MT-4 RADIO SYSTEMS

P25 DIGITAL VHF BASE TRANSMITTER INSTRUCTION MANUAL

VT-4B 136 - 174 MHz

Covers models:
VT-4B140-00-000, VT-4B160-00-000
VT-4B140-01-000, VT-4B160-01-000

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Quality Assurance:

Claudia Boorman		
Name	Signature	Date

NOTE:

The user's authority to operate this equipment could be revoked through any changes or modifications not expressly approved by Daniels Electronics Ltd.

The design of this equipment is subject to change due to continuous development. This equipment may incorporate minor changes in detail from the information contained in this manual.

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1 GENERAL

1.1 Introduction

The VT-4B P25 Digital Base Transmitter is capable of operating in 12.5 kHz / 15 kHz or 25 kHz / 30 kHz channels. The transmitter operates continuous duty in the 136 to 174 MHz frequency band and its output power is continuously adjustable from 2.0 to 8.0 Watts. A modular design allows each of the transmitter's modules: Transmitter Board, VT-3/150 Amplifier to be individually assembled and tested. This facilitates construction, tuning, maintenance as well as troubleshooting procedures. The module can support DES-OFB decryption with a plug in module.

The VT-4B Transmitter combines state of the art performance in a compact modular enclosure for applications ranging from remote mountain top repeaters to congested urban radio environments. Each receiver module is characterized by dependable, low maintenance performance under the most severe environmental conditions.

The VT-4B Transmitter is compatible with all Daniel's subrack and base station enclosures. It supports a basic analog interface, and may be used in a mixed system with MT-2 and MT-3 series receivers and transmitters. It is not intended for use as a component in a digital mode repeater system.

1.2 Manual Organization

The organization of this manual reflects the modular makeup of the VT-4 product line. Each module is fully described within its respective submanual, all of which are contained within this document. In general, each submanual contains:

1. A functional description and specification summary,
2. A detailed technical description (Theory of Operation) and
3. Assembly, setup and alignment procedures relevant to that particular module.

The module manuals are as follows.

Note: material presented in a given "sub-manual" may include information related to other module versions not directly applicable to the VT-4 136 - 174 MHz Transmitter.

VHF Amplifier Instruction Manual VT-3 132 - 174 MHz : The amplifier module provides the final stages of RF power amplification and harmonic filtering for the transmitter. This manual is intended primarily as a reference since the amplifier module is adjusted at the factory.

Radio Programming Software Instruction Manual : This manual provides instructions on using the PC-based Radio Programming Software package to perform transmitter alignment and frequency and mode selection.

1.3 VT-4B 136 - 174 MHz Transmitter Family Models

There are 2 distinct models in the VT-4B Transmitter family each with different bands of operation. The 2 models are as follows:

- VT-4B140-00-000 - 136-150 MHz band, 2.0-8.0 Watt
- VT-4B160-00-000 - 150-174 MHz band, 2.0-8.0 Watt

The transmitters' band of operation is determined by select components in the amplifier.

1.4 Performance Specifications

1.4.1 General

The following is a general set of specifications for the generic VT-4/150 transmitter. Additional specifications, specific to individual modules may be found in their respective sub manuals.

Type:	MT-4 Series Transmitter.
Family:	VT-4B 136 - 174 MHz.
Compatibility:	MT-2 Series and MT-3 Series Radio Systems, Project 25 interoperable.
Frequency Range:	136 to 150 MHz., 150 to 174 MHz
RF Power Output:	2.0 to 8.0 W Continuous.
Modulation:	Analog: 11K0F3E or 16K0F3E (Frequency Modulation). Project 25: 8K10F1E
System Impedance:	50 Ω; Type N connector.
Duty Cycle:	100%; Continuous operation from -30°C to +60°C.
Emissions:	-66 dBw
Transmitter Mismatch Protection:	20:1 VSWR at all phase angles.
Operating Temperature Range:	-30˚C to +60˚C
Operating Humidity:	95% RH (non-condensing) at +25°C.
Operating Voltage:	+13.8 Vdc Nominal (range +11 to +16 Vdc), +9.5 Vdc Regulated.
Transmit Current:	1.7 Amps at 2 Watts RF Power Output, 2.8 Amps at 8 Watts RF Power Output
Front Panel Controls:	NORM (repeat mode), OFF, and KEY TX (Tx on).
PTT Activation:	• Active to ground; • Microphone activated; • Front Panel switch: KEY TX;
PTT Time-Out-Timer:	Programmable from 1 sec. to 8 hrs. (default 5 min.), using Radio Programming Software package.
Channel Spacing:	12.5 kHz /15 kHz or 25 kHz / 30 kHz.

Frequency Stability:	Standard: ±2.5 ppm, -30°C to +60°C.
Channel Selection:	In 5.0 or 6.25 kHz increments selected with Radio Programming Software package.
Standby Current:	100 mA
DOC Type Approval:	TBA
FCC Type Acceptance:	TBA

1.4.2 Audio Specifications

Audio Input:	Unbalanced, 600 or 47k5 ohm selectable input impedance.
Audio Response:	Pre-emphasis (6 dB per octave); +0.5 to -2.0 dB from 300 Hz to 3 kHz;
Audio Deviation Limiting:	+/- 2.5 kHz, +/- 5.0 kHz
Audio Distortion:	Less than 3% THD; 1 kHz tone at 1.5 kHz or 3 kHz deviation (-40°C to +60°C).
Hum and Noise:	-45 dB typical

1.4.3 Physical Specifications

Physical Dimensions:	Width:	Height:	Depth:
	7.1 cm (2.8 in)	12.8 cm (5.05 in)	19 cm (7.5 in)
Module Weight:	1.5 kg (3.3 lbs.)		
Corrosion Prevention:	Anodized aluminum construction. Stainless steel hardware. Selectively conformal coated glass epoxy 2 and 4 layer printed circuit boards. Gold plated module connectors.		
Module Design:	Compact Eurostandard modular design. Plug-in modules mate with Daniels standard M3 repeater subrack. Subracks / modules comply with IEEE 1101, DIN 41494 and IEC 297-3 (mechanical size / modular arrangement).		
External Connections:	RF Connection: type N connector located on the transmitter module front panel. Motherboard Connections (Audio, Power, and Control) are made through a 48 pin, gold plated, type F connector on the rear of the transmitter module. User		

	connection made through mated "mother board" assembly of the repeater subrack. Type F standard connector complies with DIN 41612 Level 2 (200 mating cycles, 4 day 10 ppm SO_2 gas test with no functional impairment and no change in contact resistance). Digital I/O: 8-pin RJ-45
Handle Text Colour:	Red

2 THEORY OF OPERATION

2.1 Transmitter Operation

A VT-4B Base Transmitter is constructed using two primary modules: the MT-4 Digital Base Transmitter Main Board and the VT-4 Amplifier Board. The Main Board supports two plug in modules: the Transmitter Controller Board and the Transmitter RF Board.

The MT-4 Digital Base Transmitter Main Board receives its audio input through the balanced input on connector P1, from an external microphone input on connector P1, or from a front panel microphone. Once on the Main Board, it is immediately digitized using an Analog to Digital converter.

The digitized signal then passes to the Controller Board, where Digital Signal Processing techniques are used for volume control, tone signalling, voice compression, filtering, and other functions. The digital data is then converted to an analog waveform by a Digital to Analog Converter and passed to the RF board.

On the RF board the signal is used to modulate a RF carrier and then passed to the VT-3 Amplifier Board for final amplification and transmission.

2.2 Transmitter Programming

The transmitter is programmed with operating frequencies, modulation type, CTCSS and DCS signalling, and other parameters with the PC-based Radio Programming Software. A special programming cable is used to connect the serial port of an IBM compatible computer to the Digital I/O port on the front panel of the Transmitter module. The Radio Programming Software runs under Window 3.1, Windows 95/98 or Windows NT. Analog test modes may be selected by the Radio Programming Software, as well as test modes specific to Project 25 digital operation, such as Bit Error Rate testing.

*** Note that the current version of Radio Programming Software is a demonstration version only, and cannot be used to program a Transmitter. To program a Transmitter, use Motorola's Radio Service Software (RSS), a Motorola Radio Interface Box (RIB), and a Daniels Programming Cable.

The Transmitter settings are divided into two categories: Transmitter Wide options and Channel Wide options. When the TX menu is selected from the main screen, both the Transmitter Wide options and the Channel Wide options for the current channel are displayed. When all Transmitter Wide and Channel Wide options have been configured in the Radio Programming Software as required, the radio must have its non-volatile memory updated. The configuration may be saved to the radio by selecting the TRANSMITTER \ SAVE CONFIGURATION \ TO THE RADIO menu option. In addition, configurations may be read back from the radio, or saved and read from a file on the computer by using the TRANSMITTER \ READ CONFIGURATION \ FROM THE RADIO, TRANSMITTER \ READ CONFIGURATION \ FROM DISK, and TRANSMITTER \ SAVE CONFIGURATION \ TO DISK menu options.

2.2.1 Transmitter Wide Options

Several options may be set which affect the operation of the Transmitter on a global basis.

2.2.1.1 Disable Front Panel Led

This option is not currently used. In future models it will allow the front panel led to be disabled during normal repeater operation in order to save current.

2.2.1.2 Secure Hardware Equipped

This setting is used to allow the installation of an encryption module

2.2.1.3 Allow Emergency Transmissions

This option is not currently used.

2.2.1.4 Allow Radio Inhibit

This setting is not currently used.

2.2.1.5 Allow Radio Check

This option is not currently used. In future repeaters, this option will allow a dispatcher to query whether the repeater is switched on or off.

2.2.1.6 Enable Status

This option is not currently used. When the option is enabled it will allow the transmitter to transmit predetermined Status messages ("low battery", "intruder alert", for example). The Status messages will not take precedence over user traffic.

2.2.1.7 Frequency Band

The transmitter's frequency band is set here. The available options are 136 – 174 MHz and 406 – 470 MHz. The band from 803 – 870 MHz will become available in future models.

2.2.2 Channel Wide Settings

There are currently 32 channels, which may be individually programmed for various parameters.

2.2.2.1 Frequency

The transmitter's frequency may be set here. The Radio Programming Software will only allow frequencies within the operation band (set in the Transmitter Wide options above) to be entered.

2.2.2.2 Voice/Signal Type

Allowed values are PROJECT 25, ANALOG and MIXED MODE. PROJECT 25 mode receives digital P25 modulated signals only, while ANALOG mode receives analog FM signals only. In MIXED MODE the transmitter will transmit either PROJECT 25 digital and analog signals, depending on which mode of signal was received. When either ANALOG or MIXED MODE values are selected, additional combo boxes appear to allow selection of Squelch Type for ANALOG mode signals.

2.2.2.3 Squelch Type

This option is available for ANALOG signals only, and may be set to CSQ, CTCSS or DCS. With the CSQ option, the transmitter will not send either a CTCSS subaudible tone or a DCS code along with the signal being transmitted. With the CTCSS option the transmitter will send a subaudible Continuous Tone Coded Squelch System tone along with the audio signal. Similarly, when the DCS option is used the transmitter will transmit a Digital Controlled Squelch code with the audio signal. When either CTCSS or DCS Squelch Type is selected, additional combo boxes appear to allow selection of a particular tone or code.

2.2.2.4 CTCSS Tone

The frequency of the CTCSS tone may be selected here. All the thirty-nine standard frequencies are supported, along with three non-standard frequencies.

2.2.2.5 Enable Reverse Burst

This option enables a Reverse CTCSS Burst to be sent at the end of a transmission. The Reverse Burst signals to the receiving radio that the transmission is ending, allowing it to mute more quickly.

2.2.2.6 DCS Code

One of eighty-six DCS codes may be selected here.

2.2.2.7 DCS Invert

This option allows the DCS code to have its phase inverted by 180 degrees, which is used to compensate for phase inversions introduced in the signal path.

2.2.2.8 Enable Turn Off Code

This option enables a DCS Turn Off Code to be sent at the end of a transmission. The Turn Off Code signals to the receiving radio that the transmission is ending, allowing it to mute more quickly.

2.2.2.9 Transmitter Power

This option is not currently used.

2.2.2.10 Channel Bandwidth

This setting should be changed to match the channel spacing and bandwidth of the operating channel. Both 25 kHz and 12.5 kHz are supported for Analog channels, while Project 25 channels are limited to 12.5 kHz.

2.2.2.11 Deviation

This is a read-only field that shows the maximum amount that the transmitter frequency will deviate. This field changes automatically in response to the Channel Bandwidth setting. A bandwidth of 25 kHz selects a maximum deviation of 5 kHz, while a bandwidth of 12.5 kHz selects a maximum deviation of 2.5 kHz.

2.2.2.12 Time Out Timer

This option enables the operation of a Time Out Timer that disables the transmitter output after a predetermined period of use. If the option is enabled, a further box becomes visible to allow the user to set the desired time into the timer.

2.2.2.13 Channel Status

This option is not currently used.

2.2.2.14 Transmitter Pre-emphasis

For analog channels, the standard 6 dB/octave pre-emphasis curve may be either disabled or applied to the transmitted audio

2.2.2.15 NAC Transmitter Code

This field allows a Network Access Code to be defined for the transmitter.

2.2.2.16 NAC Transmitter

This option is not used for the Base Transmitter.

2.3 Transmitter Programming using Motorola Radio Service Software

Daniels' Radio Programming Software package is not yet ready to program the transmitter module. Therefore, it is recommended that Motorola's Radio Service Software (RSS) and Radio Interface Box (RIB) be used in conjunction with a Daniels Radio Programming Cable to program the transmitter modules. For instructions on how to use the RSS, consult Motorola's Astro Portable / Mobile Radio Software User's Guide. The MT-4 Base receiver is programmed as if it were an Astro Portable radio.

Some settings in the RSS must be configured correctly for the receiver module to work:

Menu Path	Setting	Value
Main:Change/View:Config:Radio Options	Secure Hardware Equipped	Yes or no, - according to whether or not an encryption module is installed in the transmitter
Main:Change/View:Config:Features:Buttons	Top Button 16 Pos Rotary Switch Side Button 1 (top) Side Button 2 Side Button 3	Blank Channel Select Blank Blank Blank
Main:Change/View:Config:Radio Options:Options	Time Out Timer Table	Set up to four different transmitter time values, which are then selected by each personality.
Main:Change/View:Config:Features:Switches	Two Position Concentric (A/B) Position A Position B Concentric Rocker Switch Position 1 Position 2	 Zone Select Zone Select Clear TX Select Secure TX Select
Main:Change/View:Zone/Chan		Assign personalities to channels. Each of Zone 1 and 2 must have at least one channel assigned.
Main:Change/View:Conv:MDC:Systems	Emergency	Disabled
Main:Change/View:Conv:Astro:Systems	Emergency	Disabled
Main:Change/View:Conv:Pers:Options:Options	TX Network ID (set this for each personality)	Set to desired NAC code (293 is default value)

2.4 Secure Communications

The transmitter is capable of sending secure communications if a DES-OFB encryption module is installed. To transmit a secure signal, the transmitter must be programmed with the correct encryption key using a Motorola KVL keyloader in conjunction with a Daniels Keyloader Cable. Consult the instructions for the Keyloader for details on loading a key. A loaded key may be cleared by pulling first the CLEAR KEYS 1* then the CLEAR KEYS 2* inputs to ground about 500 ms apart. Alternately, the PAC-4 controller may be used to clear the keys from all modules in a system with a single keypress.

2.5 Transmitter Assembly and Adjustment

All modules are mounted on the Transmitter Main Board that then forms a single assembly. An extruded aluminum shell that slides over the Transmitter Main Board as illustrated in section 3.2) forms an enclosure. This shell also serves as a heat sink to remove heat from the Amplifier module and for this reason, it is important that the four screws that bond the shell to the amplifier module (Screws B in Section (3-2)) be installed before prolonged operation of the transmitter. Moreover, the surface of the Amplifier module that contacts the shell should be clean and free of foreign material. The enclosure is completed by the installation of front and rear plates, which are fastened to the Transmitter Main Board.

Transmitter alignment is performed on a module by module basis and detailed steps are provided in the respective manuals. Alignment is simplified by using an SR-3 Sub rack, SM-3 System Monitor, and RF extender cable to provide transmitter power and signal interconnection. Alternatively, +9.5 Vdc and +13.8 Vdc, as well as any required test signals, may be applied directly to the individual modules. Refer to the corresponding manuals for details.

2.5.1 Controller Board Alignment

A Controller Board Alignment is performed at the factory and should not be required under normal circumstances. A large change in operating frequency, as discussed in the next section, or replacement of RF or Controller Boards may require a complete realignment operation. The Radio Programming Software and Programming Cable must be used to access these tuning modes. This operation requires that the transmitter module and amplifier be separately aligned in the following order.

Sequence	Module	Manual Reference
(1)	Transmitter Main Board	Section 2.3 of this manual,
(2)	Amplifier	Amplifier Manual

2.5.1.1 Reference Oscillator Adjustment

The reference oscillator provides an accurate frequency standard to which the transmitter's carrier signal is phase locked. To adjust the reference oscillator frequency, disconnect the RF Board from the amplifier module by separating the SMB connectors. For this test, the RF board will generate a 0 dBm RF signal from its RF output. Connect the RF output cable of the RF board to a frequency counter or communications test set. Connect the transmitter to an IBM compatible computer using the Programming Cable. Apply power to the transmitter and run the Radio Programming Software. Navigate to the TRANSMITTER \ SERVICE \ REFERENCE OSCILLATOR menu, where you will see a test frequency displayed and a slider to adjust the frequency. Click on the "ENABLE TX" button and move the slider until the frequency measured

by the frequency counter matches the test frequency displayed on the screen to within +/- 150 Hz. Click on the "UPDATE SOFTPOT" button to save the setting in the transmitter's non-volatile memory. This completes the adjustment of the reference oscillator. Leave the RF Board disconnected from the amplifier module and continue with the next alignment procedure.

2.5.1.2 Transmitter Deviation Balance Adjustment

This adjustment equalizes the modulation sensitivity of the low and high frequency modulation paths on the RF board. To perform the adjustment, disconnect the RF Board from the amplifier module by separating the SMB connectors. Connect the RF output cable of the RF board to a communications test set. Connect the transmitter to an IBM compatible computer using the Programming Cable. Apply power to the transmitter and run the Radio Programming Software. Navigate to the TRANSMITTER \ SERVICE TRANSMITTER \ DEVIATION BALANCE screen, where you will see a list of test frequencies and current SoftPot values for each frequency. YSelect the radio button next to the first test frequency and click on the "LOW PTT" button. This causes an internally generated 80 Hz tone to be applied to the modulator. Note the deviation of the carrier on the communications test set, and click on the "HIGH PTT" button. This causes a 3 kHz tone to be applied to the modulator. Adjust the slider next to the test frequency until the measured deviation matches that of the 80 Hz tone. Now click on the "LOW PTT" button again to check the deviation. If the deviation has changed from the original reading, note the new deviation and perform the adjustment at the high frequency again. It may require several iterations of this process to get the deviations to match within +/- 2%. When the deviations match, click on the "UPDATE SOFTPOT" button to save the setting in the transmitter's non-volatile memory. YRepeat the adjustment process for each of the test frequencies. Leave the RF Board disconnected from the amplifier module and continue with the next alignment procedure.

2.5.1.3 Transmitter Deviation Limit Adjustment

This adjustment prevents over-deviation of the transmitter's carrier. To perform the adjustment, disconnect the RF Board from the amplifier module by separating the SMB connectors. Connect the RF output cable of the RF board to a communications test set. Connect the transmitter to an IBM compatible computer using the Programming Cable. Apply power to the transmitter and run the Radio Programming Software. Navigate to the TRANSMITTER \ SERVICE TRANSMITTER \ ADJUST DEVIATION LIMITS menu item, where you will see a list of test frequencies and current SoftPot values for each frequency. Select the radio button next to the first test frequency and click on the "ENABLE TX" button to key the transmitter. Adjust the slider next to the selected test frequency under the measured deviation of the carrier is between 2785 Hz and 2885 Hz. Click on the "UPDATE SOFTPOT" button to save the new setting to the radio's non-volatile memory. Repeat the process for each test frequency. This completes the adjustment process for the transmitter deviation limits, and completes the alignment process for the Main Board.

2.5.2 Amplifier Alignment

The RF power output of the amplifier is set to its rated value of 2.0 Watts or 8.0 Watts at the factory. This should not require adjustment under normal circumstances. However, should it be necessary to correct the output power, follow the procedure in the Amplifier Manual. Adjustment may also be required when the transmitter's operating frequency is changed. When a large frequency change has been programmed into the transmitter, the amplifier should be aligned at the new frequency according to the Amplifier Manual.

2.5.3 Frequency Change

The transmitter is initially aligned at the factory for the frequency stamped on the 'Factory Set Operating Frequency' label (see section 3.1). This label should list the frequency at which the last complete transmitter alignment was performed. For a small frequency change, a simple channel change (see section 2.2) may be all that is required. A larger frequency change may involve the realignment of other modules. The frequency change in question is the *accumulated frequency change* in relation to the frequency stamped on the label. For example, if the frequency were changed by 0.5 MHz from that stamped on the label, then a second frequency change of 1 MHz in the same direction would result in a total change of 1.5 MHz. The action taken would be on the basis of the 1.5 MHz value. Failure to perform a realignment after a large frequency change could result in unreliable transmitter operation or transmitter operation that does not conform to the published specifications. The allowable frequency change is summarized below.

Note: It is advisable to confirm these frequency ranges with the Amplifier, as they are subject to change with updated versions. The values in the module manuals take precedent over those tabulated (following page).

Size of Frequency Change	Modules to be Aligned
less than ± 1 MHz	no alignment required, check output power
greater than ± 1 MHz	Transmitter Power Amplifier

2.6 Recommended Test Equipment List

Alignment of the transmitter requires the following test equipment or its equivalent.

Dual Power Supply:	Regulated +9.5 Vdc at 2 A. Regulated +13.8 Vdc at 2 A - Topward TPS-4000
Oscilloscope / Multimeter:	Fluke 97 Scopemeter
Current Meter:	Fluke 75 multimeter
Radio communications test set :	Marconi Instruments 2955R (analog only) Motorola R2670 with Project 25 option
Alignment Tool:	Johanson 4192

It is recommended that the radio communications test set be frequency locked to an external reference (WWVH, GPS, Loran C) so that the high stability oscillator may be accurately set to within its ±1 ppm frequency tolerance.

2.7 Repair Note

The transmitter is mainly made up of surface mount devices that should not be removed or replaced using an ordinary soldering iron. Removal and replacement of surface mount components should be performed only with specifically designed surface mount rework and repair stations complete with ElectroStatic Discharge (ESD) protection.

When removing Surface Mount Solder Jumpers, it is recommended to use solder braid in place of manual vacuum type desoldering tools when removing jumpers. This will help prevent damage to the circuit boards.

2.8 Printed Circuitboard Numbering Convention

To ease troubleshooting and maintenance procedures, Daniels Electronics Limited has adopted a printed circuitboard (PCB) numbering convention in which the last two digits of the circuitboard number represent the circuitboard version. For example:

- PCB number 43-912010 indicates circuitboard version 1.0;
- PCB number 50002-02 indicates circuitboard version 2.0.

All PCB's manufactured by Daniels Electronics are identified by one of the above conventions.

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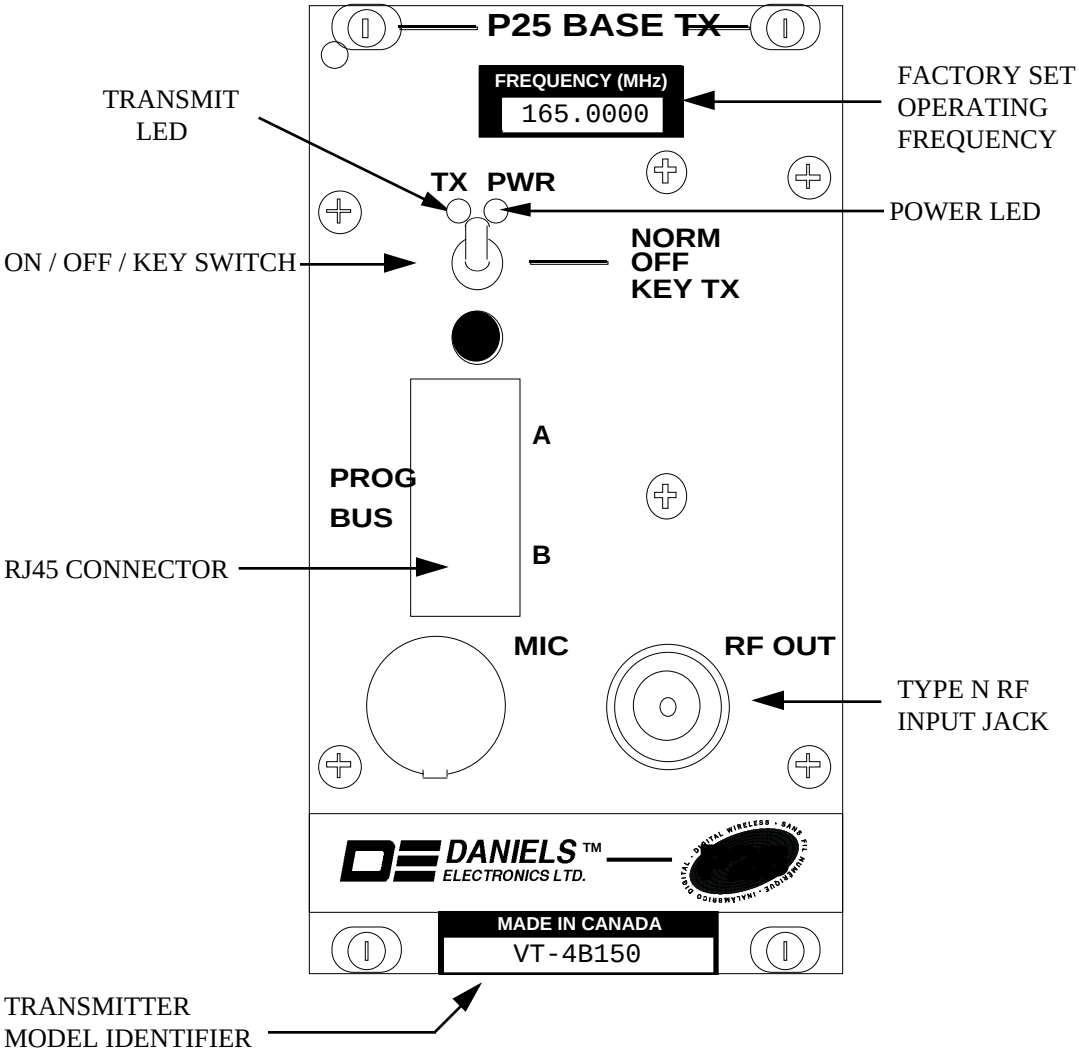
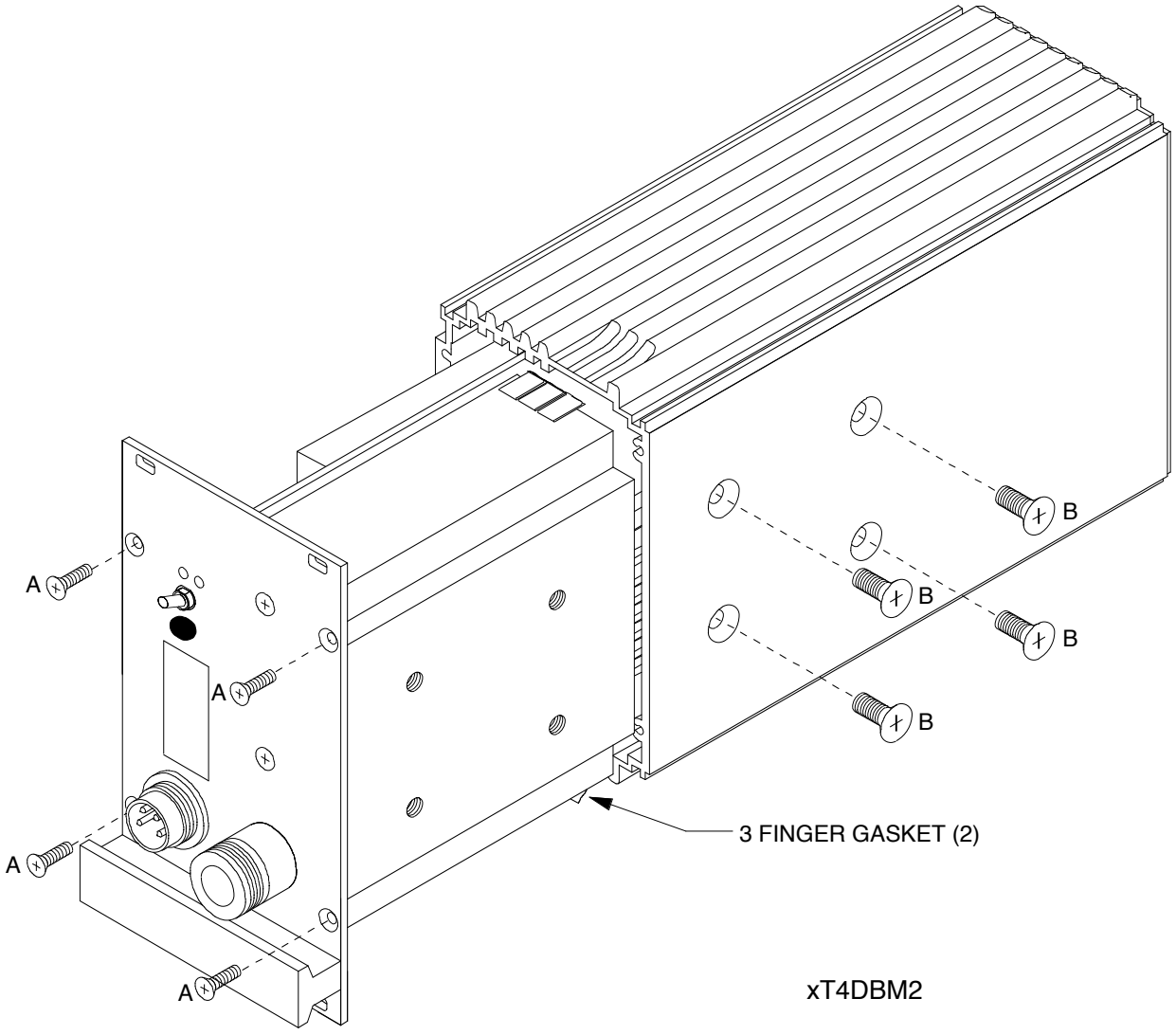
3 ILLUSTRATIONS

3.1 Digital Base Transmitter Front Panel



xT4DBM1

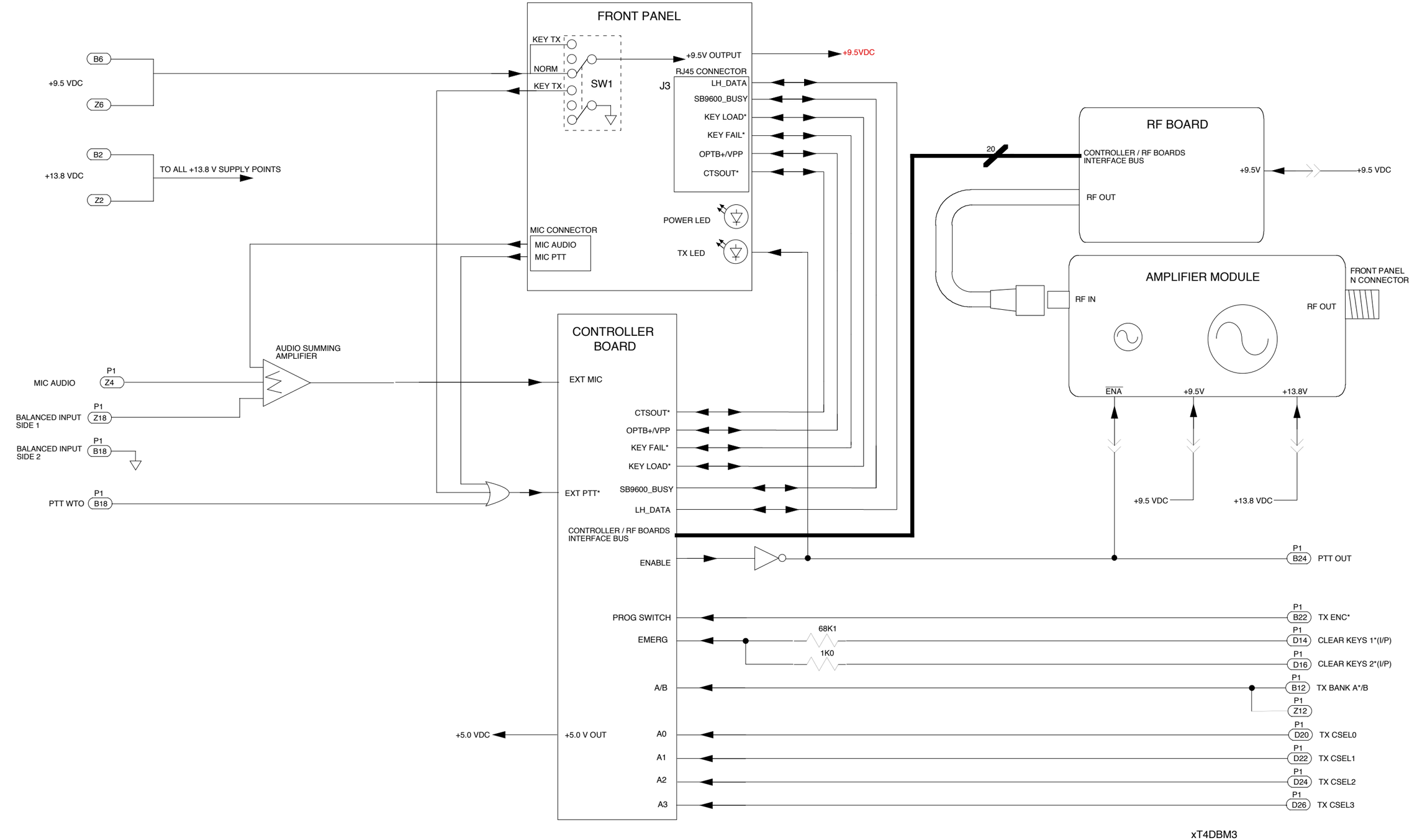
3.2 Digital Base Transmitter Case - Exploded View



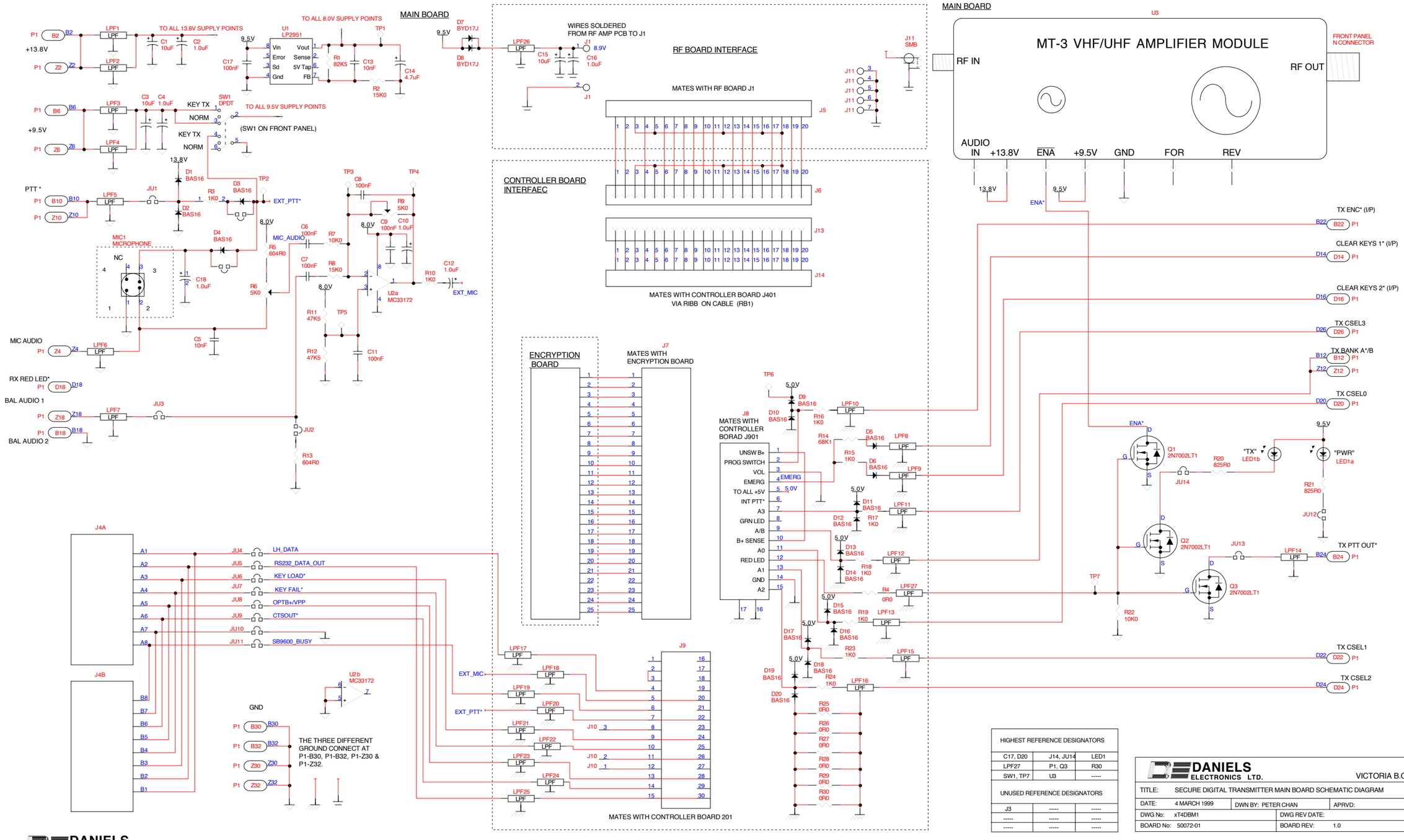
Transmitter Case Removal:

1. Remove Screws A (four M3x8mm).
2. Remove Screws B (four M5x8mm).
3. Hold Front Panel and Pull Case.

3.3 Digital Base Transmitter Block Diagram



3.4 Digital Base Transmitter Module Schematic Diagram

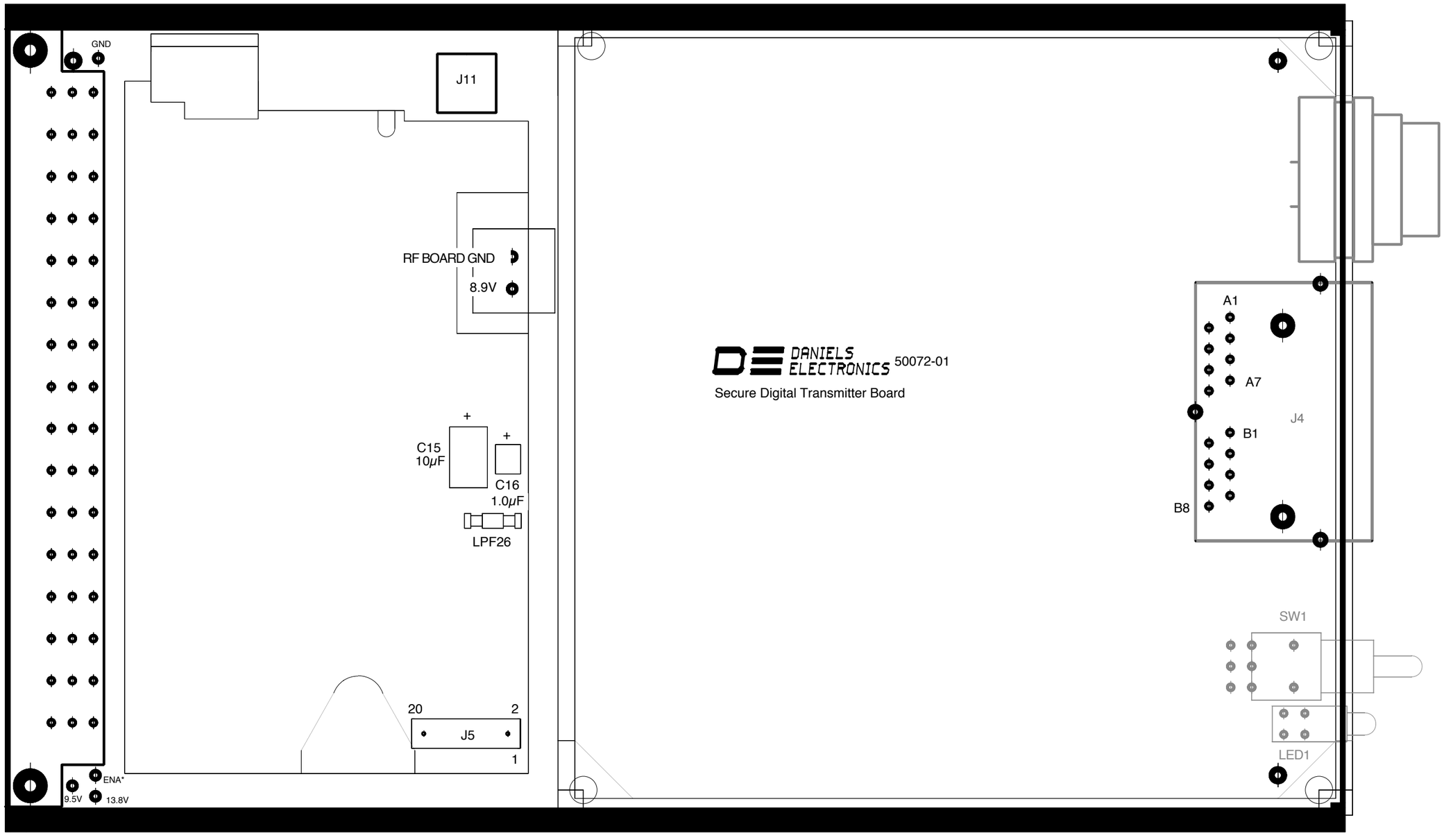


HIGHEST REFERENCE DESIGNATORS		
C17, D20	J14, JU14	LED1
LPF27	P1, Q3	R30
SW1, TP7	U3	-----
UNUSED REFERENCE DESIGNATORS		
J3	-----	-----
-----	-----	-----
-----	-----	-----

DANIELS ELECTRONICS LTD. VICTORIA B.C.

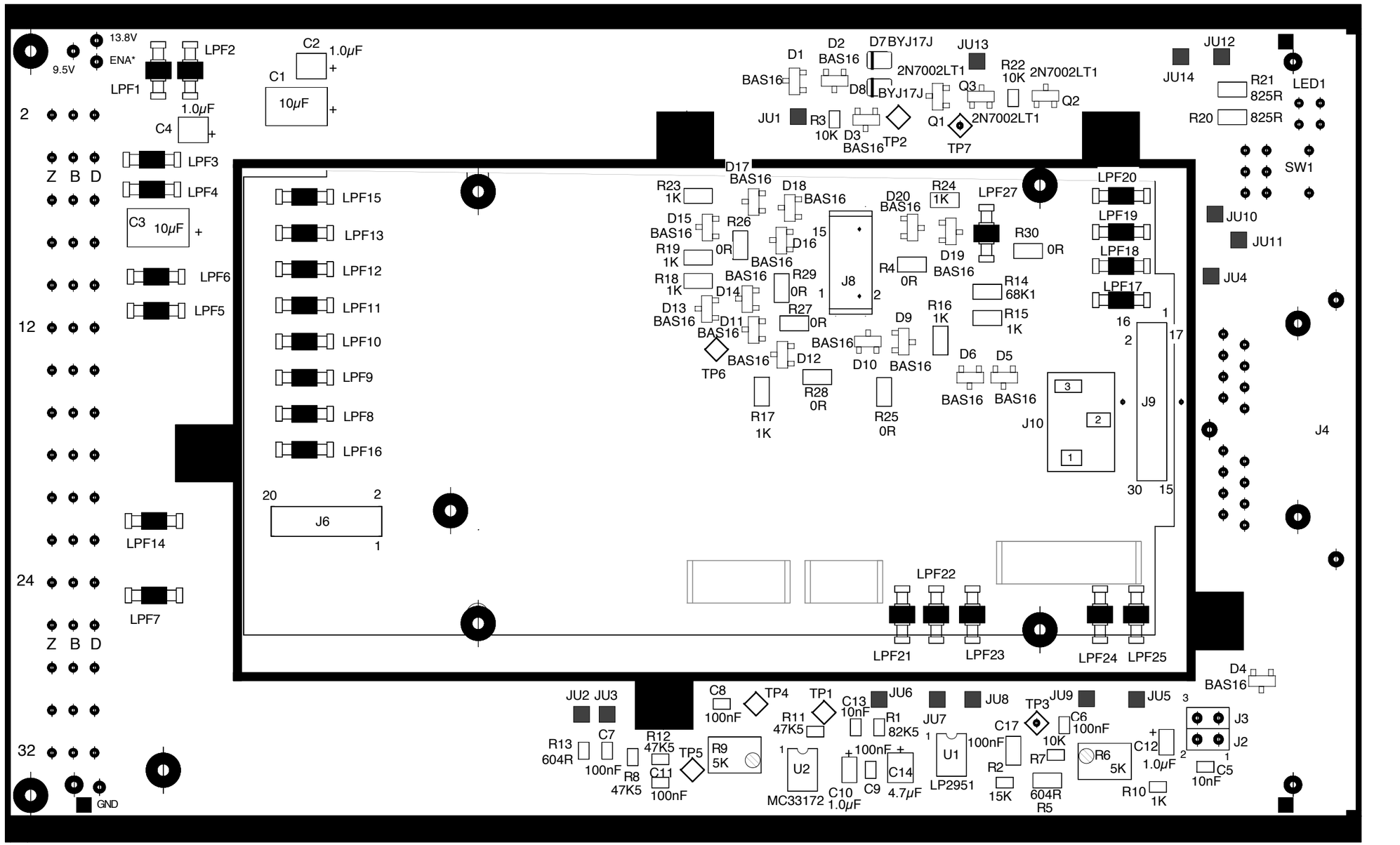
TITLE:	SECURE DIGITAL TRANSMITTER MAIN BOARD SCHEMATIC DIAGRAM	
DATE: 4 MARCH 1999	DWN BY: PETER CHAN	APRVD:
DWG No: xT4DBM1	DWG REV DATE:	
BOARD No: 50072-01	BOARD REV: 1.0	

3.5 Digital Base Transmitter Main Board Component Layout (Bottom)



xT4DBM5

3.6 Digital Base Transmitter Main Board Component Layout (Top)



Installed Jumpers

xT4DBM6

4 PARTS LIST

4.1 P25 Base Transmitter Main Board Parts List

4.1.1 P25 Base Transmitter Main Board Electrical Parts List

Ref Desig	Description	Part No.
C1	CAP., SM, 10uF TANT., 20%, 35V	1055-6D106K35
C2	CAP., SM, 1.0uF TANT., 20%, 35V	1055-5B105M35
C3	CAP., SM, 10uF TANT., 20%, 35V	1055-6D106K35
C4	CAP., SM, 1.0uF TANT., 20%, 35V	1055-5B105M35
C5	CAP., SM, 10nF CER,0805,X7R,50V	1008-4A103K5R
C6	CAP., SM, 100nF CER., 0805, X7R, 50V	1008-5A104K5R
C7	CAP., SM, 100nF CER., 0805, X7R, 50V	1008-5A104K5R
C8	CAP., SM, 100nF CER., 0805, X7R, 50V	1008-5A104K5R
C9	CAP., SM, 100nF CER., 0805, X7R, 50V	1008-5A104K5R
C10	CAP., SM, 1.0uF TANT., 20%, 16V	1055-5A105M16
C11	CAP., SM, 100nF CER., 0805, X7R, 50V	1008-5A104K5R
C12	CAP., SM, 1.0uF TANT., 20%, 16V	1055-5A105M16
C13	CAP., SM, 10nF CER,0805,X7R,50V	1008-4A103K5R
C14	CAP., SM, 4.7uF TANT., 10%, 16V	1055-5B475K16
C15	CAP., SM, 10uF TANT., 20%, 35V	1055-6D106K35
C16	CAP., SM, 1.0uF TANT., 20%, 35V	1055-5B105M35
C17	CAP., SM, 100nF CER., 1206, X7R	1008-5B104K5R
D1	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D2	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D3	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D4	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D5	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D6	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D7	DIODE, BYD17J RECTIFIER,SOD87	2101-BYD17J00
D8	DIODE, BYD17J RECTIFIER,SOD87	2101-BYD17J00
D9	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D10	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D11	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D12	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D13	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D14	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D15	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D16	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D17	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D18	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D19	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
D20	DIODE, BAS16 SWITCHING, SOT23	2100-BAS16000
J2	SOCKET, 2X2, 0.1” X 0.1”, ST, TH	TBA
J4	JACK , 8-PIN JACK PCB, MNT, DUAL PORT	TBA
J5	HEADER, 2X10, .050”X .050” PITCH, SM	TBA
J6	HEADER, 2X10, .050”X .050” PITCH, SM, RA	TBA
J8	PLUG, SM,15 CCT,1.00mm,BRD-BRD	5028-DP100S15
J9	SOCKET, 2X15, 0.025” PITCH, SM	TBA

Ref Desig	Description	Part No.
J11	CONN., SMB JACK, SM, STRHT.	TBA
LED1	LED, GREEN, BILEVEL,RA PC MNT	2017-091N12GN
LPF1	FILTER, SM, LPF1 EM1LPF, 360pF,FER	1306-T361F2D5
LPF2	FILTER, SM, LPF2 EM1LPF, 360pF,FER	1306-T361F2D5
LPF3	FILTER, SM, LPF3 EM1LPF, 360pF,FER	1306-T361F2D5
LPF4	FILTER, SM, LPF4 EM1LPF, 360pF,FER	1306-T361F2D5
LPF5	FILTER, SM, LPF5 EM1LPF, 360pF,FER	1306-T361F2D5
LPF6	FILTER, SM, LPF8 EM1LPF, 360pF,FER	1306-T361F2D5
LPF7	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF8	FILTER, SM, LPF8 EM1LPF, 360pF,FER	1306-T361F2D5
LPF9	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF10	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF11	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF12	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF13	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF14	FILTER, SM, LPF10 EM1LPF, 360pF,FER	1306-T361F2D5
LPF15	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF16	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF17	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF18	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF19	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF20	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF21	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF22	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF23	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF24	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF25	FILTER, SM, LPF6 EM1LPF, 360pF,FER	1306-T361F2D5
LPF26	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
LPF27	FILTER, SM, LPF9 EM1LPF, 360pF,FER	1306-T361F2D5
P1	CONNECTOR, F48 MALE, RA PCB	3720-6048M0RA
Q1	MOSFET, 2N7002LT1 N-CHAN,SOT23	2142-2N7002L0
Q2	MOSFET, 2N7002LT1 N-CHAN,SOT23	2142-2N7002L0
Q3	MOSFET, 2N7002LT1 N-CHAN,SOT23	2142-2N7002L0
R1	RES., SM, 82K5 0805, 1%,100ppm	1150-4A8252FP
R2	RES., SM, 15K0 0805, 1%,100ppm	1150-4A1502FP
R3	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R4	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R5	RES., SM, 604R0 1206, 1%,100ppm	1150-2B6040FP
R6	POT., SM, 5K0 12T, TOP ADJUST	1172-M20502W5
R7	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R8	RES., SM, 47K5 0805, 1%,100ppm	1150-4A4752FP
R9	POT., SM, 5K0 12T, TOP ADJUST	1172-M20502W5
R10	RES., SM, 1K0 0805, 1%,100ppm	1150-3A1001FP
R11	RES., SM, 47K5 0805, 1%,100ppm	1150-4A4752FP
R12	RES., SM, 47K5 0805, 1%,100ppm	1150-4A4752FP
R13	RES., SM, 604R0 0805, 1%,100ppm	1150-2A6040FP
R14	RES., SM, 68K1 1206, 1%,100ppm	1150-4B6812FP
R15	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R16	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP

Ref Desig	Description	Part No.
R17	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R18	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R19	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R20	RES., SM, 825R0 1206, 1%,100ppm	1150-2B8250FP
R21	RES., SM, 825R0 1206, 1%,100ppm	1150-2B8250FP
R22	RES., SM, 10K0 0805, 1%,100ppm	1150-4A1002FP
R23	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R24	RES., SM, 1K0 1206, 1%,100ppm	1150-3B1001FP
R25	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R26	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R27	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R28	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R29	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
R30	RES., SM, 0R0 ZERO OHM JUMPER,1206	1150-0B0R0000
SW1	SWITCH, TOG, DPDT ON-OFF-ON,PC,RA	TBA
U1	IC, LP2951 PROG. VOLT REG,SO-8	2305-29510N08
U2	IC, MC33172 DUAL OP AMP, SO-8	2302-33172N08
PCB	SECURE DIGITAL TRANSMITTER MAIN BOARD - 50072-01	TBA

4.1.2 P25 Base Transmitter Mechanical Parts List

Description	Part No.	Qty.
CABLE,SMB PL-SMB PL,RG316,11cm	$7910-WP0WP011	1
CASE, 14HP RF PLUG-IN, MT-3 TX	3702-62502010	1
FASTENER, QUICK RELEASE	3702-10000120	4
GASKET, BeCu,3FINGER,.25",CLIP	5630-12023250	2
HANDLE, FRONT PANEL, 14HP, GREY	3702-10000614	1
HEADER, 2X2, 0.1” X 0.1”, TH, ST	TBA	2
HOLE PLUG, .250" HOLE,NYL.,BLK	5671-250N062B	1
LABEL/LEXAN, 14HP, VHF: BLACK	3536-10131410	1
LOCKWASHER, M3, SPLIT,A2 STEEL	5814-3M0LK00S	4
MIC CONN, 4 PIN MALE, BLACK	5040-114ST0BK	1
NAMEPLATE, BLANK, 14HP, ALUM.	3702-10001214	1
NUT, PRESS,M2.5,5.6mmOD,PC MNT	5833-T2M55615	13
PANEL, REAR, POS.4, 14HP EXTRSN.	3702-63002101	1

SCREW, M2.5 x 12 FLAT/PHIL, A2	5812-2M5FP12S	9
SCREW, M3 X 6, OVAL C/S/PHIL, Ni	5812-3M0VP06N	2
SCREW, M3 X 6 PAN/PHIL, A2	5812-3M0PP06S	4
SCREW, M3 x 8,OVAL C/S/PHIL,A2	5812-3M0VP08S	4
SCREW, M5 X 8 FLAT/PHIL, A2	5812-5M0FP08S	4
SHIELD, RF BOARD, SEC DIG TX	TBA	1
SHIELD, CONTROLLER BOARD, SEC DIG TX	TBA	1
SCREW, M2.5 x 3 FLAT/PHIL, A2	TBA	4
SECURE DIGITAL TX FRONT PANEL	TBA	1
SLOTTED STANDOFF, 5mmOD, 6.5mm L,M2.5	TBA	6
STANDOFF, 5mmOD, 6mm L,M2.5	TBA	4
WIRE, TFE/STRAND., 24AWG, RED	7121-24S19362	8 CM
WIRE, TFE/STRAND., 24AWG,BLACK	7121-24S19360	8 CM

5 REVISION HISTORY

ISSUE	DATE	DESCRIPTION AND (REASON)
1	July 00	• Preliminary

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