY 18
Check for "Radio HW is READY"
MODE IDLE
FREQ RX 460.025
L1TIMER ON
AVE 10
MODE RSSI
GO
Use STOP to terminate RSSI reading
    
```



## Receiver Troubleshooting (Sheet 2)



# Front-End Tuning Troubleshooting

Failure:  
PATS parameters FE\_FILTER, FE\_DAC, FE\_OFFSET failed.

Start

Connect the radio's accessory connector to the Tetra Com interface. Connect the radio's antenna connector to the high power RF output on the IFR.

Setup IFR:  
 Select high power output  
 No System,  
 RX Test,  
 Generator Frequency 460.025MHz,  
 Generator Level -70dBm,  
 Duplex Test TX,  
 Spectrum Analyser  
 Set Reference Level to 10dBm

Run Tetra Com script for RX Test  
 Measure RF levels and frequencies with the 50ohms RF probe.  
 Measure DC levels with a multimeter.

```

Tetra Com Script for RX Test
TEST_ENTER
DELAY 18
Check for "Radio HW is READY"
MODE IDLE
FREQ RX 460.025
L1TIMER ON
AVE 10
MODE RSSI
GO
Use STOP to terminate RSSI reading
  
```

Note the RSSI reading.  
 Enter "STOP" to terminate RSSI reading  
 Send Tetra Com command "RXFEFLTR\_M"  
 Note the replied setting.  
 Send Tetra Com command "RXFEFLTR\_M 0"  
 Send Tetra Com command "RSSI" twice  
 Note the RSSI reading.  
 Send Tetra Com command "RXFEFLTR\_M 7F"  
 Send Tetra Com command "RSSI" twice  
 Note the RSSI reading.  
 Compare the RSSI readings

Did the RSSI readings change at least 5dB ?

Yes → Receiver failure! Go to Receiver Chart

No

Send the above Tetra Com commands again and measure the DC at TP5021

Did the DC change ?

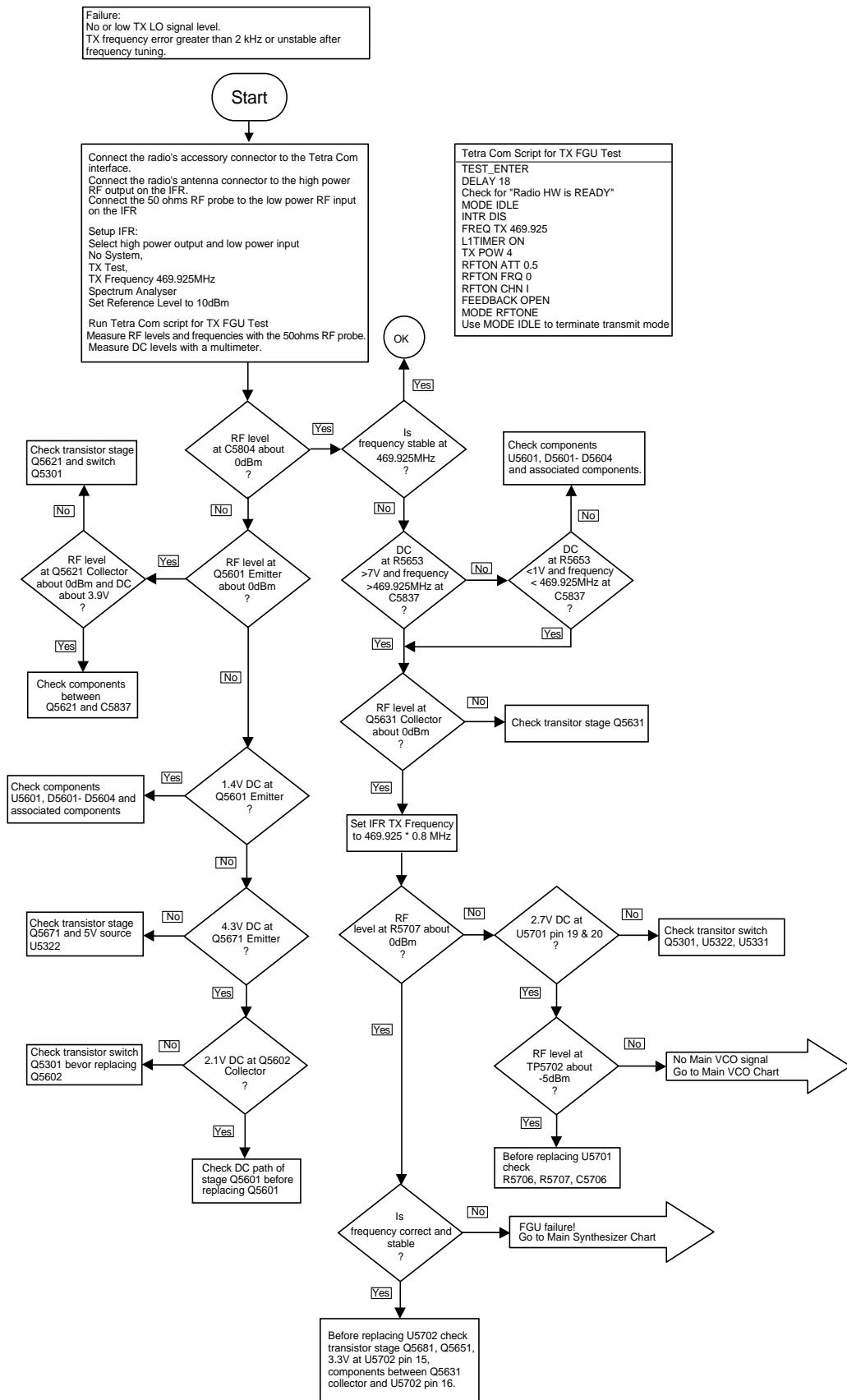
Yes → Check R5022, R5051, D5011, D5012, D5041, D5042

No

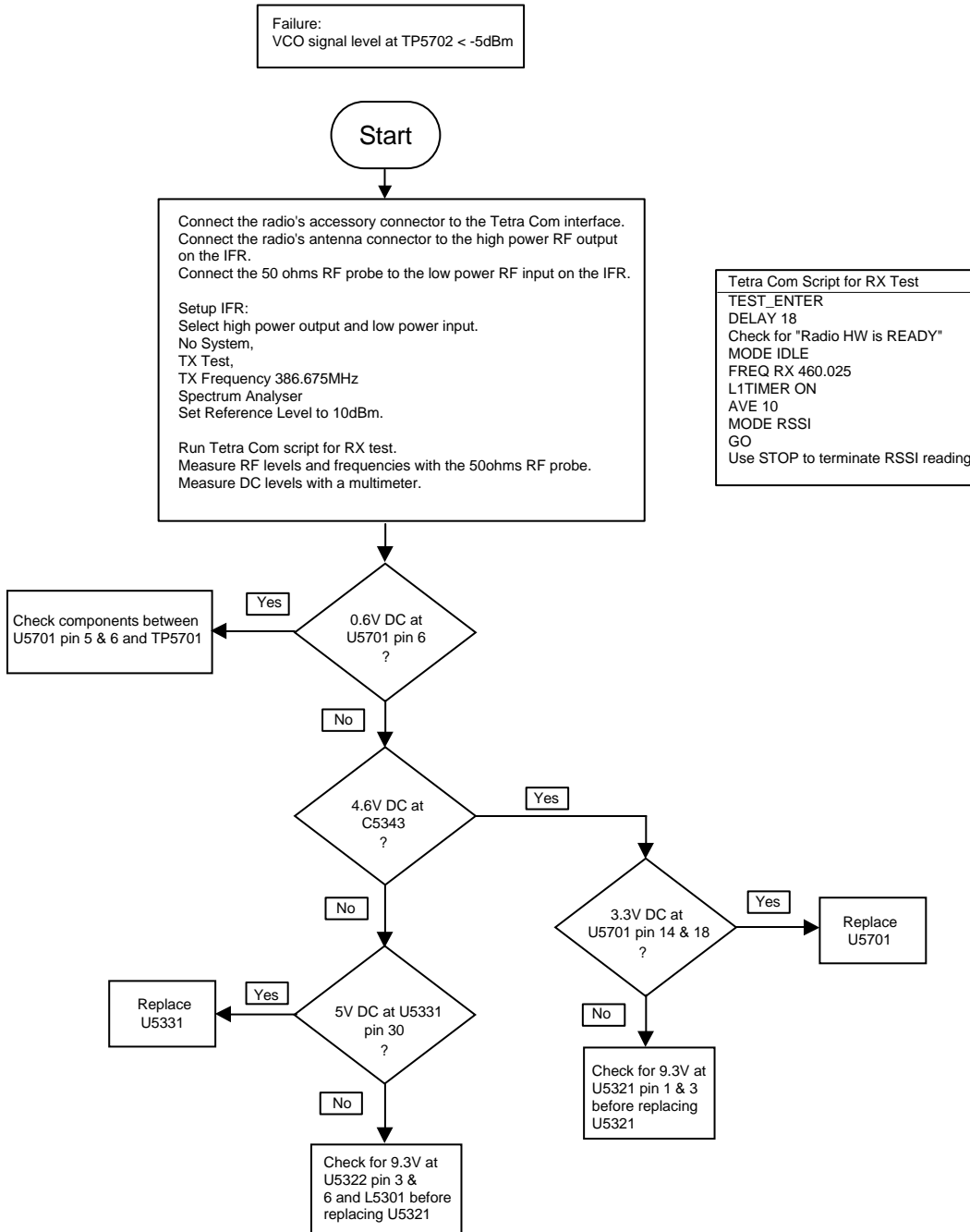
Check R5021, 9.3V DC at U0150 pin 14 before replacing U0150



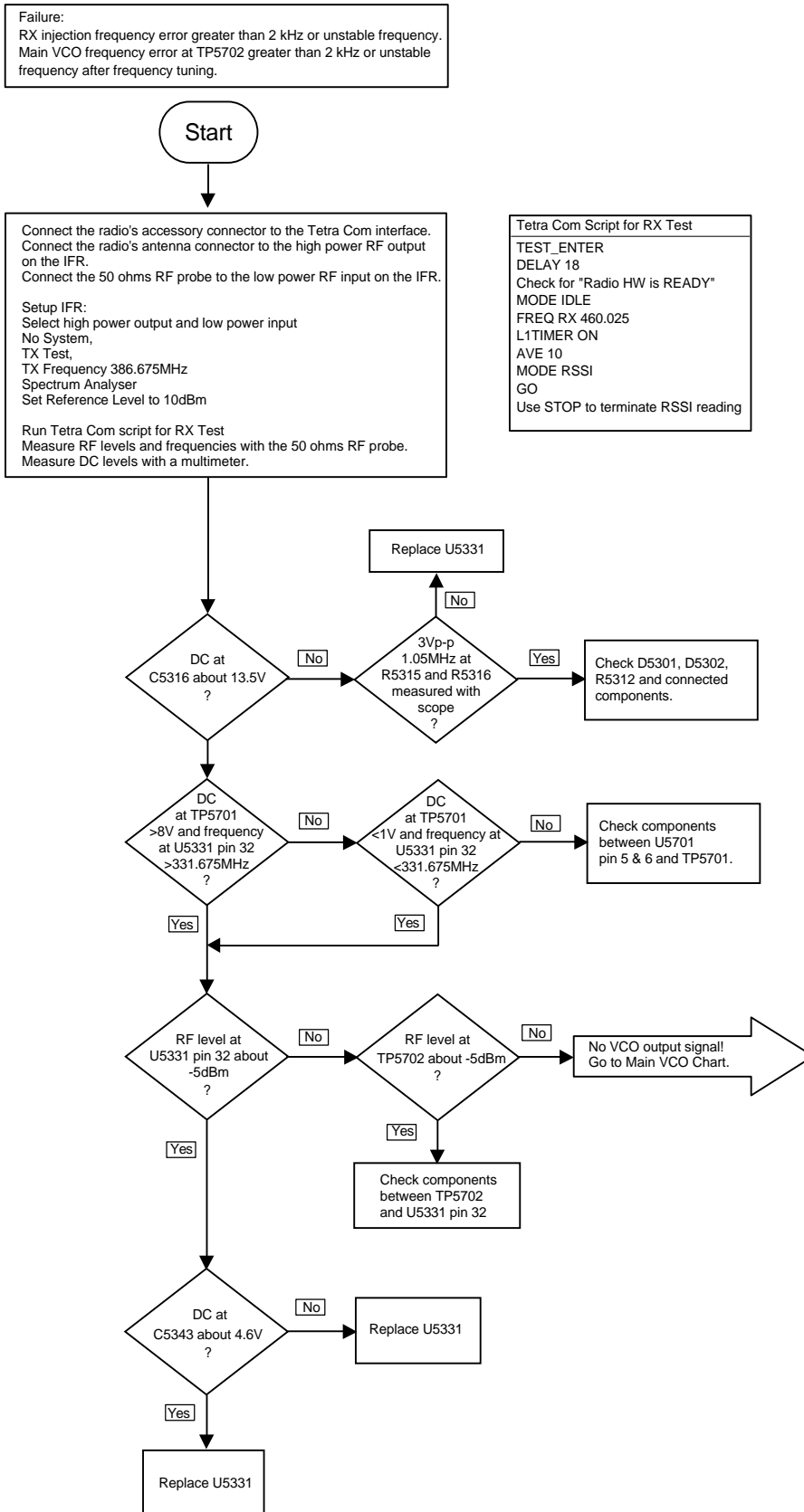
# Tx Frequency Generation Troubleshooting



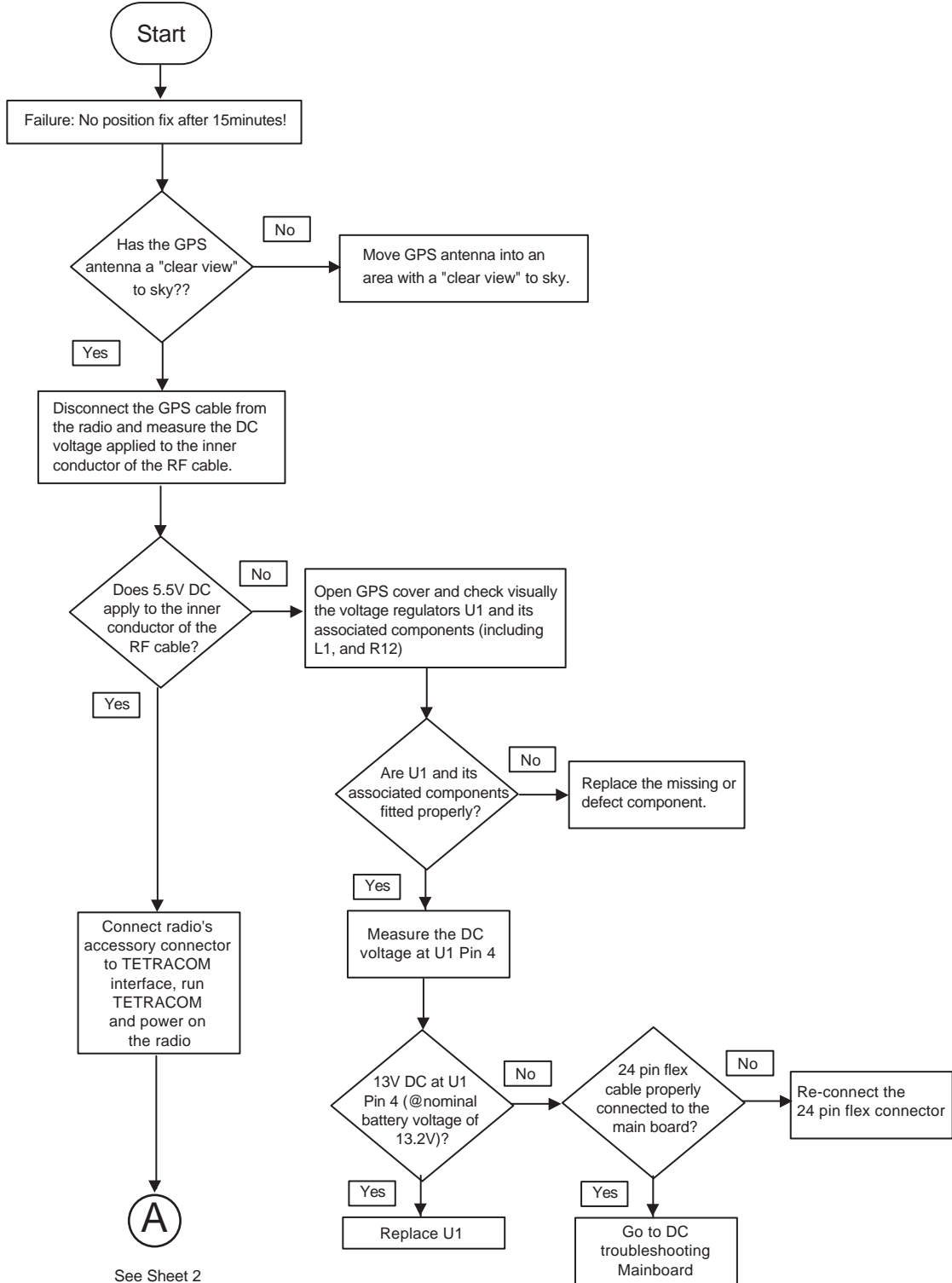
# Main VCO Troubleshooting



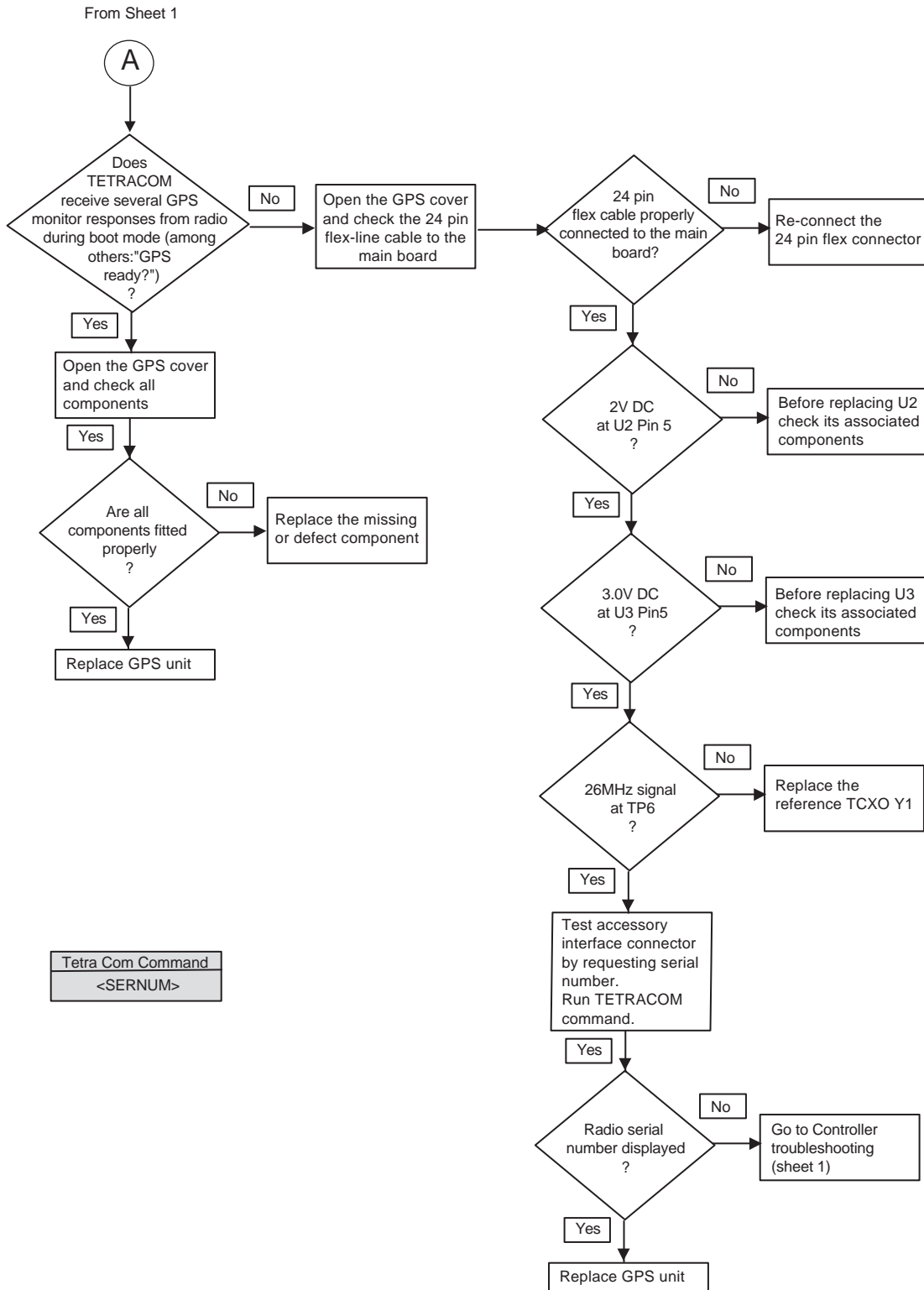
# Main Synthesizer Troubleshooting



### GPS Troubleshooting (Sheet 1)



### GPS Troubleshooting (Sheet 2)



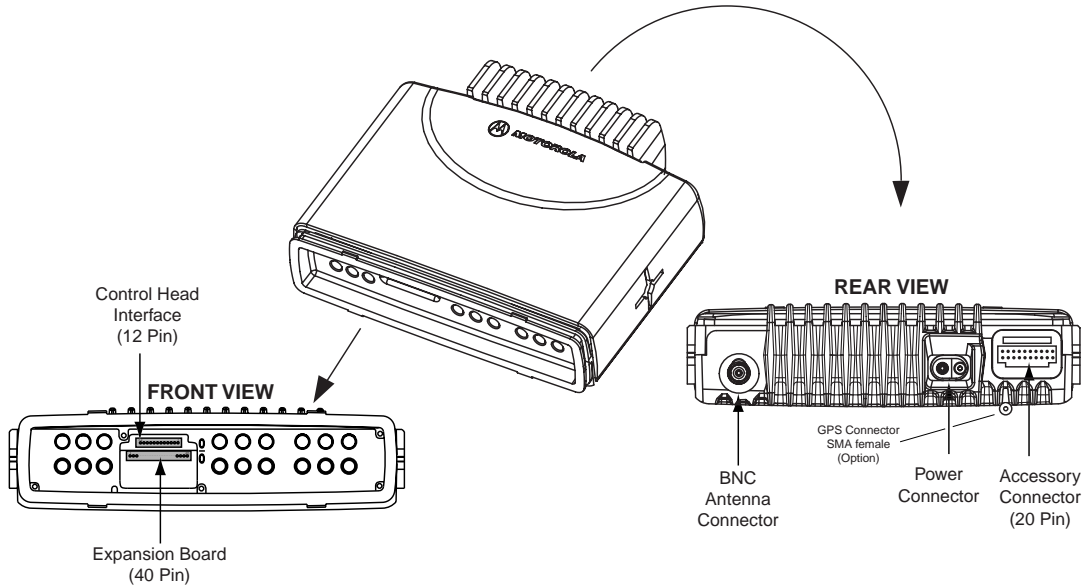
## Notes

APPENDIX A

CONNECTOR PIN FUNCTIONS

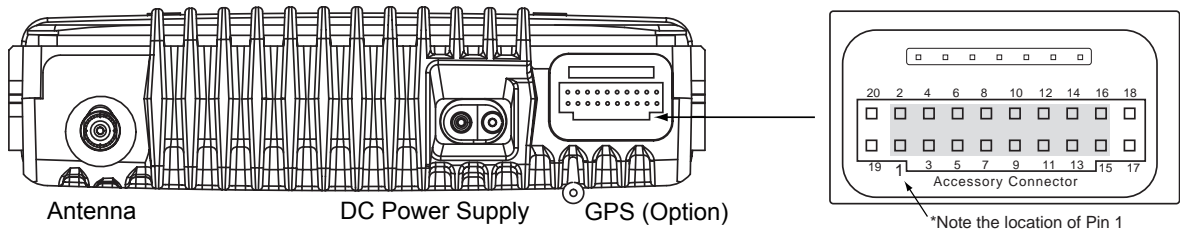


**CAUTION:** The connections shown are not compatible to some other models of Motorola terminals. Check the appropriate accessory or technical manual for further information.



**Figure A-1** Schematic view of the Connectors / MTM800 ENH Transceiver

Transceiver Rear - Pin Function



**Figure A-2** Rear view of the MTM800 ENH

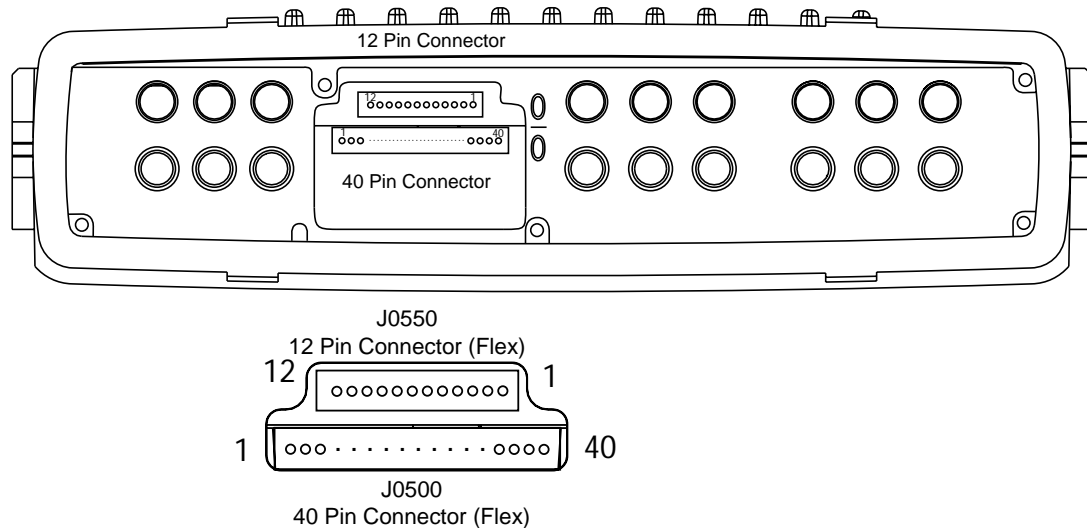
Pin	Function	Description
1	EXTERNAL SPEAKER -	Speaker – and Speaker + (Pin 16) are used to connect an external speaker. The audio PA is a bridge amplifier with a minimum load resistance of 3.2 ohms.
2	EXTERNAL MIC AUDIO	External-, Emergency-, or Hot-Microphone; depends on CPS programming. This microphone signal is independent of the microphone signal on the microphone connector. The nominal input level is 80mV <sub>RMS</sub> . The DC impedance is 660Ohms. The AC impedance is 560Ohms.
3	EXTERNAL PTT	This is a digital input to trigger external PTT; active low; non active high
4	EXTERNAL ALARM	This is a digital output for External Alarm / Fault Indication; active low; open collector with 4k7 Ohms pull up to B+;
5	TX_AUDIO	This input is intended for injecting signals into the transmit path. Input impedance > 10 k Ohms; input level = 775mV <sub>RMS</sub>
6	KEYFAIL / FLASH	This line supports the encryption module.
7	ANALOG GROUND	Ground
8	DIGITAL_GROUND	Ground
9	EMERGENCY	To activate this functionality the pin has to be connected to ground. This will turn on the terminal, Low active.
10	IGNITION	Connecting this pin to the ignition line of the vehicle that will automatically turn on the terminal if the ignition of the vehicle is turned on, High active.
11	RX_AUDIO	This is the received RX signal. Output impedance approximate 600 Ohms unsymmetrical, output level = 775mV <sub>RMS</sub>
12	AUDIO_PA_ENABLE	This is a digital input. High level or pin open enables the audio PA; Low level disables the audio PA.
13	SWB +	This voltage is available when the terminal is switched on. The max. current is 1.0A w/o GPS board and 0.8A with GPS board mounted.
14	HOOK	This is a high active digital input. Low = on hook; High = off hook
15	SCI_DTR	Reserved for service aid.
16	SPEAKER +	Positive output of terminal's audio PA (see Pin 1)
17 *	SCI_CTS	Terminal OUTPUT: Clear To Send ( <i>reserved for service aids</i> )
18 *	SCI_RTS	Terminal INPUT: Request To Send ( <i>reserved for service aids</i> )
19 *	SCI_RXD	Terminal OUTPUT: Receive Data ( <i>reserved for service aids</i> )
20 *	SCI_TXD	Terminal INPUT: Transmit Data ( <i>reserved for service aids</i> )

**Table A-1** Transceiver Pin Assignment of the Rear Accessory Connector

<b>NOTE *</b>	<b>The 4-wire 3 Volts SCI interface on the accessory connector (pins 17 -20) can only be used for flashing of terminal firmware and programming software features. It can NOT be used for communication during normal terminal operation.</b>
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## Transceiver Front - Pin Function



**Figure A-3** Transceiver Front View to the Enhanced Control Head Interface (12pins) and Expansion Head Connector (40pins)

Pin	Function	Description
1	SCI_TX	Serial Communication Interface TXD
2	SPEAKER +	Analogue Speaker output +
3	SPEAKER -	Analogue Speaker output -
4	GND	Ground
5	DIG_IN1 (Ext. PTT)	This is a digital input to trigger external PTT; active low; non active high
6	5VD	+ 5V regulated
7	HANDSET_AUDIO	Handset audio
8	BUS +	Either SBEP or Serial Communication Interface RXD
9	INT_MIC	Microphone input
10	FLT_A +	Filtered A+
11	ON_OFF_CONTRO_SV	Terminal On/Off Control shared with Enhanced Control Head request
12	GND	Ground

**Table A-2** Transceiver Pin Assignment of the Enhanced Control Head Interface (12 pins)

Pin	Function	Description
1	GND	Ground
2	MUX_CTRL	TBA for future applications.
3	SPIB_CLK	Part of the QSPIB
4	MUX_CTRL_1	To detect RS232 or SB9600 Mode (3V SB9600 / 0V RS232) *
5	A+ (via 22Ohms)	Continuous battery voltage for sense via 22Ohms.
6	RESET_OUT	Reset; its a output to Reset a SB9600 device.*
7	BUSY_OUT	Busy Out for SB9600 Interface Circuit *
8	BUSY_IN	Busy In for SB9600 Interface Circuit *
9	3V3_DIG	3.3V Sense Output (max. 10mA)
10	EXP_REQ	Request Line from 4Wire/SB9600 UART *
11	SPIB_CS1_UART	Part of the QSPIB (ship select) for 4wire RS232 UART
12	SPIB_CS_BT	Part of the QSPIB (ship select) for future applications
13	SPIB_MISO	Part of the QSPIB
14	NC	Not Connected
15	SPIB_MOSI	Part of the QSPIB
16	NC	Not Connected
17	SAP_CLK	Serial Audio Protocol, Clock.
18	GND	Ground
19	INT_MIC	Microphone Input
20	MIC	Microphone Audio; for future applications
21	EXPANSION_PTT	Expansion PTT
22	BIUE_T_FSYNC	Serial Audio Protocol, Frame Sync.
23	SAP_SRD	Serial Audio Protocol, Receive Data
24	SAP_STD	Serial Audio Protocol, Transmit Data
25	DGAN_SAP_FSYNC	Serial Audio Protocol, Frame Sync.
26	SP_AUDIO	Audio PA Input; for future applications
27	TERMINAL ON/OFF (IGNITION)	High active.
28	EXT_MUTE	External mute of audio PA; for future applications
29	RS232_DCD	Data Carrier Detect
30	RS232_TX	TX-Data
31	RS232_DSR	Data Set Ready
32	RS232_RTS	Request To Send

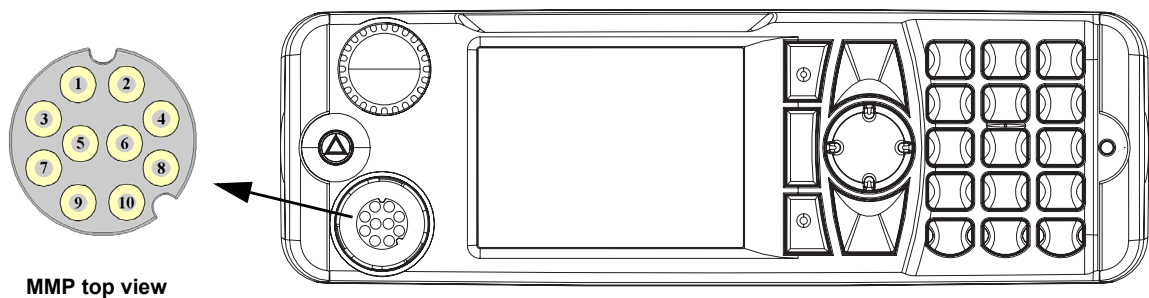
**Table A-3** Transceiver Pin Assignment of the Expansion Board Connector (40 pins)

\*) For Expansion Head Connection only.

33	RS232_DTR	Data Terminal Ready
34	RS232_CTS	Clear To Send
35	RS232_RX	RX-Data
36	RS232_RI	Ring Indicator
37	OPTION_DET	Option Detect; for future applications
38	9V3	Regulated 9V3
39	NC	Not Connected
40	HANDSET AUDIO	Handset Audio to earpiece

**Table A-3** Transceiver Pin Assignment of the Expansion Board Connector (40 pins)  
\*) For Expansion Head Connection only.

## Enhanced Control Head - Pin Function

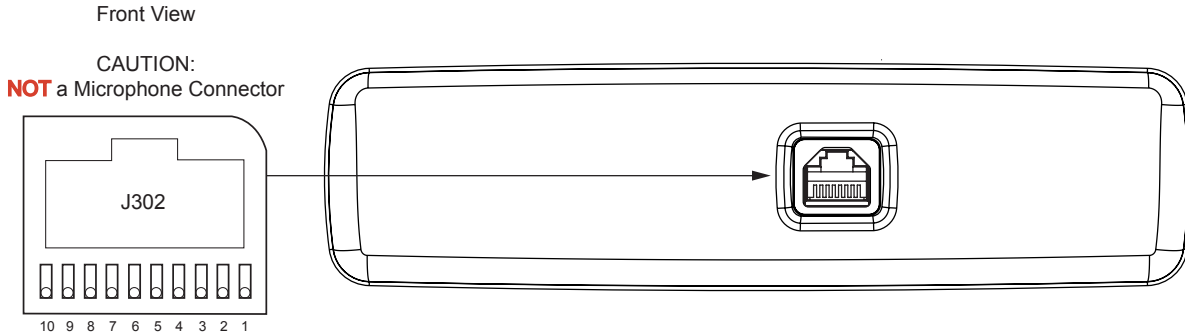


**Figure A-4** View of the Enhanced Control Head with GCAI MMP Connector

GCAI Pin #		Default Function	Alternative Functions	Functions when USB	Functions when RS232
1	1-WIRE	1-WIRE	1-WIRE	1-WIRE	1-WIRE
2	GPIO_3	PTT	GP Input or Output	GP Input or Output	RS-232-RTS *
3	SPEAKER	SPEAKER	SPEAKER	SPEAKER	SPEAKER
4	GPIO_2	GPIO_2 INPUT	GP Input or Output	<b>DATA -</b>	RS-232-RXD *
5	GND	GND	GND	<b>GND</b>	GND *
6	OPT 5V	HIGH Impedance	OPT 5V	<b>VBUS</b>	OPT 5V
7	MIC +	MIC +	MIC +	MIC +	MIC +
8	GPIO_1	GPIO_1 INPUT	GP Input or Output	<b>DATA +</b>	RS-232-TXD *
9	GPIO_4	HOOK	GP Input or Output	GP Input or Output	RS-232-CTS *
10	GPIO_0	GPIO_0 INPUT	GP Input or Output, PWR ON	GP Input or Output, PWR ON	GP Input or Output, PWR ON

**Table A-4** Pin assignment GCAI - FRONT – Mobile Microphone Port (MMP) / \*): Optional

## Remote Head Enhanced - Pin Function

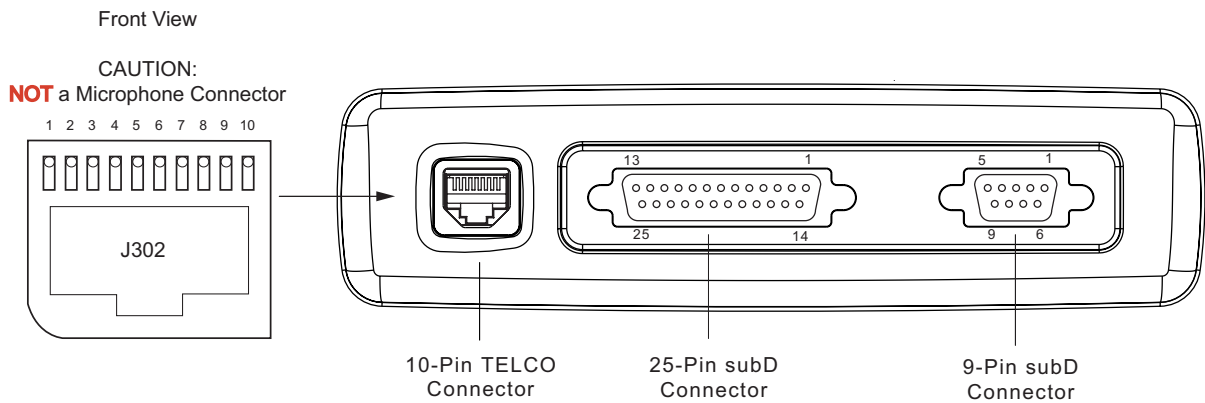


**Figure A-5** View of the Remote Head Enhanced Connector

Pin	Function	Description
1	Audio +	Balanced Audio + (Bidirectional)
2	Speaker +	Positive output of the radio's audio PA.
3	BUS+	This is used for communication between the radio and an Enhanced Control Head.
4	Audio-	Balanced Audio - (Bidirectional)
5	Speaker -	Negative output of the radio's audio PA.
6	Ground	Ground
7	Radio On/Off Control	This is the Enhanced Control Head service request input. A level of 5 volts indicates that the Enhanced Control Head needs to communicate with the radio. In addition it switches on the radio's voltage regulators. The idle state is a level below 0.6V.
8	SCI_TX	This if for communication between the radio and the Enhanced Control Head.
9	FLT_A+	This voltage is at battery voltage level and is available as long as the radio is connected to the supply voltage. The maximum current is 300mA. A fuse in the radio prevents further circuit damage in case of shorting this pin to ground.
10	Analog Ground	Analog Ground

**Table A-5** Pin Assignment of the 10 Pin TELCO-Connector of the Remote Head Enhanced

## Data Expansion Head Enhanced - Pin Function



**Figure A-6** View of the Data Expansion Head Enhanced Connectors

Pin	Function	Description
1	Audio +	Balanced Audio + (Bidirectional)
2	Speaker +	Positive output of the radio's audio PA.
3	BUS+	This is used for communication between the radio and an Enhanced Control Head.
4	Audio-	Balanced Audio - (Bidirectional)
5	Speaker -	Negative output of the radio's audio PA.
6	Ground	Ground
7	Radio On/Off Control	This is the Enhanced Control Head service request input. A level of 5 volts indicates that the Enhanced Control Head needs to communicate with the radio. In addition it switches on the radio's voltage regulators. The idle state is a level below 0.6V.
8	SCI_TX	This is for communication between the radio and the Enhanced Control Head.
9	FLT_A+	This voltage is at battery voltage level and is available as long as the radio is connected to the supply voltage. The maximum current is 300mA. A fuse in the radio prevents further circuit damage in case of shorting this pin to ground.
10	Analog Ground	Analog Ground

**Table A-6** Pin Assignment of the 10 Pin TELCO Connector of the Data Expansion Head Enhanced

Pin	Function	Description	PC direction
1	DCD	Data Carrier Detect	Input
2	RXD	Received Data	Serial IN
3	TXD	Transmitted Data	Serial OUT
4	DTR	Data Terminal Ready	Output
5	Ground	Ground	
6	DSR	Data Set Ready	Input
7	RTS	Request to Send	Output
8	CTS	Clear to Send	Input
9	RI	Ring Indicator	Input

**Table A-7** Pin Assignment of 9 Pin subD Connector of the Data Expansion Head Enhanced

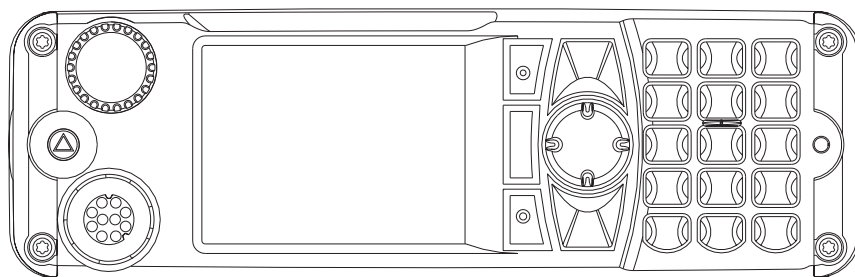
Pin	Function	Description
1	GND	Ground
2	RS232_SCI_TX	Transmit Data (4-wire RS232 with RS232 level)
3	RS232_SCI_RX	Receive Data (4-wire RS232 with RS232 level)
4	RS232_RTS	Request to Send (4-wire RS232 with RS232 level)
5	RS232_CTS	Clear to Send (4-wire RS232 with RS232 level)
6	FLT_A+	This voltage is at battery voltage level and is available as long as the radio is connected to the supply voltage. A fuse in the radio prevents further circuit damage in case of shorting this pin to ground. This pin is only used together with the pins 14, 20, and 23 to select flashing and programming mode, or to switch the radio on.
7	Ground	Ground for RS232
8	SB9600_BUSY	SB9600 Busy
9	NC	Not Connected
10	NC	Not Connected
11	NC	Not Connected
12	SW_B+	Switched $U_B$ +/100mA
13	SB9600_BUS-	SB9600 BUS-
14	FLASH_MODE	This input is intended to switch the radio into flashing & programming mode. When the radio is switched off and this pin is connected with pin 6 (FLT A+), the radio switches on and enters flashing & programming mode.
15	SB9600_BUS+	SB9600 BUS+.

**Table A-8** Pin Assignment of the 25 Pin subD Connector of the Data Expansion Head Enhanced

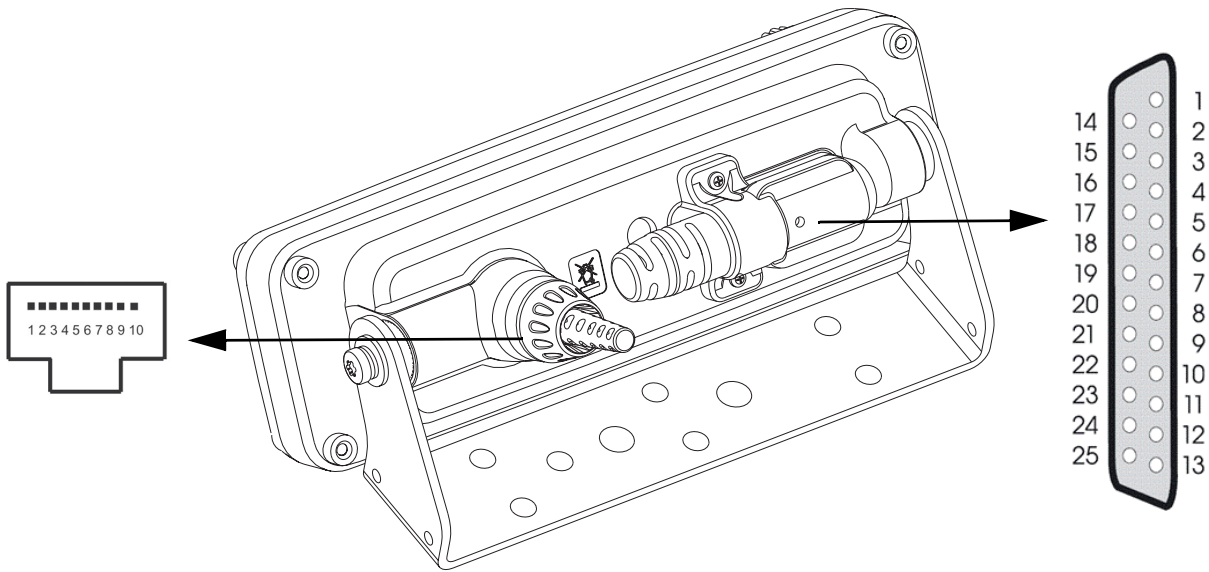
Pin	Function	Description
16	Internal Mic Audio	This input depends on radio programming mode. This microphone signal is independent of the microphone signal on the accessory connector. The nominal input level is 80 mV. The DC impedance is 660 ohms and the AC impedance is 560 ohms.
17	SB9600-Reset	This output can be used to reset a SB9600 device.
18	NC	Not Connected
19	GROUND	Ground
20	IGNITION	The radio can be switched on by connecting this pin with pin 6 (FLT A+). As long as both pins are connected, the radio will be switched on.
21	ON/OFF	On/Off control.
22	EXPANSION-PTT	When this input is used to key up the transmitter, the internal Mic Audio input (pin 16) is selected.
23	SB9600_SW	This input is intended to switch the 4 wire RS232 interface into SB9600 mode. The radio must be switched off and then this input must be connected to pin 6 (FLT A+). When the radio is switched on again, the 4 wire RS232 interface will be disabled and the SB9600 mode will be active.
24	HANDSET_AUDIO	This is a low power audio output primarily intended for a connected handset. the Dc level is 4.6 V and the AC level depends on the volume setting.
25	NC	Not Connected

**Table A-8** Pin Assignment of the 25 Pin subD Connector of the Data Expansion Head Enhanced

## Motorcycle & Remote Mount Connection - Pin Functions



**Figure A-7** Front View of the Motorcycle Enhanced Control Head



**Figure A-8** Rear View of the Motorcycle Enhanced Control Head

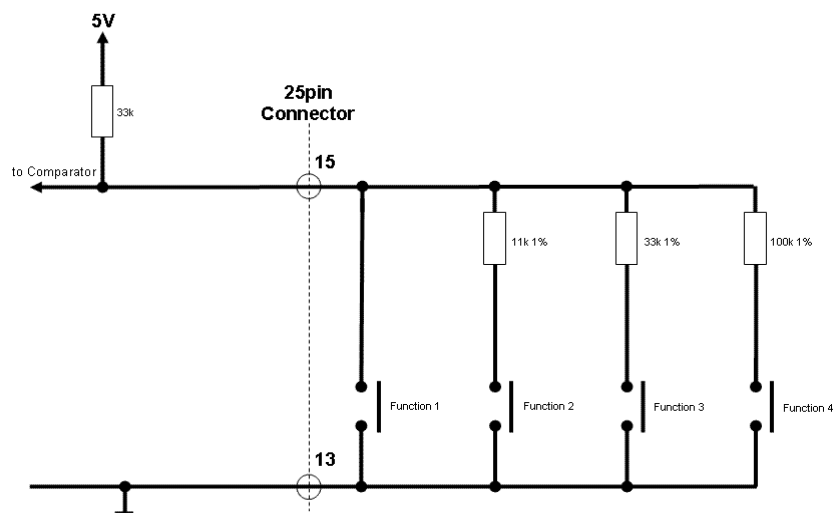
Pin	Function	Description	Default
1	GPIO_9	GPIO, open collector, 4.7k to FLT_A+ PU Output: 200mA @ low, 0,5mA @ high Input: high > 2V, low < 0.5V	Output: Active for duration of call (car radio mute)
2	GPIO_6	GPIO, open collector, 4k7 to 5V PU Output: 1mA @ low, 0,5mA @ high Input: high > 2V, low < 0.5V	PTT Input, TX audio from MIC_REAR_2
3	GPIO_8	GPIO, open collector, 4k7 to 5V PU Output: 1mA @ low, 0,5mA @ high Input: high > 2V, low < 0.5V	Disabled
4	GPIO_3	GCAI PIN 2: 15k to 3V3 PU, 5V tol. Output: see GCAI spec. 1.20 Input: high > 2V, low < 0.5V	PTT Input, TX audio from MIC_REAR_1
5	VBUS_1B	GCAI PIN 6: 5V Supply	Disabled
6	REAR_D-	GCAI PIN 4: USB D-, GPIO_2 shared with front MMP	Disabled
7	REAR_D+	GCAI PIN 8: USB D+, GPIO_1 shared with front MMP	Disabled
8	GPIO_0	GCAI Pin 10 GPIO, open coll., 15k to 3V3 PU, 5V tol. Output: see GCAI spec. 1.20 Input: high > 2V, low < 0.5V	Input, GCAI detection/Select Line
9	VBUS_2	Second USB, 5V Supply	Disabled
10	TX	4 wire RS232 TX, EIA/TIA-232 level	
11	RX	4 wire RS232 RX, EIA/TIA-232 level	
12	MIC_REAR_2	2nd REAR MIC Input 80mVrms Bias 9V= / 600Ohm	Disabled
13	GND	GND	
14	GPIO_5	GPIO, open collector, 4k7 to 5V PU Output: 1mA @ low, 0,5mA @ high Input: high > 2V, low < 0.5V	Disabled
15	GPI_7	4 Level Analogue Input, 33k to 5,0V PU (refer to graphic below)	Enabled
16	1_WIRE	GCAI PIN 1, 1-Wire® bi-directional serial bus	Disabled

**Table A-9** Pin assignment of the 25pin back connector – for RMC and MCC



Pin	Function	Description	Default
17	HANDSET	GCAI PIN 3, Handset audio output, VOL onrolled, AC coupled, min. RL 150Ohm	Parallel to front GCAI
18	GND	GCAI PIN 5 GND	
19	MIC_REAR_1	GCAI PIN 7 MIC Input 80mVrms Bias 9V= / 600Ohm	Disabled
20	GPIO_4	GCAI PIN 9 GPIO open collector, 15k to 3V3 PU, 5V tol. Output: see GCAI spec. 1.20 Input: high > 2V, low < 0.5V	Hook Input
21	USB_D+	Second USB, D+	
22	USB_D-	Second USB, D-	
23	RTS	4 wire RS232 RTS, EIA/TIA-232 level	
24	CTS	4 wire RS232 CTS, EIA/TIA-232 level	
25	PWR_ON	NGCH Power On input, high active, > 2V	

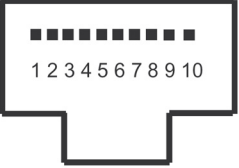
**Table A-9** Pin assignment of the 25pin back connector – for RMC and MCC



**Figure A-9** 4 Level Analogue Input provided by GPI\_7

Function	Voltage Level (V)	Tolerance (V)	Default Function
1	0,00	0.000 - 0,625	Volume Up
2	1,25	0,625 - 1,875	Volume Down
3	2,50	1,875 - 3,125	Talk group Up
4	3,75	3,125 - 4,375	Talk group Down
Idle	5,00	4,375 - 5,000	

**Table A-10** Function of the voltage level at GPI\_7

TELCO top view	Pin #	Function	Description
	1	Audio +	Balanced Audio + (bidirectional)
	2	Spkr +	Speaker +
	3	BUS+	Serial Bus (115 kBd), Data from NGCH
	4	Audio -	Balanced Audio - (bidirectional)
	5	Spkr -	Speaker -
	6	GND	GND
	7	ON_OFF_CONTROL	Radio "Turn On" Signal
	8	SCI_TX	Serial Bus (115 kBd), Data to NGCH
	9	FLT_A+	Supply voltage
	10	GND	GND

**Table A-11** Pin assignment of the 10pin TELCO back connector for RMC and MCC

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## APPENDIX B

# REPLACEMENT PARTS & KITS

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## Servicing MTM800 With Enhanced Control Head Mobile Units

Service for the mobile units is based on the substitution method; a faulty part is replaced by a working one, providing quicker service to the customer. For example, if the controller board is faulty, it is replaced. If the mobile requires more complete testing or servicing than that is available at field level, it is sent to the European Radio Service Centre; where it is serviced, and returned to the Regional Service Centre.

### Level 1 and Level 2 Maintenance

This manual covers Level 1 and Level 2 Maintenance: at Level 1 maintenance you replace the transceiver and/or accessories and send the faulty transceiver and/or accessories to higher level of maintenance; at level 2 maintenance a transceiver board is replaced.

The MTM800 With Enhanced Control Head mobiles are programmed at the factory. They cannot be tuned at the field service level.

### Level 3 Maintenance

All Radio Support Depots are level 3 service partners. The depots are capable of performing repairs down to component level where retuning is required. Contact your local CGISS office for information.

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## Replacement Parts

Damaged parts should be replaced with identical replacement parts. For complete information on ordering required parts and kits, contact your local customer service representative (see following pages).

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## SERVICE INFORMATION

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### Europe, Middle East and Africa Region

#### European Radio Support Centre (ERSC)

Motorola European Radio Support Centre is available at:

Motorola European Radio Support Centre ERSC  
Tel.: +49 (0)30 6686 1555  
Fax: +49 (0)30 6686 1579  
Am Borsigturm 130  
13507 Berlin  
Germany

#### EMEA Systems Support Centre (ESSC)

The Systems Support Centre is available at:

Telephone: +44 (0) 1256 484448  
E-mail: [ESSC@motorola.com](mailto:ESSC@motorola.com)

#### Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital Tetra Terminal: **The CPS has no capability to tune the terminal. Tuning the terminal can only be performed at the factory or at the appropriate Motorola Repair Centre. Components replacement can affect the terminal tuning and must only be performed by the appropriate Motorola Repair Centre.**

#### Parts identification and ordering

Request for help in identification of non-referenced spare parts should be directed to the Customer Care Organization of Motorola's local area representation. Orders for replacement parts, kits and assemblies should be placed directly on Motorola's local distribution organization or via the Extranet site Motorola Online at: <https://emeaonline.motorola.com>.

#### EMEA Test Equipment Support

Information related to support and service of Motorola Test Equipment is available by calling the Motorola Test Equipment Service in Germany at +49 (0) 6128 702179, Telefax +49 (0) 6128 951046, through the Customer Care Organization of Motorola's local area representation, or via the Internet at: <http://www.gd-decisionssystem.com/cte/>.

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## Asia, Pacific Region

### Piece Parts

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola Radio Aftermarket and Accessory Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Note on this digital TETRA Terminal: **The CPS has no capability to tune the terminal. Tuning the terminal can only be performed at the factory or at the appropriate Motorola Repair Center. Component replacement can affect the terminal tuning and must only be performed by the appropriate Motorola Repair Center.**

All orders for parts/information should include the complete Motorola identification number. All part orders should be directed to your local AAD office. Please refer to your latest price pages.

### Technical Support

Technical support is available to assist the dealer/distributor in resolving any malfunction which may be encountered. Initial contact should be by telephone wherever possible.

When contacting Motorola Technical Support, be prepared to provide the product model number and the unit's serial number.

### Further Assistance From Motorola

You can also contact the Customer Help Desk through the following web address:  
<http://www.motorola.com/governmentandenterprise/contactus>.

### Parts identification and ordering

Request for help in identification of non-referenced spare parts should be directed to the Customer Care Organization of Motorola's local area representation. Orders for replacement parts, kits and assemblies should be placed directly on Motorola's local distribution organization or via Motorola Online (Extranet).

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## Latin America Region

Latin America Radio Support Centres

The Customer Support is available through the following service centres:

### **Warranty and Repairs:**

#### **MOTOROLA DE COLOMBIA SERVICE CENTRE**

Torre Banco Ganadero

Carrera 7 No. 71-52

Torre B piso 13

Oficina 1301

Bogota- Colombia

(571) 376-6990

#### **MOTOROLA DE MEXICO SERVICE CENTRE**

Bosques de Alisos #125

Col. Bosques de las Lomas

CP 05120 Mexico DF

5252576700

### **Piece Parts:**

To order parts in Latin America and the Caribbean contact your local Motorola CGISS representative.

#### **MOTOROLA, INC.**

Latin American Countries Region

789 International Parkway

Sunrise, FL 33325

USA 954-723-8959

#### **MOTOROLA DE ARGENTINA**

Ave. del Libertador 1855

B1638BGE, Vicente Lopez

Buenos Aires, Argentina

5411-4317-5300

#### **MOTOROLA DE LOS ANDES C.A.**

Ave. Francisco de Miranda

Centro Lido, Torre A

Piso 15, El Rosal

Caracas, 1060 Venezuela

58212-901-4600

#### **MOTOROLA DO BRASIL LTDA.**

Av. Chedid Jafet

222 Bloco D Conjuntos 11,12,21,22 E 41

Condominio Millennium Office Park

04551-065- Vila Olimpia, Sao Paulo

Brasil

5511-3847-668

**MOTOROLA CHILE**

Ave. Nueva Tajamar 481  
Edif. World Trade Center  
Of. 1702, Torre Norte  
Las Condes  
Santiago, Chile  
562-338-9000

**MOTOROLA DE COLOMBIA, LTDA.**

Carrera 7 #71-52  
Torre A, Oficina 1301  
Bogotá, Colombia  
571-376-6990

**MOTOROLA DE COSTA RICA**

Parque Empresarial Plaza Roble  
Edificio El Portico, 1er Piso  
Centro de Negocios Internacional  
Guachepelin, Escazu  
San Jose, Costa Rica  
506-201-1480

**MOTOROLA DEL ECUADOR**

Autopist Gral. Rumiñahui, Puente 2  
Conjunto Puerta del Sol Este-Ciudad Jardin  
Pasa E, Casa 65  
Quito, Ecuador  
5932-264-1627

**MOTOROLA DE MEXICO, S.A.**

Calle Bosques de Alisos #125  
Col. Bosques de Las Lomas  
05120 México D.F.  
México  
52-555-257-6700

**MOTOROLA DEL PERU, S.A.**

Ave. República de Panama 3535  
Piso 11, San Isidro  
Lima 27, Peru  
511-211-0700

**Technical Support:**

<https://businessonline.motorola.com>, go to Contact Us to request technical support

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, it is available from Motorola. If no part number is assigned, the part is not normally available from Motorola. If the part number is appended with an asterisk, the part is serviceable by Motorola Depot only. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

## SERVICE KITS

Type No.	Sales Model No.	Short Description	Model
MT512M	M80RCS6TZ5AN	MTM800 ENH 410-470 Dash	M1
MT512M	M80RCS6TZ4AN	MTM800 ENH 410-470 Desk	M2
MT512M	M80RCS6TZ6AN	MTM800 ENH 410-470Remote	M3
MT512M	M80RCS6TZ2AN	MTM800 ENH 410-470 M'cycle	M4
MT512M	M80RCC6TZ5AN	MTM800 ENH 410-470 Exp/ Data	M5

**Table B-1** Service Kits-To-Model Chart

MTM800 Service Kits						
Description	Part Number	M1	M2	M3	M4	M5
<b>Service Boards</b>	PMUE4480AS	X	X	X	X	X
MTM800 ENH 410-470 CLEAR	PMUE4481AS	X	X	X	X	X
MTM800 ENH 410-470 TEA1*	PMUE4482AS	X	X	X	X	X
MTM800 ENH 410-470 TEA2*	PMUE4483AS	X	X	X	X	X
MTM800 ENH 410-470 GPS CLEAR	PMUE4484AS	X	X	X	X	X
MTM800 ENH 410-470 GPS TEA1*	PMUE4485AS	X	X	X	X	X
MTM800 ENH 410-470 GPS TEA2*	PMUE4486AS	X	X	X	X	X
MTM800 ENH 410-470 UCM AES128	PMUE4487AS	X	X	X	X	X
MTM800 ENH 410-470 UCM TEA1* AES128	PMUE4488AS	X	X	X	X	X
MTM800 ENH 410-470 UCM TEA2* AES128	PMUE4489AS	X	X	X	X	X
MTM800 ENH 410-470 UCM/GPS AES128	PMUE4490AS	X	X	X	X	X
MTM800 ENH 410-470 UCM/GPS TEA1* AES128	PMUE4491AS	X	X	X	X	X
MTM800 ENH 410-470 UCM/GPS TEA3* AES128	PMUE4480AS	X	X	X	X	X
<b>Enhanced Control Head/Kits</b>						
<b>Dash/Desk Mount</b> -English Keypad	GMWN4298_	X	X			
Chinese Keypad	GMWN4299_	X	X			
Korean Keypad	GMWN4300_	X	X			
Arabic Keypad	GMWN4301_	X	X			
BoPoMoFo Keypad	GMWN4302_	X	X			
Cyrillic Keypad	GMWN4303_	X	X			
English Keypad - Hungarian	GMWN4608_	X	X			
<b>Remote Mount</b> -English Keypad	GMWN4304_			X		
Chinese Keypad	GMWN4305_			X		
Korean Keypad	GMWN4306_			X		



**Table B-1** Service Kits-To-Model Chart

<b>MTM800 Service Kits</b>							
Arabic Keypad	GMWN4307_			X			
BoPoMoFo Keypad	GMWN4308_			X			
Cyrillic Keypad	GMWN4309_			X			
English Keypad - Hungarian	GMWN4606_			X			
<b>Motorcycle</b> -English Keypad	GMWN4600_				X		
Chinese Keypad	GMWN4601_				X		
Korean Keypad	GMWN4602_				X		
Arabic Keypad	GMWN4603_				X		
BoPoMoFo Keypad	GMWN4604_				X		
Cyrillic Keypad	GMWN4605_				X		
English Keypad - Hungarian	GMWN4607_				X		
<b>Data Expansion Head Enhanced</b>	PMLN4908_			X	X		
Data Expansion Head	GMCE4053_					X	
Remote Head Enhanced	PMLN4904_			X	X		
<b>Cables/Kits</b>							
Remote Mount Cable - 3m	RKN4077_			X			
Remote Mount Cable - 5m	RKN4078_			X			
Remote Mount Cable - 7m	RKN4079_			X			
Remote Mount Cable - 10m	PMKN4020_			X			
Accessories Expansion Cable	PMKN4029_			X	X		
Motorcycle Mount TELCO Cable - 2.3m	PMKN4030_				X		
Ferrite Clamp	PMLN5148_			X	X		

\*) TETRA Encryption Algorithm 1, 2 or 3

## Notes

## APPENDIX C

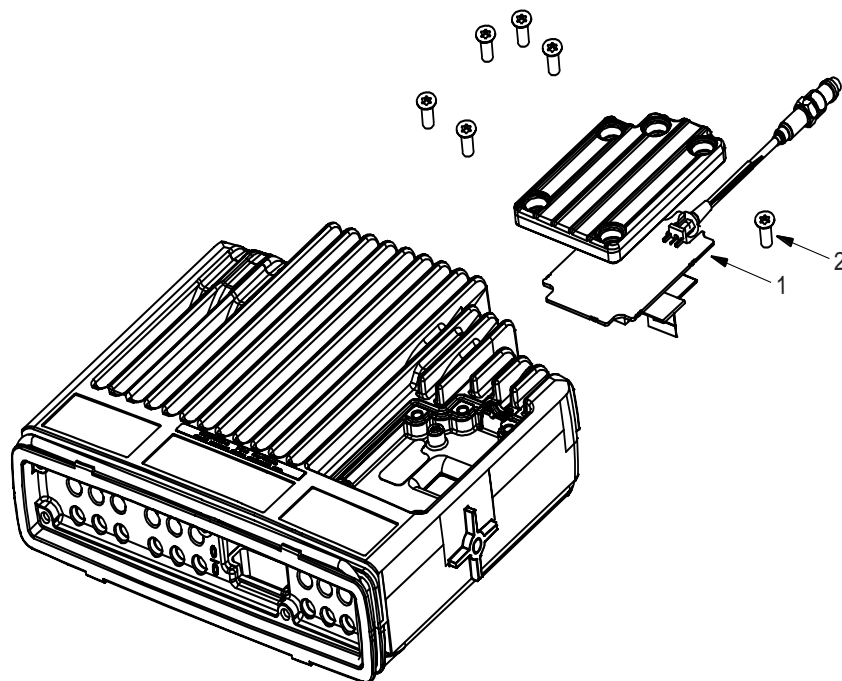
## RETROFITTING the GPS and UCM BOARD

Retrofitting the UCM and GPS module should only be done by specially authorized and educated Service Personnel. All operating and safety instructions are to be followed carefully.

**Note:** Refer to chapter 7 MAINTENANCE for dis-assembling and re-assembling the terminal properly.

## Retrofitting the GPS board

1. Remove the metal blind cover from the bottom (5 screws, T10 TORX™).
2. Pull out the protection bushing.
3. Install the GPS board by starting with the connection of the flex to the mainboard.
4. Take care to fit the gasket of the coax cable in the right position for proper IP54 protection.
5. Fix the GPS board with one T10 TORX™ screw (1.13 Nm +/- 10% or 10 lbin +/- 10%).
6. Fix the GPS cover plate with five T10 TORX™ screws (1.13 Nm +/- 10% or 10 lbin +/- 10%).



**Figure C-1** Position of GPS module at the terminal (view from bottom side)

**Table C-1** GPS Upgrade Kit Parts List

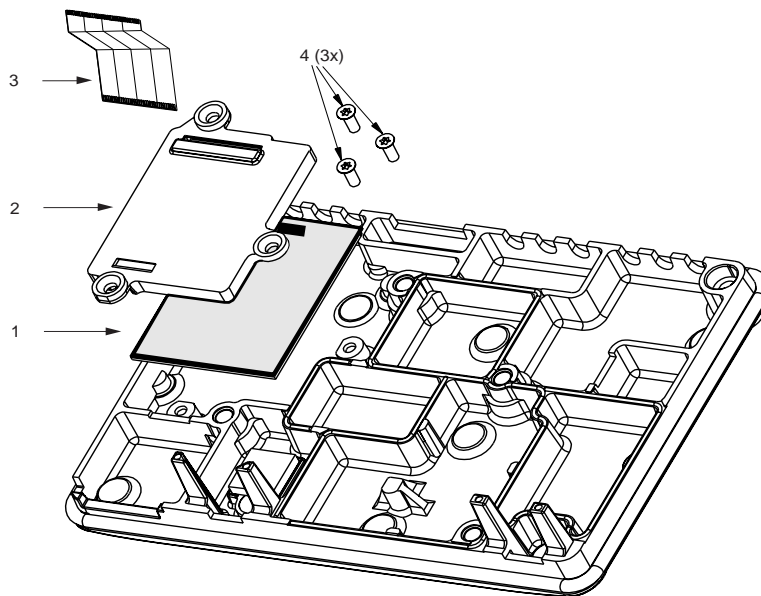
Item No.	Description	Part Number
	GPS Upgrade Kit	GMRG4219_
1	GPS Board (with flex and coax cable)	0166502N65
2	Screw (M3x8)	0310907A19
3	Label (not shown)	5466571B01

## GPS Software activation

After installing the GPS hardware, a software upgrade for the MTM800 ENH will be necessary. Please refer to the CPS documentation in the Product Information Manual (P/N: 6866537D87) for more details or contact your local Customer Support Centre / see Appendix B - Service Information)

## Retrofitting the UCM board

1. If attached, remove the Enhanced Control Head from the terminal, refer to chapter 7 (page 7-5, following).
2. Remove the top plastic cover from the terminal.
3. Remove the six screws from the diecast cover using a T20 TORX™ driver and lift the cover from the chassis.
4. Fix the flex to the UCM board and place it at the cover plate.
5. Fix the plastic cover with 3 screws starting with the pull-through of the flex.
6. Place the cover plate (UCM at left side) in front of the transceiver front side and carefully attach the flex to the mainboard at the 40-pin internal option board connector (J0450).
7. Re-assemble the terminal.

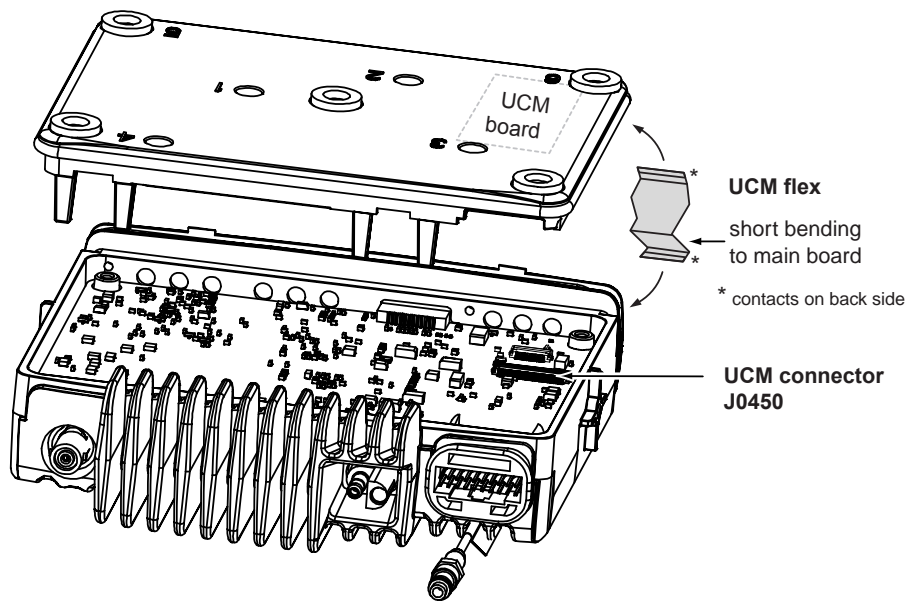


**Figure C-2** Location of UCM board inside the cover plate

**Table C-2** UCM Upgrade Kit parts list

Item No.	Description	Part Number
<b>UCM Upgrade Kit:</b>		GMLN4218_
1	UCM Board Module	CLN8041_
2	UCM Board Cover	0786183B01
3	UCM Board Flex	8485615Z02
4	Screw 3x (M5x8)	0310943R55

**NOTE:** The CLN8041\_ UCM board is not repairable. Order a replacement board if necessary.



**Figure C-3** Location of UCM connector J0450 on the main board

## UCM Software activation

After installing the UCM hardware, a software upgrade for the MTM800 ENH will be necessary. Please refer to the CPS documentation in the Product Information Manual (P/N: 6866537D87) for more details.

Before use, provision the UCM with E2E Keys and Associations according to your E2E Deployment Plan. This will require a Key Variable Loader (KVL), and may also require configuration changes to your system's Key Management Facility (KMF).

Refer to the **Dimetra End-to-End Encryption KVL 3000 Plus Key Variable Loader User Guide** (P/N: 6802800U14) for more details. For questions refer to your local Customer Support Centre (see Appendix B - Service Information).

## Notes

## APPENDIX D

## PRODUCT SPECIFIC INFORMATION for Digital Terminals Type MT512M

This section gives the Service Personnel an overview about product specific notes. This is necessary to take special precautions to avoid the introduction of hazards when operating, installing, servicing or storing equipment. This terminal meets the applicable safety standards if it is used as described. All operating and safety instructions are to be followed carefully.

### Equipment Electrical Ratings

**Rated Voltage:** 12 Volt DC

**Rated Voltage Range:** 10.8 to 15.6 V DC

**Rated Current:**

3 Amps @ 3Watts RF power

Please be aware when planning the installation that there is a current consumption of approx. 3.5A during PTT and even 30mA when terminal is switched off.

**Transmitter Frequency Range:**

TMO: 450 to 470 MHz

DMO: 450 to 470 MHz

**Receiver Frequency Range:**

450 to 470 MHz

### Normal Load Conditions:

**Rated RF Power:** 3Watts

**Rated Audio Power:** 10 Watts @ 4 Ohms; 6 Watts @ 8 Ohms

**Antenna Impedance:** 50 Ohms

**Operating Temp. Range:** -30 to +60°C

**Operating Time\*:** Continuous / Intermittent

\*Note: In general, the terminal transmit and receive time (operating cycle time) is determined by the communication system. On overload, respectively on extensive use beyond the systems specifications at high ambient temperatures, the terminal is protected by its thermal control, which cuts down the RF output power, thus reducing the terminal coverage range.

### Fuse Identification

In case of blown fuses during the installation only replace those with identically value. **Never insert different values.**

**Fuse for Power Cable GKN6270/GKN6274:** 10A (Motorola Part Number: 65C80283E05)

**Fuse for Ignition Sense Cable HKN9327:** 4A (Motorola Part Number: 65C80283E02)

# SPEZIELLE PRODUKTINFORMATIONEN

## für Funkgeräte des Typs MT512M

Dieses Kapitel gibt dem geschulten Servicepersonal einen Überblick über wichtige produktspezifische Informationen. Diese Informationen sind wichtig, um Risiken beim Bedienen, Installieren und Service zu vermeiden. Dieses Funkgerät erfüllt die allgemeinen Sicherheitsstandards, sofern es so betrieben wird, wie in der Bedienungsanleitung beschrieben.

### Nennwerte für das Funkgerät

**Nennspannung:** 12 Volt DC

**Nennspannungsbereich:** 10.8 bis 15.6 V DC

**Nennstrom:**

3 A @ 3W HF Leistung

Bevor Sie die Installation planen, bedenken Sie, dass das Sprechfunkgerät beim Senden einen Stromverbrauch von ca. 3,5A hat und auch im ausgeschalteten Zustand einen Strom von ca. 30 mA verbraucht.

**Sender-Nennfrequenzbereich:**

TMO: 450 bis 470 MHz

DMO: 450 bis 470 MHz

**Empfänger-Nennfrequenzbereich:**

450 bis 470 MHz

### Betriebsbedingungen

**HF Nennleistung:** 3 Watt

**Lautsprecher Nennleistung:** 10 Watt an 4 Ohm; 6 Watt an 8 Ohm

**Antennenimpedanz:** 50 Ohm

**Betriebstemperatur Bereich:** -30 to +60°C

**Betriebszeit\*:** fortwährend / periodisch

\*Hinweis: Im allgemeinen wird die Sende- und Empfangszeit (Betriebszeit) des Funkgerätes durch das Funktionssystem bestimmt. Bei Überlastung bzw. extensivem Betrieb über die Systemspezifikationen hinaus bei hohen Umgebungstemperaturen wird das Funkgerät durch eine Temperaturkontrollschaltung geschützt, die die HF-Leitung reduziert. Daraus kann sich eine Verringerung der Leistungsmerkmale des Gerätes ergeben.

### Sicherungen

Sollte während der Installation die Sicherung durchbrennen, darf sie **nur durch eine gleichwertige** Sicherung ersetzt werden.

**Sicherung für DC Kabel GKN6270/GKN6274:** 10A (Motorola Bestellnummer: 65C80283E05)

**Sicherung für Ignition Sense Kabel HKN9327:** 4A (Motorola Bestellnummer: 65C80283E02)