



VS300 TRANSMITTER

TROUBLESHOOTING MANUAL

Document:NHB-VS300-TRB

Issue: 10.0 2019-01-18

Status: Standard

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The comparisons and other information provided in this document have been prepared in good faith based on publicly available information. The reader is encouraged to consult the respective manufacturer's most recent published data for verification.

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RELEASE CONTROL RECORD

Issue	Date	Reason
10.0	2019-01-18	Supports hardware NARF64I/02 and NARF64I/03. Supports software version VS SW 5.2 and higher.

SECTION 1: RESPONDING TO ALARMS

This section provides instructions you need when performing troubleshooting on the VS300 transmitter. This section includes the following topics:

- [Corrective maintenance](#)
- [Electrostatic protection - see page 1-3](#)
- [Identifying and troubleshooting an alarm - see page 1-4](#)
- [Troubleshooting tips - see page 1-27](#)
 - [AUI lockup - see page 1-27](#)
- [Replacing a suspect PWB, power supply or fan - see page 1-29](#)

If none of the procedures and alarms described in this section address your problem, contact Nautel for assistance. See [“Technical support” on page ix](#).

CORRECTIVE MAINTENANCE

Corrective maintenance procedures consist of identifying and correcting defects or deficiencies that arise during transmitter operation. Local and/or remote alarm signals are generated when a malfunction occurs. If an alarm condition is caused by a malfunction in the RF power stage, the transmitter may maintain operation at a reduced RF output level. The nature of the fault – and station policy – will dictate whether an immediate maintenance response is necessary. Fault analysis and rectification may be conducted from three different levels, with a different technical competence level required for each: on-air troubleshooting, remote or local, and off-air troubleshooting.

**CAUTION:**

The transmitter contains many solid state devices that may be damaged if subjected to excessive heat or high voltage transients. Every effort must be taken to ensure that circuits are not overdriven or disconnected from their loads while turned on.

ON-AIR TROUBLESHOOTING

On-air troubleshooting can be performed from a remote location, or locally at the transmitter site.

REMOTE TROUBLESHOOTING

Remote on-air troubleshooting consists of monitoring the transmitter's radiated signal using an on-air monitor or via a LAN connection, and observing the status of each remote fault alarm indicator. Information obtained from these sources should enable an operator to decide whether an alarm response may be deferred to a more convenient time, an immediate corrective action must be taken, or if a standby transmitter must be enabled (if one is available). It is recommended that the significance of remote indications, and the appropriate responses, be incorporated into a station's standard operating procedures. Refer to [“Identifying and troubleshooting an alarm” on page 1-4](#) to determine the remedial action for a given fault.

LOCAL TROUBLESHOOTING

Local on-air troubleshooting consists of monitoring the transmitter's integral meters and fault alarm indicators. Analysis of this data will normally identify the type of fault, and in most cases will determine what corrective action must be taken. Refer to [“Identifying and troubleshooting an alarm” on page 1-4](#) to determine the remedial action for a given fault.

The power amplifier stage contains an integral modular reserve (IMR) feature. This feature permits the transmitter to operate at a reduced RF output level when a malfunction occurs in one of its power modules. Station operating procedures will dictate whether a reduced RF output level is acceptable. When a reduced RF output level can be tolerated, replacement of the defective RF components may be deferred to a convenient time.

OFF-AIR TROUBLESHOOTING

Off-air troubleshooting must be performed when routine on-air calibration adjustments will not restore operation.

It is recommended that the transmitter's output be connected to a precision 50 Ω resistive dummy load (rated for at least the maximum transmitter power rating of 330 W) before starting off-air troubleshooting procedures. If an appropriate dummy load is not available, troubleshooting for a majority of faults can be performed with the RF power stage turned off. The transmitter may remain connected to its antenna system for these procedures.

**CAUTION:**

Reduce the RF output level to a minimal value when troubleshooting faults in the transmitter. This is particularly important when the transmitter's cover is removed - where possible overheating could occur - or when the transmitter is connected to the antenna system.

ELECTROSTATIC PROTECTION

The transmitter's assemblies contain semiconductor devices that are susceptible to damage from electrostatic discharge. The following precautions must be observed when handling an assembly which contains these devices.

**CAUTION:**

Electrostatic energy is produced when two insulating materials are rubbed together. A person wearing rubber-soled shoes, walking across a nylon carpet or a waxed floor, can generate an extremely large electrostatic charge. This effect is magnified during periods of low humidity. Semiconductor devices such as integrated circuits, field-effect transistors, thyristors and Schottky diodes may be damaged by this high voltage unless adequate precautions are taken.

ELECTRICAL DISCHARGING OF PERSONNEL

Personnel should be electrically discharged by a suitable grounding system (e.g., anti-static mats, grounding straps) when removing an assembly from the transmitter, and while handling the assembly for maintenance procedures.

HANDLING/STORAGE

An assembly should be placed in an anti-static bag when it is not installed in a host transmitter, or when it is not undergoing maintenance. Electronic components should be stored in anti-static materials.

TOOLS/TEST EQUIPMENT

Testing and maintenance equipment – including soldering and unsoldering tools – should be suitable (i.e., grounded tip) for contact with static sensitive semiconductor devices.

STRESS CURRENT PROTECTION

Every precaution should be taken to ensure the static sensitive semiconductor devices are protected from unnecessary stress current. This is achieved by ensuring that current is not flowing when an electrical connection is broken, and that voltages are not present on external control/monitoring circuits when they are connected.

IDENTIFYING AND TROUBLESHOOTING AN ALARM

You can identify an alarm locally by viewing the front panel (see [“Front panel alarm checks”](#)) or remotely by viewing the AUI’s Transmitter Status page (see [“AUI Transmitter status page checks” on page 1-7](#)).

FRONT PANEL ALARM CHECKS

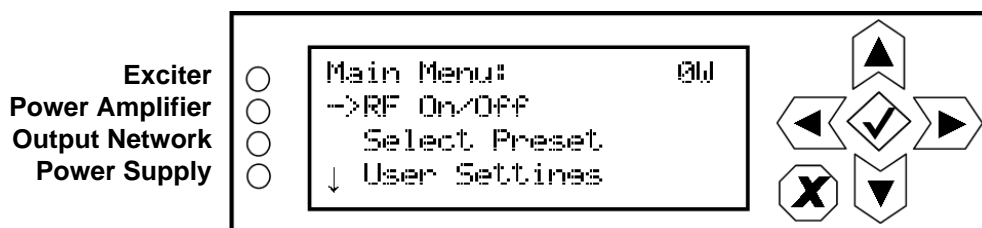
There two ways to check for alarms on the front panel:

- [Alarm/status LEDs](#)
- [View alarms screen - see page 1-5](#)

ALARM/STATUS LEDs

There are four LEDs on the left-hand side of the LCD display that provide information about the operational status of the transmitter - Exciter, Power Amplifier, Output Network and Power Supply (see [Figure 1.1](#)). The LEDs can glow green, amber or red. Typically, green indicates normal operation, amber indicates a warning, and red indicates a fault or error.

Figure 1.1: Alarm/Status LEDs



When an LED is:

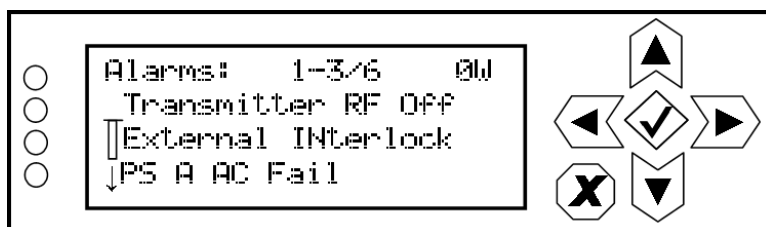
- green - transmitter is on, with no known faults.
- amber - a fault is present that may cause a reduction in RF power, but the transmitter is still producing RF power.
- red - a fault is present and the transmitter is not producing RF power.

When a fault is present, the transmitter may still produce an RF output. In this case, or if the transmitter has shut down, you should schedule and commence more in-depth fault diagnosis. See [“View alarms screen” on page 1-5](#).

VIEW ALARMS SCREEN

If an alarm exists and is currently being recognized by the transmitter system, it is displayed in the View Alarms screen (Main Menu -> View Status -> View Alarms) of the front panel Display (see [Figure 1.2](#)).

Figure 1.2: View Alarms Screen



[Table 1.1 on page 1-9](#) contains a column for most alarms that can occur, sorted alpha-numerically. The Description and Troubleshooting Action column provides a brief description of the alarm, troubleshooting tips and a cross-reference to more troubleshooting, if applicable.

1. Scroll through the View Alarms screen to view the active faults.
2. Attempt to clear any latching alarms by pressing the checkmark button in the Main Menu -> Reset Alarms screen. If the alarm persists, it will not clear from the display.
3. Locate the alarm name in [Table 1.1 on page 1-9](#) to determine the cause of the alarm and perform any recommended procedures in the Description and Troubleshooting Action column. This may also lead to replacing a suspect PWB, power supply or fan, as detailed in [“Replacing a suspect PWB, power supply or fan” on page 1-29](#).



NOTE:

Before undertaking any troubleshooting, record all meter readings and note if any other alarms are displayed on the View Alarms screen. Record all alarms.



NOTE:

*[Table 1.1 on page 1-9](#) contains a column for most **Alarms** that can occur, sorted alphanumerically for each sub-system, including both the names displayed on the AUI and, if different, the front panel UI (in parentheses).*

*The **Description and Troubleshooting Action** column provides a description of the alarm, troubleshooting tips and a link to detailed troubleshooting, as applicable.*

4. Refer also to [Table 1.2 on page 1-24](#) for *Summary* alarms that can occur - when properly configured - as remotely monitored outputs.

**NOTE:**

Table 1.2 lists the Summary alarms that can be configured for remote monitoring through the front panel UI's Main Menu -> User Settings -> Remote I/O -> Remote Outputs screen (see the "Operating the Transmitter" section of the Operations & Maintenance Manual for configuration details). Each Summary alarm can be triggered by any one alarm in a specific sub-set, as shown in [Table 1.2](#). The Description and Trigger Alarms column of [Table 1.2](#) provides a brief description of the summary alarm and a list of the triggering alarms. To determine the root cause(s) of a Summary Alarm, check the front panel UI for an offending trigger alarm and refer to its troubleshooting information in [Table 1.1 on page 1-9](#) for more details.

5. If troubleshooting and subsequent replacement of a suspect PWB or module causes the alarm to disappear from the **View Alarms** screen, the alarm has been successfully cleared. If the fault condition does not clear, contact Nautel.

AUI TRANSMITTER STATUS PAGE CHECKS

If an alarm exists and is being recognized by the transmitter (i.e., the **Status** button at the bottom of the AUI display will be red), it is displayed on the transmitter status page (see [Figure 1.3](#)). The Device name indicates the sub-system origin of the alarm. The sub-systems that can be displayed are:

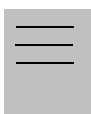
- Controller: All alarms in this sub-system apply to the controller.
- Exciter: All alarms in this sub-system apply to the exciter.

Figure 1.3: Transmitter Status Page



1. Click the **Status** button to go to the Transmitter Status page (see [Figure 1.3](#)). View the list of active faults. Alarms are listed by their origin (Device column), then by name (Alarm column), and then by severity (Level column) [single orange ! indicates low severity (RF output not affected); single red ! indicates medium severity (RF output is reduced); two red ! indicates high severity (RF output is inhibited)].
2. Attempt to clear any latching alarms by pressing the **Reset** button on the bottom banner of the page. If the alarm persists, it will not be cleared from the display.

3. Locate the alarm name in [Table 1.1 on page 1-9](#) to determine the cause of the alarm and perform any recommended procedures in the **Description and Troubleshooting Action** column. This may also lead to replacing a suspect PWB, power supply or fan, as detailed in [“Replacing a suspect PWB, power supply or fan” on page 1-29](#).

**NOTE:**

*Before undertaking any troubleshooting, record all meter readings and note if any other alarms are displayed on the **View Alarms** page. Record all alarms. Use the remote AUI's **Critical Parameters** page (Menu -> User Settings) to **Capture Meters** and **Capture Alarms**, which copies meter readings and active alarms into a spreadsheet for future reference.*

**NOTE:**

*[Table 1.1 on page 1-9](#) contains a column for most **Alarms** that can occur, sorted alphanumerically for each sub-system, including both the names displayed on the AUI and, if different, the front panel UI (in parentheses).*

*The **Description and Troubleshooting Action** column provides a description of the alarm, troubleshooting tips and a link to detailed troubleshooting, as applicable.*

4. Refer also to [Table 1.2 on page 1-24](#) for *Summary* alarms that can occur - when properly configured - as remotely monitored outputs.

**NOTE:**

*[Table 1.2](#) lists the *Summary* alarms that can be configured for remote monitoring through the remote AUI's Menu -> Remote I/O -> Remote Outputs page (see the “Operating the Transmitter” section of the Operations & Maintenance Manual for configuration details). Each *Summary* alarm can be triggered by any one alarm in a specific sub-set, as shown in [Table 1.2](#). The **Description and Trigger Alarms** column of [Table 1.2](#) provides a brief description of the summary alarm and a list of the triggering alarms. To determine the root cause(s) of a *Summary Alarm*, check the remote AUI for an offending trigger alarm and refer to its troubleshooting information in [Table 1.1 on page 1-9](#) for more details.*

5. If troubleshooting and subsequent replacement of a suspect PWB or module causes the alarm to disappear from the **Transmitter Status** page, the alarm has been successfully cleared. If the fault condition does not clear, contact Nautel.

Table 1.1: Troubleshooting Alarms

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
+1.2V Supply Fail (+1.2V Fail)	PS (red)	This alarm occurs if the +1.2 V supply on the exciter/control PWB (A1) is outside of its acceptable voltage range (between +1.1 V and +1.3 V). The VS300 takes no action on this alarm. Check for a +5V Supply Fail alarm: If present, follow the associated troubleshooting procedure. If not present, use a digital multimeter to measure between TP3 (+1.2 V) and TP4 (ground) of the exciter/control PWB. If the measured value is within the acceptable range, suspect the sampling circuitry on the exciter/control PWB (A1). If not, use a digital multimeter to measure between TP5 and TP4 (ground). The measured voltage should be between +4.5 V and +5.5 V. If the measured voltage is within the acceptable range, the power supply circuitry on the exciter/control PWB has failed. Replace the exciter/control PWB (see “Exciter/Control PWB Replacement” on page 1-41). If not, check ribbon cable W4 for damage, and verify connectors W4P1 and W4P2 are properly seated in A2J3 and A1J11 respectively. If there are no visible problems with the ribbon cable, contact Nautel for further support.
+1.8V Supply Fail (+1.8V Fail)	PS (red)	This alarm occurs if the +1.8 V supply on the exciter/control PWB (A1) is outside of its acceptable voltage range (between +1.6 V and +2.0 V). The VS300 takes no action on this alarm. Check for a +3.3V Supply Fail alarm: If present, follow the associated troubleshooting procedure. If not present, use a digital multimeter to measure between TP2 and TP4 of the exciter/control PWB. If the measured value is within the acceptable range, suspect the sampling circuitry on the exciter/control PWB. If not, the power supply circuitry has failed on the exciter/control PWB. If necessary, replace the exciter/control PWB (see “Exciter/Control PWB Replacement” on page 1-41).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
+15V Supply Fail (+15V Fail)	PS (green/ amber)	This alarm occurs if the +15 V output of the low voltage power supply (LVPS) (U3) is outside of its acceptable voltage range (between +13.5 V and +16.5 V). Use a digital multimeter to measure between +V2 and COM of the LVPS. If the measured value is not within the acceptable range, replace the LVPS (see “LVPS Replacement” on page 1-38). If the measured value is within the acceptable range, use a digital multimeter to measure the voltage between TP11 (+15 V) and TP7 (ground) of the PS distribution PWB (A2). If the measured value is not within the acceptable range, turn off ac power and use a digital multimeter to perform a continuity check across fuse F1 of the PS distribution PWB. If the measurement is greater than 1 Ω , replace F1 (Nautel Part # FA58 in the ancillary kit), restore ac power and check the alarm again. If the measurement is less than 1 Ω , or replacing F1 does not clear the alarm, suspect the connection between the +48 V power supply and the PS distribution PWB, and contact Nautel for further assistance. If the measured value is within the acceptable range, check ribbon cable W2 for damage and that W2P1 and W2P2 are properly seated in A1J12 and A2J2 respectively. If there are no visible problems with the ribbon cable, suspect the sampling circuitry on the PS distribution PWB. If necessary, replace the PS distribution PWB (see “PS Distribution PWB Replacement” on page 1-44). If the alarm persists after replacing the PS distribution PWB, suspect the exciter/control PWB (A1).
-15V Supply Fail (-15V Fail)	PS (amber)	This alarm occurs if the -15 V supply on exciter/control PWB (A1) is outside of its acceptable voltage range (between -13.5 V and -16.5 V). The VS300 takes no action on this alarm. Check for a +15V Supply Fail alarm: If present, follow the associated troubleshooting procedure. If not present, use a digital multimeter to measure between TP11 and TP7 (ground) of the exciter/control PWB. If the measured value is within the acceptable range, suspect the sampling circuitry on the exciter/control PWB. If not, use a digital multimeter to measure between TP23 and TP4 (ground). The measured voltage should be between +13.5 V and +16.5 V. If the measured voltage is within the acceptable range, the power supply circuitry on the exciter/control PWB has failed. Replace the exciter/control PWB (see “Exciter/Control PWB Replacement” on page 1-41). If not, check ribbon cable W4 for damage and that connectors W4P1 and W4P2 are properly seated in A2J3 and A1J11 respectively. If there are no visible problems with the ribbon cable, contact Nautel for further support.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
+3.3V Supply Fail (+3.3V Fail)	PS (red)	This alarm occurs if the +3.3 V supply on the exciter/control PWB (A1) is outside of its acceptable voltage range (between +3.0 V and +3.6 V). The VS300 takes no action on this alarm. Check for a +5V Supply Fail alarm: If present, follow the associated troubleshooting procedure. If not present, use a digital multimeter to measure between TP1 (+3.3 V) and TP4 (ground) of the exciter/control PWB. If the measured value is within the acceptable range, suspect the sampling circuitry on the exciter/control PWB. If not, use a digital multimeter to measure between TP5 and TP4 (ground). The measured voltage should be between +4.5 V and +5.5 V. If the measured voltage is within the acceptable range, the power supply circuitry on the exciter/control PWB has failed. Replace the exciter/control PWB (see “Exciter/Control PWB Replacement” on page 1-41). If not, check ribbon cable W4 for damage and that connectors W4P1 and W4P2 are properly seated in A2J3 and A1J11 respectively. If there are no visible problems with the ribbon cable, contact Nautel for further support.
+5V Supply Fail (+5V Fail)	PS (red)	This alarm occurs if the +5 V output of the low voltage power supply (LVPS) (U3) is outside of its acceptable voltage range (between +4.5 V and +5.5 V). Use a digital multimeter to measure between +5V and COM of the LVPS. If the measured value is not within the acceptable range, replace the LVPS (see “LVPS Replacement” on page 1-38). If the measured value is within the acceptable range, use a digital multimeter to measure the voltage between TP12 (+5 V) and TP7 (ground) of the PS distribution PWB (A2). If the measured value is not within the acceptable range, turn off ac power and use a digital multimeter to perform a continuity check across fuse F2 of the PS distribution PWB. If the measurement is greater than 1 Ω , replace F2 (Nautel Part # FA57 in the ancillary kit), restore ac power and check the alarm again. If the measurement is less than 1 Ω , or replacing F2 does not clear the alarm, suspect the connection between the +48 V power supply and the PS distribution PWB, and contact Nautel for further assistance. If the measured value is within the acceptable range, check ribbon cable W2 for damage and that W2P1 and W2P2 are properly seated in A1J12 and A2J2 respectively. If there are no visible problems with the ribbon cable, suspect the sampling circuitry on the PS distribution PWB. If necessary, replace the PS distribution PWB (see “PS Distribution PWB Replacement” on page 1-44). If the alarm persists after replacing the PS distribution PWB, suspect the exciter/control PWB (A1).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
All Power Amplifiers Inactive (All PAs Inactive)	PA (red)	This alarm indicates that the PA, pre-amp or the power supply module has failed; therefore a PA failure alarm or power supply module related alarms should also be present. If there are power supply module or pre-amp related alarms present, follow the associated troubleshooting procedure. If there are no power supply module related alarms, perform the “PA resistance checks” on page 1-32 . If there is no problem found with the PA, or the alarm still persists after replacing the damaged PA, suspect the PS distribution PWB (A2).
Analog Left Audio Low (Anlg Left Aud Low)	Exciter (amber)	This alarm indicates the analog left audio input level is too low or is not applied. The VS300 takes no action on this alarm.
Analog Right Audio Low (Anlg Right Aud Low)	Exciter (amber)	This alarm indicates the analog right audio input level is too low or is not applied. The VS300 takes no action on this alarm.
Audio Loss	Exciter (red)	This alarm, enabled by the user, indicates that the exciter's audio modulation level is below the level specified in the mod loss settings of the active preset [see page 2-72 (remote AUI) or “Mod Loss” on page 2-93 (front panel UI)] of the Operations and Maintenance Manuals to enable/disable this alarm and to configure the resulting action). Depending on the setting, this alarm could trigger a preset change, inhibit RF or have no effect (alarm only). Check the appropriate program input(s) and the mod loss setting for the preset.
Audio Processor Offline	Exciter (amber)	This alarm occurs if the exciter is configured to include an Orban Inside audio processor, but it is not communicating with the processor on the internal serial bus. Check all connections to the Orban Inside audio processor card.
Audio Processor Output Fail	Exciter (amber)	This alarm occurs if the exciter is configured to include an Orban Inside audio processor, but it is not detecting audio from the processor. Check all connections to the Orban Inside audio processor card.
Audio Shutdown	Exciter (red)	This alarm occurs if the exciter's audio processing and FM modulation code is shut down. Should display only during a software upgrade.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
Composite Audio Low (MPX Aud Low)	Exciter (amber)	This alarm indicates the composite audio input level is too low. The VS300 takes no action on this alarm.
CPLD Version Mismatch (CPLD Ver Mismatch)	Exciter (red)	This alarm indicates that the CPLD version installed on the transmitter does not match the version expected to be seen by the version of code installed on the DSP. The VS300 will not be able to turn RF on. Contact Nautel for further assistance.
Cutback Active	Output Network (amber)	This alarm occurs whenever the transmitter experiences a cutback. A cutback (reduction in power) occurs when repeated shutback alarms occur within a prescribed time period. Shutbacks occur when the transmitter's peak reflected power exceeds 2:1 due to a transient SWR condition (arc or lightning) within the output transmission line or antenna system. The transmitter shuts back and recovers to a series of cutback levels (depending on the severity of the alarm), with each level being a 1/8th reduction in power from the previous cutback level, starting from the preset setpoint. Inspect the output transmission line for punctures or damage. After repairing damage, or if no damage is found, attempt to reset the latched condition [using the remote AUI's Reset button (see “Reset:” on page 2-18 of the Operations and Maintenance Manual) or using the local front panel display (see “Resetting Alarms” on page 2-96 of the Operations and Maintenance Manual)]. If no damage can be found, suspect a fault with the output power probe PWB (A7) (see “Output power probe PWB replacement” on page 1-45).
Digital Audio Low (Digital 1 Aud Low)	Exciter (amber)	This alarm indicates the corresponding digital input level is too low and is typically accompanied by a SRC1 Unlock alarm (see its description and troubleshooting action). If no accompanying SRC alarm exists, suspect a problem with the external audio processor or studio feed. The VS300 takes no action on this alarm.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
Discharging PA Volts (Discharging PA V)	PS (red)	This alarm occurs when the transmitter has initiated a shutback sequence, and residual PA voltage energy stored in the capacitors in the power supplies and PAs is being discharged. During a shutback sequence, the RF drive to the PAs is turned off immediately after the event, and this occurs faster than the power supply modules can be inhibited. Therefore, PA voltage is still being applied to the capacitors with no drive to discharge the energy. To discharge the stored energy from the capacitors, the PA bias is increased to a discharge level after the power supplies have been inhibited. This causes the stored energy to be dissipated through dc current in the FET. This alarm should only occur with a Residual PA Volts Present alarm. See Residual PA Volts Present alarm for more information.
Entered Firmware Upgrade (Exc Firmware Upgr)	Exciter (red)	This alarm occurs when the exciter is in "firmware upgrade" mode. It should only be displayed during a transmitter software upgrade.
Exciter Offline	Exciter (red)	For use with VS-HD exciter only. This alarm occurs if the serial communication fails between the controller and the exciter, or a problem has occurred with the exciter. Check all connections to the exciter and make sure that its controller front panel power LED is on.
External Interlock Open (External Interlock)	Exciter (red)	This alarm occurs when the external interlock input wired to the exciter/control PWB (A1) is open. The VS300 will not be able to enable its RF output. Check the interlock connection between A1J2A-19 and A1J2A-20 on the rear of the transmitter. If the interlock connection is intact, check that all external interlock switches are closed. If no problem is found with the connection at the transmitter or any of the external interlock switches, suspect a problem with the interlock circuitry on the exciter/control PWB (A1).
External Mute (Ext Mute)	Exciter (red)	For use with VS-HD exciter only. This alarm occurs if the exciter has been muted (0W) by the transmitter. This is typical when the transmitter is in an "RF Off" condition, or any other condition that causes the RF drive to be inhibited (external interlock open, etc.). If this alarm persists and there are no other inhibiting alarms present, check the connections between the VSHD exciter and the VS transmitter, verify the preset settings and verify IBOC settings.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
Fan Fail	Output Network (amber)	This alarm occurs if the speed of the transmitter's cooling fan is below 3000 RPM (half of its nominal value of 6000 RPM). The VS300 will inhibit the RF output if this alarm is present. Check the connection between the fan and the interface PWB (A3). If this connection looks OK, replace the fan (see “Cooling fan replacement” on page 1-39). If the alarm still occurs after the fan has been replaced, suspect the exciter/control PWB (A1).
Forward Power Limiting (Fwd Power Limiting)	Output Network (amber)	When the High Forward Power alarm is active, the Forward Power Limiting alarm occurs if its associated threshold is exceeded (1.063 times the maximum power setting; 351 W). The transmitter will fold back the forward power each time the threshold is exceeded. This alarm occurs only if the exciter ALC cannot respond fast enough to transmitter load changes. Inspect the antenna network attached to the transmitter. If there are no major issues with the antenna network that would cause an impedance change (icing for example) suspect the output power probe PWB (A7) (see “Output power probe PWB replacement” on page 1-45).
Forward Power Low (Fwd Power Low)	Output Network (amber)	This alarm occurs if the transmitter's average forward power falls below the low forward power threshold (defaulted to 50% of the preset power level and is user adjustable) due to PA failures, fan failures, SWR foldback or a pre-amp failure. The VS300 takes no action on this alarm. Check for associated alarms, and follow the associated troubleshooting procedure if present. If no other alarms are being indicated, suspect the output power probe PWB (A7) (see “Output power probe PWB replacement” on page 1-45).
Forward Power Shutdown (Fwd Power Shutdown)	Output Network (red)	This alarm occurs if the transmitter tries to reduce the forward power below minimum (8 W) due to repeated Forward Power Limiting alarms. The transmitter latches off. See Forward Power Limiting for troubleshooting tips.
Forward Power Very Low (Fwd Power Very Low)	Output Network (amber)	This alarm occurs if the transmitter's average forward power falls below the very low forward power threshold (defaulted to 12.5% of the preset power level and is user adjustable) due to PA failures, fan failures, or SWR foldback. The VS300 takes no action on this alarm. See Forward Power Low for troubleshooting tips.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
High Forward Power (High Fwd Power)	Output Network (amber)	This alarm occurs if the transmitter's average forward power exceeds the high forward power threshold (1.036 times the maximum power setting; 342 W). This alarm occurs only if the exciter ALC cannot respond fast enough to transmitter load changes. The VS300 takes no action on this alarm. Check for associated alarms and follow the associated troubleshooting procedure, if present. If no other alarms exist, inspect the antenna network attached to the transmitter. If there are no major issues with the antenna network that would cause an impedance change (icing for example) suspect the output power probe PWB (A7) (see "Output power probe PWB replacement" on page 1-45).
High Reflected Power	Output Network (amber)	This alarm occurs if the transmitter's average reflected power exceeds the high SWR threshold (8.3 W). The VS300 takes no action on this alarm. Inspect the antenna and transmission line system for damage or de-tuning. If there are no major issues with the antenna network that would cause an impedance change (icing for example), suspect the output power probe PWB (A7) (see "Output power probe PWB replacement" on page 1-45).
High SWR Shutdown	Output Network (red)	This alarm occurs if the transmitter tries to reduce the forward power below a level that is equivalent to a 3:1 VSWR (forward power of 48 W) at the SWR Foldback threshold (reflected power of 12 W) due to a gradually degrading load match. This alarm causes the transmitter to latch off. Inspect the antenna and transmission line system for damage or de-tuning. If there are no major issues with the antenna network that would cause an impedance change (icing for example), suspect the output power probe PWB (A7) (see "Output power probe PWB replacement" on page 1-45).
Host Network Down	Exciter (amber)	This alarm indicates that the microcontroller that runs the remote interfacing applications is unable to acquire an IP address. When this alarm is present, the communication between the LAN controller (server) and the transmitter server that was once established has now been lost. It will not be possible to access any of the remote AUI functionality. Check that the Ethernet cable is properly connected to A1J8A (LAN) on the rear of the transmitter. If the alarm is still present see "Network Setup" on page 2-127 of the Operations and Maintenance Manual for information on setting up the network connection. Disable the alarm by setting DHCP to OFF and setting the IP Address to all zeroes (i.e. 0.0.0.0).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
Host Not Booted	Exciter (amber)	This alarm indicates that the controller's host has not finished booting. The remote AUI will not yet be available. Occurrence of this alarm is normal for approximately one to five minutes while the host is booting, immediately after ac power has been applied/ restored or after a software upgrade. If this alarm continues to occur more than 30 minutes after ac power has been applied to the transmitter, cycle (turn off, then on) the ac power. If the alarm persists after 30 minutes, replace the exciter/control PWB (A1) (see "Exciter/Control PWB Replacement" on page 1-41).
Host Not Responding	Exciter (amber)	This alarm indicates that the microcontroller (host) that runs the remote interfacing applications is not communicating with the transmitter's primary microcontroller (DSP). If the watchdog function is enabled, the DSP will automatically reset the host. If this alarm persists for more than 10 minutes, try cycling power (off, then on) to the transmitter. If the alarm persists, replace the exciter/control PWB (A1) if necessary (see "Exciter/Control PWB Replacement" on page 1-41).
Insufficient Fans Active (Insuf. Fans Active)	Output Network (red)	This alarm indicates that the fan in the transmitter's RF power stage is not running. This alarm causes the transmitter to shut down, and clears when the system detects a running fan in the RF power stage. See Fan Fail alarm for troubleshooting information.
Invalid HD Data	-	This alarm occurs, in FM+HD or HD mode, if IBOC data is detected from the Exgine PWB, but is not usable (all logic 0s). Digital carriers are muted. Check the IBOC data source.
Low Battery	Exciter (amber)	This alarm occurs if the backup battery voltage falls below an acceptable level (2.7 V). The VS300 takes no action on this alarm. Use a digital multimeter to measure the battery voltage (with ac power on). If the battery voltage is low, replace the battery. If battery voltage is OK, cycle ac power (off, then on). If the alarm does not clear, suspect the exciter/control PWB (A1).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
LVPS Fail (+48V Fail)	PS (red)	This alarm occurs if the output of the +48 V power supply (U4) is outside of its acceptable voltage range (between +43 and +53 V). The VS300 takes no action on this alarm. Use a digital multimeter to measure between +V and -V of the +48 V power supply. If the measured value is not within the acceptable range, replace the +48 V power supply (see “+48 V Power Supply Replacement” on page 1-37). If the measured value is within the acceptable range, use a digital multimeter to measure the voltage between TP10 (+48V) and TP7 (ground) on the PS distribution PWB (A2). If the measured value is not within the acceptable range, suspect the connection between the +48V power supply and the PS distribution PWB, and contact Nautel for further assistance. If the measured value is within the acceptable range, check ribbon cable W2 for damage and that W2P1 and W2P2 are properly seated in A1J12 and A2J2 respectively. If there are no visible problems with the ribbon cable, suspect the sampling circuitry on the PS distribution PWB. If necessary, replace the PS distribution PWB (see “PS Distribution PWB Replacement” on page 1-44). If the alarm persists after replacing the PS distribution PWB, suspect the exciter/control PWB (A1).
Mode/ Frequency Mismatch	Exciter (red)	For use with VS-HD exciter only. This alarm occurs if there is a mismatch between the operating mode or carrier frequency of the transmitter and the exciter. Suspect a possible communication problem between the controller and exciter. The alarm should clear once the transmitter transfers the preset settings to the exciter.
No 1 PPS	Exciter (amber)	This alarm occurs if the pilot phase locking to 1 PPS is enabled and the 1 PPS signal is not present. Check the 1 PPS input. If there are no problems with the 1 PPS signal and connection, suspect the exciter/control PWB (A1). The VS300 takes no action on this alarm.
No External 10 MHz (No Ext 10MHz)	Exciter (amber)	This alarm occurs if frequency locking to an external 10 MHz source is enabled and no external 10 MHz is detected. The exciter will automatically switch over to the internal 10 MHz reference, and will continue to run. Check the 10 MHz input. If there are no problems with the 10 MHz signal and connection, suspect the exciter/control PWB (A1).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
No HD Data	Exciter (amber)	This alarm occurs, in FM+HD or HD mode, if IBOC data is not detected from the VSHD exciter's Exgine PWB. Digital carriers are muted. Verify the RJ45 cable (W1) between the XMTR LINK (A1J2) connector on the rear of the VS-HD exciter and the XMTR LINK (A1J1) connector on the rear of the transmitter is seated properly. Check that the Exgine PWB is correctly powered up.
No Internal 10 MHz	Exciter (red)	This alarm occurs if no 10 MHz clock is being detected on the exciter/control PWB (A1). This alarm will cause the transmitter to shut-down and the exciter/controller PWB may not be running. Replace the exciter/control PWB (see "Exciter/Control PWB Replacement" on page 1-41).
PA Fail	PA (red)	This alarm occurs if the dc input current for the PA has fallen below a predetermined threshold (500 mA). Perform the "PA resistance checks" on page 1-32 . If there is no problem found with the PA, or the alarm still persists after replacing the PA, suspect the PS distribution PWB (A2).
PA Over Temperature (PA Over Temp)	PA (red)	This alarm occurs when the temperature as measured by RT1 exceeds 60°C (140°F). This alarm will cause the transmitter to shut down and latch off. Check for Fan Fail alarms and follow the associated troubleshooting procedure if present. If no Fan Fail alarms are present, check the transmitter's air filters and clean or replace as required (see Section 3, "Routine maintenance" of the Operations and Maintenance Manual). If the alarm persists, suspect the exciter/control PWB (A1).
PA Pwr Foldback	Output Network (amber)	This alarm occurs if the control system determines that the calculated dissipation in any FET on a PA is above the high dissipation threshold (170 W), or the forward power being asked for out of an individual PA [calculated as output power - combiner losses] is above the PA output high threshold (400 W). The forward power of the transmitter will be limited to a level such that neither of these thresholds are exceeded. Check for associated alarms. Typically, the assertion of this alarm is the result of a PA failure or removal, or a high SWR condition. If no other alarms are being indicated, contact Nautel for further support.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
PA Volts Fail	PS (red)	This alarm is for indication only, and occurs when the voltage output by the power supply module does not match what the controller thinks it should be based on the control signal it is sending to the power supply module. No action is taken on this alarm. This alarm may show up when turning RF on or off.
Pilot Unsync	Exciter (amber)	This alarm occurs if there is no synchronization between the 10 MHz and 1PPS signals. It may indicate that the GPS receiver is not detecting a signal. Check the GPS receiver and antenna. The VS300 takes no action on this alarm.
PLL Unlock	Exciter (red)	This alarm indicates that the exciter's master clock is not locked. Possible causes are an out-of-range 10 MHz input or a hardware failure on the exciter/control PWB (A1). The VS300's RF output is inhibited.
Preamplifier Fail	PA (red)	This alarm occurs if the measured pre-amp current is below 17.5 mA. The VS300 takes no action on this alarm. Try running the Bias Routine in the front panel UI's System Settings -> Calibration menu. If the alarm does not clear, replace the pre-amp PWB (see Pre-amp PWB replacement - see page 1-33). If the alarm persists, suspect the PS distribution PWB (A2).
PS A AC Fail	PS (red)	This alarm occurs if the power supply module (U2) is reporting an ac failure, indicating its ac input voltage is less than 175 V ac. The VS300 will inhibit its RF output until the alarm is cleared. Check the ac voltage applied to the power supply module. If the ac voltage is acceptable, try replacing the power supply module with a new module (see "Power Supply Module Replacement" on page 1-36).
PS A Fail	PS (red)	This alarm occurs if the power supply module (U2) is reporting a PS failure, indicating its output voltage is outside of its acceptable range. The VS300 will inhibit its RF output until the alarm is cleared. Try replacing the power supply module with a new module (see "Power Supply Module Replacement" on page 1-36). If replacing it with a new power supply module does not clear the fault, suspect the PS distribution PWB (A2) or the exciter/control PWB (A1).

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
PS A Missing	PS (red)	This alarm occurs if the power supply module (U2) is not being detected or has been removed. The VS300 will inhibit its RF output until the alarm is cleared. If there is a power supply module in the transmitter, try replacing the power supply module with a new module (see “Power Supply Module Replacement” on page 1-36). If replacing it with a new power supply module does not clear the fault, suspect the PS distribution PWB (A2).
PS A Over Temperature (PS A Over Temp)	PS (red)	This alarm occurs if the power supply module (U2) is reporting a high temperature alarm, indicating its operating temperature has exceeded its internal threshold. The VS300 will inhibit its RF output until the alarm is cleared. This alarm is most likely caused by a module fan failure or blockage. Allow the module to cool and attempt to reset the alarm. Verify the module turns on and its fan is operational. If the fan is not operational, inspect it for possible blockage. If a problem is found, replace the power supply module (see “Power Supply Module Replacement” on page 1-36). If there is no problem found, inspect the transmitter’s air filters and clean or replace as required (see Section 3, “Routine maintenance of the Operations and Maintenance Manual). If the alarm persists, try replacing the power supply module with a new module (see “Power Supply Module Replacement” on page 1-36). If replacing it with a new power supply module does not clear the fault, suspect the PS distribution PWB (A2).
Rebooted Exciter	Exciter (red)	This is an informational alarm only that is displayed when the watchdog timer reboots the transmitter’s main microcontroller (DSP). Typically, this alarm will show up after an ac power interruption.
Reboot Required (Exc Need Reboot)	Exciter (red)	This alarm indicates that exciter setup changes have been made, typically via the Hardware Configuration page of the AUI. Typically, the DSP will reboot itself automatically; however, if this alarm persists for more than five minutes, cycle the transmitter’s ac power (off, then on) to store the changes.

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
Residual PA Volts Present (Residual PA V Pres)	PS (red)	This alarm indicates that after the transmitter has turned off its RF output, it is unable to discharge the PA volts to a level that is below 3 V. This condition will not allow the transmitter to turn on its RF output; however the condition will be cleared once the PA volts reaches a level that is below 3 V. This condition will typically occur with a failed PA or power supply module. Check for associated alarms and follow the associated troubleshooting procedure, as applicable. If no associated alarms are present, suspect the PS distribution PWB (A2) or the exciter/control PWB (A1).
Running Bias Routine	-	This is an informational alarm only that is displayed when the bias routine has been initiated.
SCA1 Low	Exciter (amber)	This alarm indicates the SCA 1 input level is too low or is not applied. The VS300 takes no action on this alarm.
SCA2 Low	Exciter (amber)	This alarm indicates the SCA 2 input level is too low or is not applied. The VS300 takes no action on this alarm.
SRC1 Unlock	Exciter (amber)	This alarm indicates that no valid AES/EBU stream data is being detected on the selected AES/EBU. The VS300 takes no action on this alarm.
SWR Foldback	Output Network (amber)	<p>This alarm occurs if the transmitter's average reflected power exceeds the SWR foldback threshold (12 W) due to a gradually degrading load match. The forward power of the transmitter will be limited to a level such that this threshold is not exceeded. If the load match improves while the transmitter is producing RF output, the forward power will increase. If the transmitter folds back to a forward power that is equivalent to a 3:1 VSWR at the SWR Foldback threshold (forward power of 48 W), an SWR Shutdown alarm occurs.</p> <p>Refer to Table 1.3 on page 1-28 to determine the approximate operating forward power levels for FM+HD systems [with more aggressive (Efficiency Priority) and less aggressive (MER Priority) HD PowerBoost] at various injection levels.</p> <p>Inspect the antenna and transmission line system for damage or de-tuning. If there are no major issues with the antenna network that would cause an impedance change (icing for example), suspect the output power probe PWB (A7) (see "Output power probe PWB replacement" on page 1-45).</p>

Alarm Name AUI and (Front Panel)	Front Panel LED (color)	Description and Troubleshooting Action
SWR Shutback	Output Network (red)	This alarm occurs if the transmitter's reflected power suddenly exceeds the SWR shutback threshold, which is the reflected power that is equivalent to a 2:1 VSWR at max power (36 W) due to a transient SWR condition (arc or lightning) within the output transmission line or antenna system. Attempt to reset the latched condition by pressing Reset [using the remote AUI's Reset button (see " Reset: " on page 2-18 of the Operations and Maintenance Manual) or using the local front panel display (see " Resetting Alarms " on page 2-96 of the Operations and Maintenance Manual)]. Inspect the output transmission line for punctures or damage. If no damage can be found, suspect the output power probe PWB (A7) (see " Output power probe PWB replacement " on page 1-45). See also Cutback Active alarm.
Unsigned DSP Image (Exc Bad DSP Image)	Exciter (red)	This alarm indicates that the exciter is operating with 'unsigned code', but is otherwise operational. This alarm may only be displayed if the transmitter is operating with a 'beta' version of factory software.

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name	Description and Triggering Alarms
AC	This summary alarm is triggered if any of the following ac power related alarms occur: PS A AC Fail
Audio Loss	This summary alarm is triggered if any of the following audio loss related alarms occur: Audio Loss Audio Shutdown
Exciter	This summary alarm is triggered if any of the following Exciter related alarms occur: <div> <div> Analog Audio Left Low Analog Audio Right Low Audio Loss Audio Proc. Offline Audio Proc. O/P Fail Audio Shutdown Composite Audio Low Digital Audio Low Entered Firmware Upgrade Exciter Offline </div> <div> External Interlock Open Host Network Down Host Not Booted Host Not Responding Low Battery Missing Preset Mode/Freq. Mismatch Need Reboot For Settings No External 10 MHz </div> <div> No HD Data No Internal 10 MHz No 1 PPS Pilot Unsync PLL Unlock Rebooted Exciter SCA1/2 Audio Low SRC1 Unlock Unsigned DSP Image </div> </div>
External	This summary alarm is triggered if any of the following external alarms occur: External Interlock Open No External 10 MHz
HD	This summary alarm is triggered if any of the following digital (HD) alarms occur: No HD Data
High Reflected (Power)	This summary alarm is triggered if any of the following high reflected power related alarms occur: <div> High SWR Shutdown PA Pwr Foldback </div> <div> SWR Foldback SWR Shutback </div>
High Temperature	This summary alarm is triggered if any of the following temperature related alarms occur: <div> Fan 1 Fail High Temperature Latch </div> <div> PA Over Temperature PS A Over Temp </div>

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name	Description and Triggering Alarms		
Low Battery/Memory	This summary alarm is triggered if any of the following battery or memory related alarms occur:		
	Entered Firmware Upgrade	Low Battery	
Maintenance Required	This summary alarm is triggered if any of the following maintenance related alarms occur:		
	+15V Supply Fail	Audio Processor O/P Fail	No External 10MHz
	-15V Supply Fail	High SWR	No 1 PPS
	Audio Processor Offline	Low Battery	Pilot Unsync
Off Air	This summary alarm is triggered if any of the following off-air related alarms occur:		
	All Power Amplifiers Inactive	Need Reboot For Settings	Unsigned DSP Image
	Audio Loss	No HD Data	+1.2V Supply Fail
	Discharging PA Volts	No Internal 10MHz	+1.8V Supply Fail
	Entered Firmware Upgrade	PA Volts Fail	+3.3V Supply Fail
	External Interlock	PLL Unlock	+48V Supply Fail
	Forward Power Shutdown	Preamp Fail	+5V Supply Fail
	Insufficient Fans Active	SRC 1/2 Unlock	PS A AC Fail
	IPA Fail	Reject Shutback	PS A Missing
	IPA Output High	Residual PA Volts Present	PS A Overtemp
	IPA Output Low	SWR Shutback	PA Over Temperature
	Missing Preset	SWR Shutdown	PA 1 Fail
Output Network	This summary alarm is triggered if any of the following output network related alarms occur:		
	Cutback Active	High Forward Power	PA Pwr Foldback
	Fan 1 Fail	High Reject Power	Reject Foldback
	Forward Power Limiting	High SWR	Reject Shutback
	Forward Power Low	High SWR Shutdown	SWR Foldback
	Forward Power Shutdown	High Temperature Latch	SWR Shutback
	Forward Power Very Low	Insufficient Fans Active	
Power Amplifier	This summary alarm is triggered if any of the following power amplifier (PA) related alarms occur:		
	All PAs Inactive	IPA Output High	PA Fail
	HD PA Fault Foldback	IPA Output Low	Preamp Fail
	IPA Fail	PA Over Temperature	

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name	Description and Triggering Alarms		
Power Supply	This summary alarm is triggered if any of the following power supply related alarms occur:		
	Discharging PA Volts	PS A Over Temp	+1.8V Fail
	PA Volts Fail	Residual PA Volts Present	+3.3V Fail
	PS A AC Fail	+1.2V Fail	+48V Fail
	PS A Fail	+15V Fail	+5V Fail
	PS A Missing	-15V Fail	
Reduced Power	This summary alarm is triggered if any of the following reduced power related alarms occur:		
	Cutback Active	High Temperature Latch	
	Fan 1 Fail	PA Over Temperature	
	Forward Power Limiting	PA Pwr Foldback	
	Forward Power Low	Reject Foldback	
	Forward Power Very Low	SWR Foldback	
	HD PA Fault Foldback		

TROUBLESHOOTING TIPS

AUI LOCKUP

If the remotely accessed AUI screen stops responding, and subsequent attempts to re-access the AUI are unsuccessful, verify that all network settings are correct (see **Network Setup** in the Operations and Maintenance Manual). If all network settings are correct and the AUI continues to be inaccessible, perform the **ARM Reset** procedure in the Operations and Maintenance Manual. If the AUI is still inaccessible, try cycling (turn off, then on) the ac power. If the problem persists, contact Nautel for further assistance.

OPERATING IN FM+HD MODE WITH SWR FOLDBACK

When an SWR Foldback alarm occurs, the VS300's forward power will be reduced to a level that maintains an SWR that is below the foldback threshold. For FM+HD systems, the reduced forward power also depends on the injection level (e.g., -20 dBc, -14 dBc, etc.) and the aggressiveness of Nautel HD Power Boost [MER (less aggressive) or Efficiency (more aggressive), as set in the HD PowerBoost Priority field of FM+HD presets]. [Table 1.3](#) shows the approximate maximum forward power expectation for various FM+HD injection levels, with Efficiency and MER priority.

Table 1.3: Output Power vs SWR and FM+HD Injection Levels (-20, -14 and -10 dBc)

VSWR	Maximum Output Power (W)					
	MER Priority			Efficiency Priority		
	-20 dBc	-14 dBc	-10 dBc	-20 dBc	-14 dBc	-10 dBc
1.2:1 to 1.35:1	228	133	86	238	157	95
1.35:1 to 1.5:1	160	115	82	160	145	91
1.5:1 to 2:1	100	70	60	105	85	75
2.1:1 to 3:1	60	40	35	70	50	45

NOTE: To determine the maximum output power for other injection levels, linearly interpolate between the injection levels shown, for the effective injection level.

REPLACING A SUSPECT PWB, POWER SUPPLY OR FAN

MAINTENANCE PHILOSOPHY

Maintenance on a VS300 transmitter consists of replacing any of the PWBs, power supplies or fans identified in [Table 1.4 on page 1-30](#).

SPECIAL TOOLS AND TEST EQUIPMENT

The following tools and test equipment are required to troubleshoot a VS300 transmitter.

- Digital multimeter
- Torque screwdriver, capable of torquing up to [1.2 N-m \(11 in.-lbs\)](#). Required for installing securing hardware for PA PWB FETs and power supply connections.
- Soldering iron and desoldering tool
- VS300 station spares kit, if purchased (contains replacement PA PWBs, pre-amp/ IPA PWBs and cooling fans)
- Electrical schematics in Section 5 of this manual.
- Mechanical drawings in Section 6 of this manual.

ELECTROSTATIC PRECAUTIONS

The VS300 transmitter contains semiconductor devices that are susceptible to damage from electrostatic discharge. Be sure to follow the electrostatic precautions in [“Electrostatic protection” on page 1-3](#) at all times.

PREPARATION FOR REPLACING A PWB OR MODULE

1. Disable the VS300's RF output (RF off) and set its AC POWER switch to the off position. Disconnect all cabling from the rear of the VS300, remove the VS300 from its host cabinet and place the VS300 on a suitable work surface.
2. Based on the alarm that prompted troubleshooting, replace the appropriate PWB, module or cooling fan (see the appropriate replacement procedure in [Table 1.4 on page 1-30](#)).

**NOTE:**

If a power amplifier (PA) failure occurs, you must replace the entire power amplifier PWB, rather than an individual FET. A spare PA PWB (NAPA23/03A) is provided in the transmitter station spares kit, if purchased. To order a station spares kit contact Nautel. Failure to observe this recommendation may void your equipment warranty or cause further failures.

Table 1.4: Replacement Procedures

Module	Replacement Procedure
PA PWB	See page 1-31
Pre-amp PWB	See page 1-33
Power Supply Module	See page 1-36
+48 V Power Supply	See page 1-37
Low Voltage Power Supply (LVPS)	See page 1-38
Cooling Fan	See page 1-39
Exciter/Control PWB	See page 1-41
PS Distribution PWB	See page 1-44
Output Power Probe PWB	See page 1-45

PA PWB REPLACEMENT

See Figure MD-2 in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Before replacing the PA PWB, verify the fault is with the PA PWB by performing the continuity and resistance checks detailed in [“PA resistance checks” on page 1-32](#). If you are prompted to replace the PA PWB, return to [Step 3](#) of this procedure.
3. Unsolder and remove the three solder connections to the defective PA PWB. They include a white, 16 AWG wire (to pad B), a tinned copper jumper (to pad A or E) and either a tinned copper jumper (to pad F) or a white coaxial cable (to pads F and G).
4. Remove the two #4 screws, split and flat washers securing the FET to the heat sink.
5. Remove the four M3 screws securing the PA PWB to the heat sink. Remove the PA PWB from the heat sink, noting the proper orientation for installation of the new PA PWB. **Note** that one of the securing screws also holds thermistor **RT1** in place (see Figure MD-2 in section 6 of this manual). Temporarily move **RT1** and its associated wiring to allow removal of the PA PWB.
6. Clean the heat sink surface with a soft cloth and non-abrasive grease remover. **Do not** use any material that may scratch the heat sink surface.
7. Obtain the replacement NAPA23/03A PA PWB from the station spares kit, if purchased.

**NOTE:**

FETs are static sensitive. Handle the PA PWB in a static protected manner.

8. Spread a small amount of thermal compound (Nautel Part # HAG39, from the station spares kit), in a thin, even layer, on the top and bottom of the RT1 tab, removed in [Step 5](#). Use thermal compound to cover the threads on the M3 screw that secures RT1 in [Step 9](#).
9. Spread a small amount of thermal compound (Nautel Part # HAG39, from the station spares kit), in a thin, even layer, on the bottom of the FET flange on the new PA PWB. If the layer of thermal compound is too thick, the FET junction may operate at a higher temperature, possibly shortening the FET's lifespan.

10. Secure the PA PWB on the module's heat sink using the four screws removed in [Step 5](#). Ensure correct orientation. Re-install thermistor RT1 under the appropriate securing screw (see Figure MD-2 in section 6 of this manual). Do not tighten the four screws at this time.

**CAUTION:**

When installing FET securing hardware, you can damage the FET case if you fully tighten one screw while the other is loose. Avoid this by alternately tightening the two screws.

11. Secure the FET (Q1) with two # 4 screws, a mini-flat washer and a new split washer. Using a torque screwdriver, alternate tightening the left and right screws on each FET, a quarter turn at a time, until 6 inch-pounds (0.67 Newton-meters) of torque has been applied.
12. Tighten the four PWB screws. Use a torque screwdriver to tighten RT1's securing screw to 9 inch pounds (1.0 Newton-meters).
13. Solder the wires removed in [Step 3](#). If necessary, refer to Section 4 of this manual for wiring details for A6 through A9.
14. Re-install the transmitter's top cover.
15. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

PA RESISTANCE CHECKS

1. Using a digital multimeter, measure the resistance between each gate lead of the FET and the metal flange of the FET.
 - If the measurement is less than 14 k Ω , replace the PA PWB (see [“PA PWB replacement” on page 1-31](#)).
 - If the measurement is greater than 14 k Ω , proceed to [Step 2](#).

2. Using a digital multimeter, check the continuity between each drain lead of the FET (positive meter probe) and the metal flange of the FET (negative meter probe).
 - If the measurement is open circuit, the PA PWB is OK and does not require replacement. Continue troubleshooting and suspect a problem with an associated PWB.
 - If the measurement is not open circuit, replace the PA PWB (see “PA PWB replacement” on page 1-31).

PRE-AMP PWB REPLACEMENT

See Figure MD-1 in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter’s top cover. Retain hardware for re-installation.
2. Unsolder and remove the six solder connections to the pre-amp PWB (A5). They include a white, 24 AWG wire (to pad A), a white, 16 AWG wire (to pad B), and two coaxial cables (to pads C and D and F and G).
3. Remove the two M3 screws, Belleville and flat washers securing the clamp that secures FET Q1 to the heat sink.
4. Remove the four M3 screws securing the pre-amp PWB to the heat sink.
5. Remove the pre-amp/IPA PWB from the heat sink, noting the orientation.
6. Clean the heat sink surface with a soft cloth and non-abrasive grease remover. **Do not** use any material that may scratch the heat sink surface.
7. Obtain the replacement NAPA27A pre-amp PWB from the station spares kit, if purchased.



NOTE:

FETs are static sensitive. Handle the pre-amp PWB in a static protected manner.

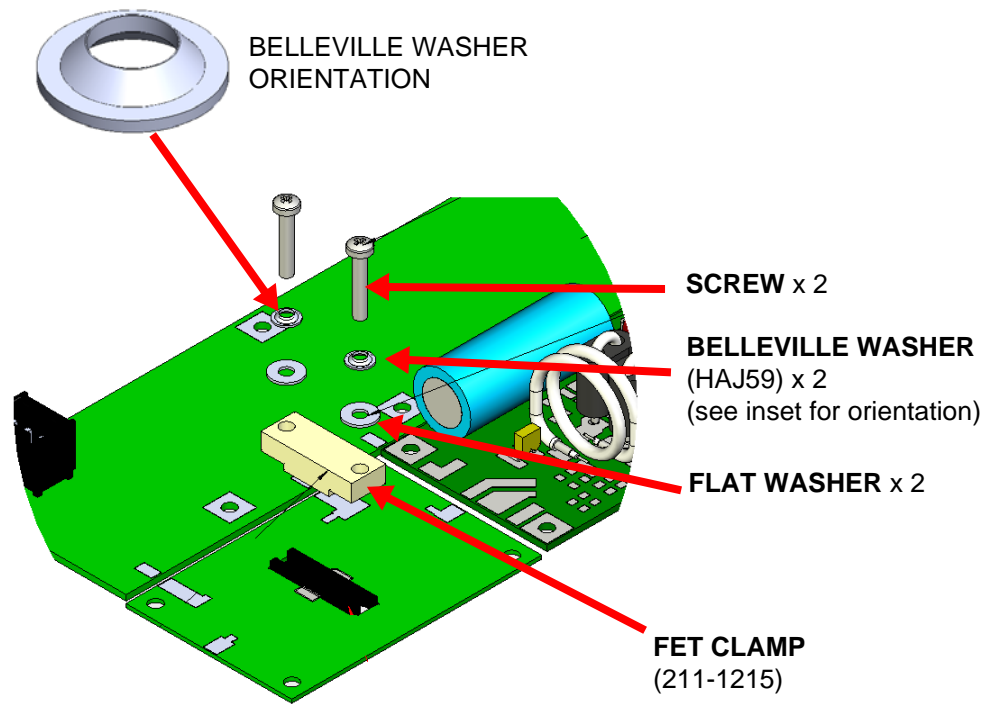
8. Spread a small amount of thermal compound (Nautel Part # HAG39, from the station spares kit), in a thin, even layer, on the bottom surface of the pre-amp/IPA PWB palette.

9. Secure the pre-amp PWB on the heat sink using the four screws removed in [Step 4](#), noting the correct orientation. Do not tighten the four screws at this time.

**CAUTION:**

When installing FET securing hardware, you can damage the FET case if you fully tighten one screw while the other is loose. Avoid this by alternately tightening the two screws.

- Install a FET clamp (Nautel Part # 211-1215) on Q1, ensuring it is parallel to the heat sink. Loosely secure the FET (Q1) with two M3 screws, two Belleville washers [use two new washers (Nautel Part # HAJ59) provided with the replacement kit, if applicable, otherwise re-use the washers removed in [Step 3](#); note orientation] and flat washers (see [Figure 1.4 on page 1-35](#)). Turn screws until they barely put pressure on the clamp.
10. Using a torque screwdriver, alternate tightening the left and right screws on each FET clamp, a quarter turn at a time, until 5 inch-pounds (0.56 Newton-meters) of torque has been applied.
 11. Tighten the four M3 PWB screws.
 12. Solder the wires removed in [Step 2](#). If necessary, refer to Section 4 of this manual for wiring details for A5.
 13. Re-install the transmitter's top cover.
 14. Re-install the transmitter in its host cabinet and reconnect all interconnect cables. Enable ac power.
 15. With RF off and the system interlock circuit intact (closed), initiate a Bias Routine using the front panel UI (see Main Menu -> System Settings -> Calibration menu; refer to the Operations and Maintenance Manual for more detail).
 16. Enable the transmitter's RF output (RF on).

Figure 1.4: Pre-amp PWB mounting hardware

POWER SUPPLY MODULE REPLACEMENT

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Remove the securing cover over the power supply module (U2) by removing four M4 screws (two on the side of the VS300, two in the bottom of the VS300). Note the orientation of the bracket for installation of the new power supply module. Retain hardware.
3. Slide the power supply module toward the front of the transmitter to disengage it from its mating connector.
4. Remove the power supply module from the transmitter.
5. Locate or obtain a replacement power supply module (Nautel Part # UG69J). Reverse [Step 1](#) through [Step 4](#) to reinstall the new power supply module.
6. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

+48 V POWER SUPPLY REPLACEMENT

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Disconnect wires # 1, 19, 20, 21 and 24 from the +48 V power supply's terminal block, noting their destinations.
3. Remove the two countersunk M3 screws that secure the +48 V power supply (U4) to the transmitter. Retain hardware.
4. Remove the +48 V power supply from the transmitter. Note the orientation for installation of the new power supply.
5. Locate or obtain a replacement +48 V power supply (Nautel Part # UG79). Reverse [Step 1](#) through [Step 4](#) to reinstall the new +48 V power supply. If necessary, refer to Section 4 of this manual for wiring details for U4. Torque all terminal connections on [U4](#) to 11 inch pounds (1.2 Newton-meters).
6. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

LVPS REPLACEMENT

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Disconnect wires # 1, 5, 12, 14, 18, 19, 20, 21, 22 and 23 from the LVPS's terminal block, noting their destinations.
3. Remove the two countersunk M3 screws that secure the LVPS (U3) to the transmitter. Retain hardware.
4. Remove the LVPS from the transmitter. Note the orientation for installation of the new power supply.
5. Locate or obtain a replacement LVPS (Nautel Part # UG80). Reverse [Step 1](#) through [Step 4](#) to reinstall the new LVPS. If necessary, refer to Section 4 of this manual for wiring details for U3. Torque all terminal connections on U3 to 11 inch pounds (1.2 Newton-meters).
6. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

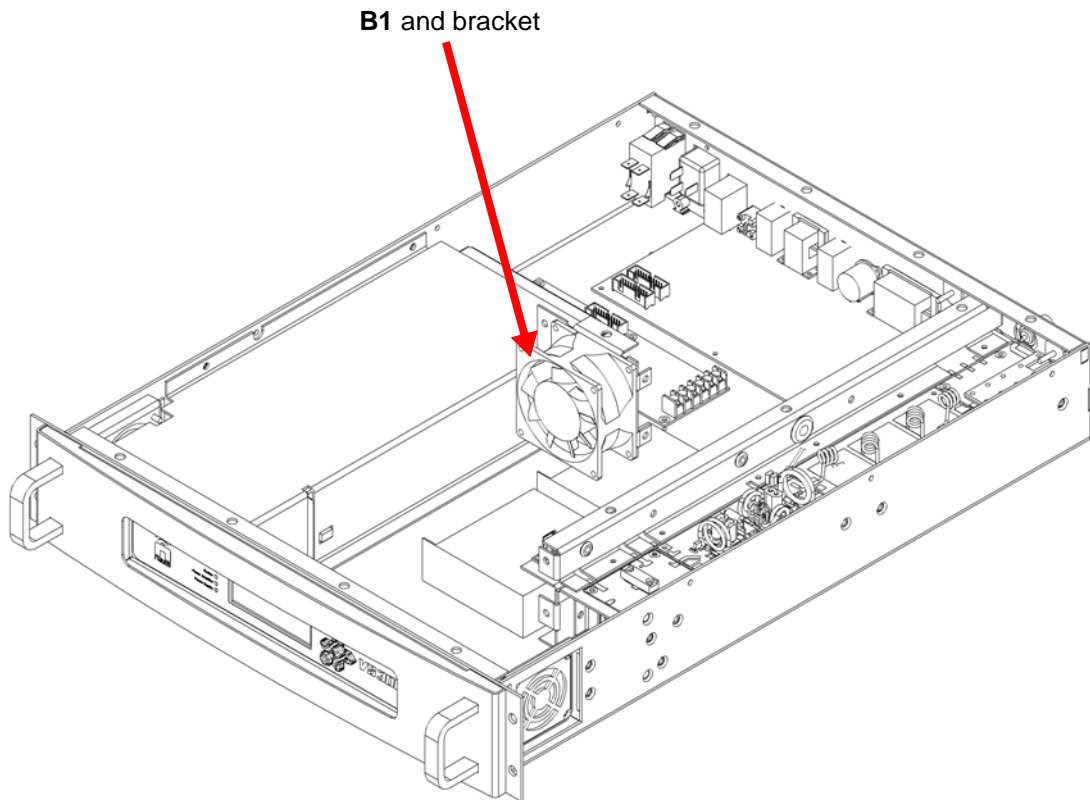
COOLING FAN REPLACEMENT

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

**CAUTION:**

Do not replace a cooling fan while ac power is applied to the transmitter. Failure to observe this could result in damage to the fan's associated tachometer circuitry.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Disconnect the fan mating plug (B1P1).
3. Remove and retain four M4 screws securing the fan bracket assembly to the transmitter chassis. Remove the fan bracket from the transmitter (see [Figure 1.5 on page 1-40](#)).
4. Remove and retain all M3 screws and other hardware that secures the fan to the mounting bracket. Note the orientation of the bracket and fan before disassembling.
5. Obtain a replacement fan (Nautel Part # ZAP50) from the station spares kit, if purchased, or a suitable equivalent (vendor part # is Minebea Motor Mfg. Co. 3115RL-07W-B79-E51).
6. Install the replacement fan on the mounting bracket using retained screws.
7. Re-install the cooling fan bracket assembly in the transmitter chassis using retained hardware.
8. Reconnect the fan mating plug to the interface PWB (A3). If necessary, refer to Section 4 of this manual for connector mating details for A3.
9. Re-install the transmitter's top cover.
10. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

Figure 1.5: Fan Bracket Removal

EXCITER/CONTROL PWB REPLACEMENT

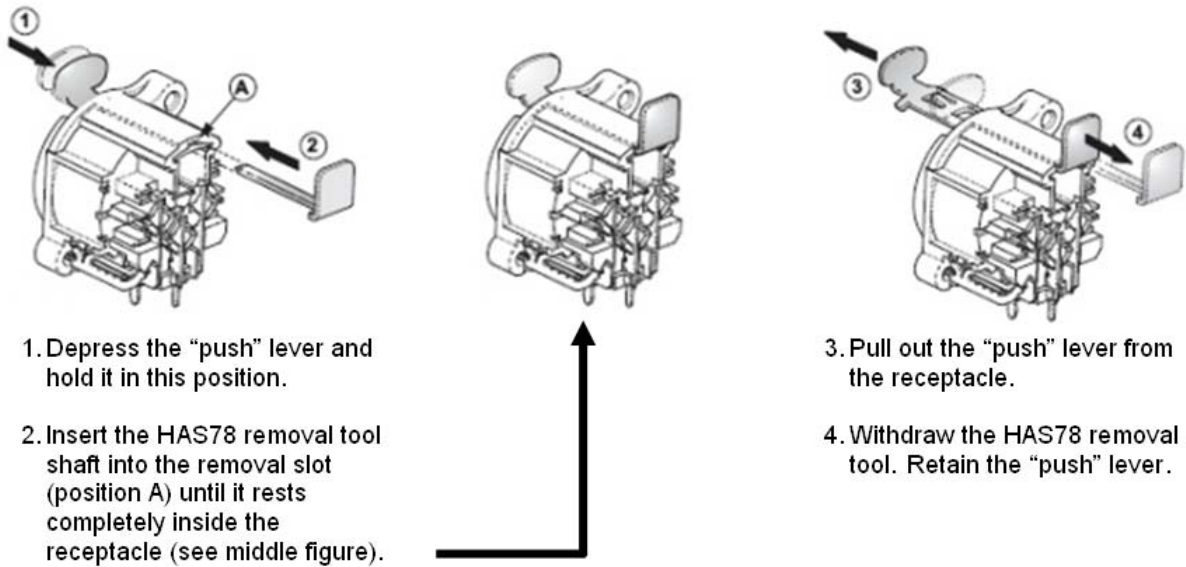
See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.



NOTE:

The exciter/control PWB is static sensitive and must be handled in a static protected manner.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Disconnect all mating plugs from the exciter/control PWB (A1), both inside the transmitter and at the rear of the transmitter.
3. At the rear panel, remove any securing hardware for connectors that protrude through the rear panel. Retain all hardware for re-installation.
 - Locate the two DB-25 connectors (J2A and J2B) and the two DB-9 connectors (J5A and J5B) on the rear panel. Using a 5 mm nut driver or socket, remove the mounting nuts.
 - Locate the AES/EBU XLR audio connector (J3) on the rear panel. Remove the two small pan-head Phillips screws.
 - Remove the silver push button connector lock ("push" lever) on the XLR connector. Locate the HAS78 removal tool from the ancillary kit, provided with the transmitter. Follow the manufacturer's instructions in [Figure 1.6 on page 1-42](#) to remove the push button. You will need access to the front and rear of the receptacle to remove it.
4. See [Figure 1.7 on page 1-42](#). Remove the locking rings from five BNC connectors (J4A, J4B, J6A, J6B and J7). To remove the locking rings, use small 4 - 6 inch slip-jaw pliers. Gently loosen (do not tightly pinch or deform) each locking ring. Typically, half a turn with the pliers will loosen a locking ring enough to remove it by hand. Remove and retain the locking rings.
5. Remove the three small Phillips screws, which mount the front of the exciter/control PWB to the chassis, located along the edge of the exciter/control PWB. Retain hardware for re-installation.

Figure 1.6: Removing the XLR connector's "push" lever**Figure 1.7: Loosening the BNC connector's locking ring**

6. Slightly lift the front edge of the exciter/control PWB and withdraw towards the front of the transmitter.
7. Locate or obtain a replacement exciter/control PWB (Nautel Part # NAPE87B). Remove the “push” lever from the XLR connector as detailed in [Step 3](#).

**CAUTION:**

When re-installing the exciter/control PWB, lift the PWB high enough so that mounting pillars do not damage parts on the underside of the PWB.

8. Install the replacement exciter/control PWB. Replace all hardware for the through-chassis connectors. Take care not to over-tighten the BNC connector locking rings.
9. Install the three Philips screws that mount the front of the exciter/control PWB to the chassis.
10. Install the “push” lever into the XLR connector. Align it with the slot located on the top section of the connector body and gently press it into position.
11. Reconnect all internal and external cables to the exciter/control PWB. If necessary, refer to Section 4 of this manual for connector mating details for A1.
12. Remove the “Interlock” jumper, if applicable, from J2A of the original exciter/control PWB and reinstall it on the new exciter/control PWB between J2A pins 19 and 20.
13. Reinstall the transmitter’s top cover.
14. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power. The new exciter/control PWB is shipped with all standard or default power presets and audio settings. Check and restore them to your specific site requirements.
15. Locate the scale factor date recorded during transmitter commissioning (see Section 8 of the *Installation Manual*) and go to the Main Menu -> System Settings -> Factory Settings -> Calibration -> Cal Values screen. Enter the recorded scale factor values in the Fwd Scale and Rfld Scale screens.

PS DISTRIBUTION PWB REPLACEMENT

**NOTE:**

The PS distribution PWB is static sensitive. Handle it in a static protected manner.

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Temporarily remove the power supply module (U2) from the transmitter (see [“Power Supply Module Replacement” on page 1-36](#)).
3. Disconnect ribbon cable plugs W2P2 and W4P1 and quick-disconnects P5 and P6 from the PS distribution PWB (A2). Remove the seven wires # 2, 3 (jumper between TB1-1 and TB1-3), 4, 18, 22, 23 and 24] connected to terminal E3 and terminal block TB1.
4. Remove the two screws that secure the cover to connector A2J1. Retain the cover and screws.
5. Use a 5.5 mm nut driver to remove the M3 nuts, split and flat washers that secure the PS distribution PWB to the transmitter. Retain hardware.
6. Remove the PS distribution PWB from the transmitter.
7. Locate or obtain a replacement PS distribution PWB (Nautel Part # NAPS40). Reverse [Step 1](#) through [Step 6](#) to reinstall the new PS distribution PWB. If necessary, refer to the Wiring Lists section (Section 4) for wiring and connector mating details for A2. Torque connections on TB1 to 6 inch pounds (0.67 Newton-meters). Torque connection on E3 to 20 inch pounds (2.24 Newton-meters).
8. Reinstall the transmitter's top cover.
9. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

OUTPUT POWER PROBE PWB REPLACEMENT

See Figure MD-1 (top view) in the Mechanical Drawings section (Section 6) of this manual.

1. Remove the transmitter's top cover. Retain hardware for re-installation.
2. Remove the four screws securing the RF output connector to the transmitter.
3. Unsolder the tinned copper wire connection between the RF OUT (J3) connector and pad F of the output power probe PWB (A7). Pull the RF OUT (J3) connector out of the transmitter.
4. Disconnect the remaining tinned copper wire jumpers connected to pads A, B, C and D and disconnect the two coaxial cables connected to pads J/K and M/L.
5. Remove the four M3 screws that secure the output power probe PWB to the transmitter chassis and remove the 10 M3 screws that secure the output power probe PWB's cover and stiffening plate.
6. Remove the stiffening plate, noting its orientation for reassembly.
7. Remove the four screws that secure the LPF PWB (A6).
8. Without removing any connections to the LPF PWB, lift up and hold the LPF PWB to allow removal of the output power probe PWB and its cover from under the crimp of RF MONITOR (J2) BNC connector. If necessary, remove thermistor RT1 from the PA PWB (A5) (see RT1 removal information in [“PA PWB replacement” on page 1-31](#)). While holding up the LPF PWB, be careful not to bend the windings of the coils on the LPF PWB or to apply excessive pressure to connections on pads A and B of the LPF PWB or on pads C and D of the PA PWB.
9. Locate or obtain a replacement output power probe PWB (Nautel Part # NAPP06). Reverse [Step 1](#) through [Step 8](#) to reinstall the new output power probe PWB. If necessary, refer to the Wiring Lists section (Section 4) for wiring details for and any other connections removed.
10. Re-install the transmitter's top cover.
11. Re-install the transmitter in its host cabinet, reconnect all interconnect cables and restore operation by enabling ac and RF power.

SECTION 2: DETAILED CIRCUIT DESCRIPTIONS

Refer to the functional block diagram: **“Block Diagram - VS300 Transmitter”** on [page 1-7](#) and high level descriptions of the *VS300 Operation and Maintenance Manual*.

This section provides a detailed description of the transmitter’s key modules and assemblies, including:

- [Exciter/control PWB \(NAPE87B\)](#) - see [page 2-1](#)
- [PS distribution PWB \(NAPS40\)](#) - see [page 2-2](#)
- [Pre-amplifier PWB \(NAPA27A\)](#) - see [page 2-3](#)
- [Power amplifier PWB \(NAPA23/03\)](#) - see [page 2-3](#)

VS300 ELECTRICAL SCHEMATICS

The descriptions in this section all refer to the VS300 electrical schematics listed in [Table 5.1](#) on [page 5-4](#) of the *VS300 Troubleshooting Manual*.

EXCITER/CONTROL PWB (NAPE87B)

Detailed theory for the exciter/control PWB (A1) is not included in this manual.

PS DISTRIBUTION PWB (NAPS40)

See electrical schematic Figure SD-3.

INTERFACING

The PS distribution PWB provides the interface between the VS300's power supplies and the rest of the transmitter. It passes:

- ac voltage from the AC INPUT (U1) to the power supply module (U2).
- PA voltage from the power supply module (U2) to the power amplifier (PA) PWB (A5).
- Pre-amp voltage (+48 V) from the +48 V power supply (U4) to the pre-amp PWB (A4) [via the exciter/control PWB (A1)].
- +15 V and +5 V voltages from the LVPS module (U3) to the exciter/control PWB (A1).
- Power supply control voltage and power supply inhibit signal from the exciter/control PWB (A1) to the power supply module (U2).

POWER SUPPLY VOLTAGE MONITORING

10-bit ADC IC U2 accepts several power supply related inputs (PA volts, PA current, pre-amp current, +48 V, +15 V and +5 V) and converts them to a digital data stream on the *MISO* ADC output (J2-2). This output is applied to the exciter/control PWB for monitoring and protection purposes.

POWER SUPPLY MODULE FAULT MONITORING

8-bit shift register IC U1 accepts the status and alarm signals from the power supply module (U2) (PS present, PS ac fail, PS temp and PS fail) and converts them to a serial data stream on the *MISO 165* output (J2-4). This output is applied to the exciter/control PWB for monitoring and protection purposes. If a power supply module fault occurs, the exciter/control PWB will inhibit the power supply module via the *PS Inhibit* input (J2-6).

FAN ENABLE

Transistor Q1, FET Q2 and associated components form a fan enable circuit that controls the application of power supply voltage (+48 V) to the cooling fan (B1). When the transmitter's RF status is 'on', the *Fan Enable* input (J3-2) is logic high and transistor Q1 turns on. This causes FET Q2 to turn on, allowing +48 V to be applied to the *Fan V +* outputs (J3-11, 12 and 13), enabling fan B1. When the transmitter's RF status is 'off', transistor Q1 turns off. This causes FET Q2 to turn off, preventing +48 V from being applied to the *Fan V +* outputs; hence disabling the fan.

PRE-AMPLIFIER PWB (NAPA27A)

See electrical schematic Figure SD-4.

The pre-amplifier PWB (A4) accepts the RF output of the exciter/control PWB (A1) or external source and amplifies it to an intermediate RF drive level for application to the PA PWB (A5). It contains an N-channel FET (Q1) and associated components configured as an RF power amplifier. The RF output is controlled by the *Pre-amp V* level generated by the PS distribution PWB (A2), and the *Pre-amp Bias* output from the exciter/control PWB (A1). Cooling air for the pre-amp PWB is provided by fan B1.

The *RF Drive* input is applied to the gate of FET Q1 through a series of micro-strip transmission line sections and capacitors C1 and C5 and inductor L1, which provide impedance matching to transform the 50 ohm input to low impedance for application to Q1. Additional micro-strip transmission line sections at the output of Q1, as well as inductors L7 and L8 and capacitors C16 and C17, impedance match the *RF Output* signal to 50 ohms.

The *Pre-amp V* input is applied to capacitors C9, C11 and C15, which act as a broadband decoupling network. Capacitor C14 and inductors L4 and L6 provide low-pass filtering of the RF signal back to the ac-dc power stage.

The *Pre-amp Bias* input voltage is provided by the exciter/control PWB to establish a dc bias current for Q1. The bias current depends on the operating mode.

POWER AMPLIFIER PWB (NAPA23/03)

See electrical schematic Figure SD-5.

Each power amplifier (PA) PWB (A6 through A9) accepts the RF output of the pre-amp/IPA PWB (A5), which has been split four ways by the splitter PWB (A4), and amplifies it to its RF output level. Each PA PWB is a push-pull, RF power amplifier that is capable of providing 350 W of RF power in the FM broadcast band (87.5 to 108.0 MHz). The RF output is controlled by the *PA V* level generated by the power supply module, the *PA Bias* output from the exciter/control PWB (A1), and the RF drive level generated by the IPA PWB. Cooling air for the PA PWBs is provided by fans B1, B2 and B3.

The *RF Drive* input is applied to cable T1, which is connected as a balun to provide balanced, 180° out-of-phase, RF drive signals to the individual gates of dual N-channel power MOSFET (Q1). Cables T2:A and T2:B, as well as capacitors C2, C6, C7 and C17, inductor L2 (part of R12/R13 leads) and resistors R5, R8, R9, R10, R12 and R13 provide impedance matching, which transforms the 50 ohm input to low impedance for application to Q1. The PA voltage is

applied to the individual drains of Q1 via inductors L4 and L5, which provide proper resonating reactance for Q1's output. Cable T3:A and T3:B transform the impedance at the RF output, ensuring an optimum (low) impedance is presented at Q1's output. Cable T4 converts the balanced RF signal to an unbalanced RF Output signal.

The *PA V* input is applied to capacitors C1, C3, C5, C8 and C11, which act as a broadband decoupling network. Capacitor C13 and inductor L3 provide low-pass filtering of the RF signal back to the ac-dc power stage.

The *PA Bias* input voltage is provided by the exciter/control PWB to establish a dc bias current for Q1. The bias current depends on the operating mode.

SECTION 3: PARTS LISTS

PARTS INFORMATION

This section contains reference designation lists that provide descriptive and provisioning information for all electrical and mechanical parts that have an assigned reference designation and form a part of the subject equipment.

FAMILY TREE

Figure 3.1 depicts the family tree for the subject equipment. It is based on the descending order of the reference designation hierarchy and identifies all assemblies that have an assigned Nautel configuration control number.

HOW TO LOCATE INFORMATION ABOUT A SPECIFIC PART

To locate the information for a specific part, the assigned reference designation for the part must be known. In addition, the Nautel nomenclature (e.g., NAPA23/03A) assigned to the assembly containing the part or the full reference designation, including the reference designation of all higher assemblies, must be known.

WHEN THE NAUTEL NOMENCLATURE IS KNOWN:

- Refer to the family tree ([Figure 3.1 on page 3-4](#)) and identify the block(s) associated with the Nautel nomenclature. Locate the part's reference designation in the identified reference designation list in this section, noting they are sorted alphanumerically.

WHEN THE REFERENCE DESIGNATION IS KNOWN:

- Refer to the family tree depicted in [Figure 3.1 on page 3-4](#) with the full reference designation.
 - Follow the family tree branches to the block that represents the lowest level assembly assigned a Nautel configuration control number, then locate the reference designation information for that Nautel configuration control number.
 - Locate the part's reference designation and associated Nautel Part # in the list provided at the end of this section. In a PDF manual, use Ctrl-F (find) to quickly locate the reference designation.
-

REFERENCE DESIGNATION LISTS

Reference designation lists are provided for:

- assemblies with an alpha-prefixed Nautel nomenclature (e.g., NAPA23/03A)
- cable harnesses with a numbered Nautel part (e.g., 211-8004-01)
- optional kits with a numbered Nautel part

To obtain the full reference designation for a specific part the Nautel configuration control number must be located in the family tree ([Figure 3.1 on page 3-4](#)) to include the reference designation of all higher level assemblies. The reference designation lists are presented in alphanumeric order - for each component level of the transmitter - are divided into columns to aid in locating specific information.

COLUMN CONTENT

The following paragraphs provide an explanation of the purpose and contents of each column in the part number indexes.

COMPONENT LEVEL, STOCK CODE COLUMN

This column contains the *Component Level* number (01 through 10, as required) and the Nautel *Stock Code* (part number) assigned to each part.

COMPONENT LEVEL

This number represents the level of a component in relation to the highest level parts list. In this case the highest level parts list is the VS300's overall parts list, or the top block in the family tree shown in [Figure 3.1 on page 3-4](#) to determine where to locate its part information.

Components that are directly descended from the highest level parts list are component level 01. The associated stock code and description for level 01 items appear in bold text in the reference designation list, followed by their sub-assembly components, as applicable. Level 01 items are sorted alphanumerically.

Components that are directly descended from component level 01 items are component level 02. The associated stock code and description for level 02 items appear below their associated level 01 component, slightly indented, followed by their sub-assembly components, as applicable. Level 02 items are sorted alphanumerically.

Component level 03 through 10 items, as applicable, descend similarly to component level 02 items, with continuing indentations to identify each new level.

STOCK CODE

This number is Nautel's drawing number for Nautel manufactured parts, Nautel's configuration control number for assemblies that are under configuration control management, or Nautel's inventory management number for purchased parts. When a Nautel configuration control number (e.g., NAPA*) is shown in this column, its sub-assembly reference designation items are listed below it.

Note: This section includes Nautel part numbers only. It does not include original equipment manufacturer (OEM) information (i.e., vendor part numbers). Some vendor information is provided in the Responding to Alarms section of this manual, otherwise contact Nautel to order a replacement part or to request assistance to find a suitable replacement.

DESCRIPTION COLUMN

The *Description* column contains the name and descriptive information for each part. The key word is presented first, followed by the adjective identifiers.

REFERENCE DESIGNATION COLUMN

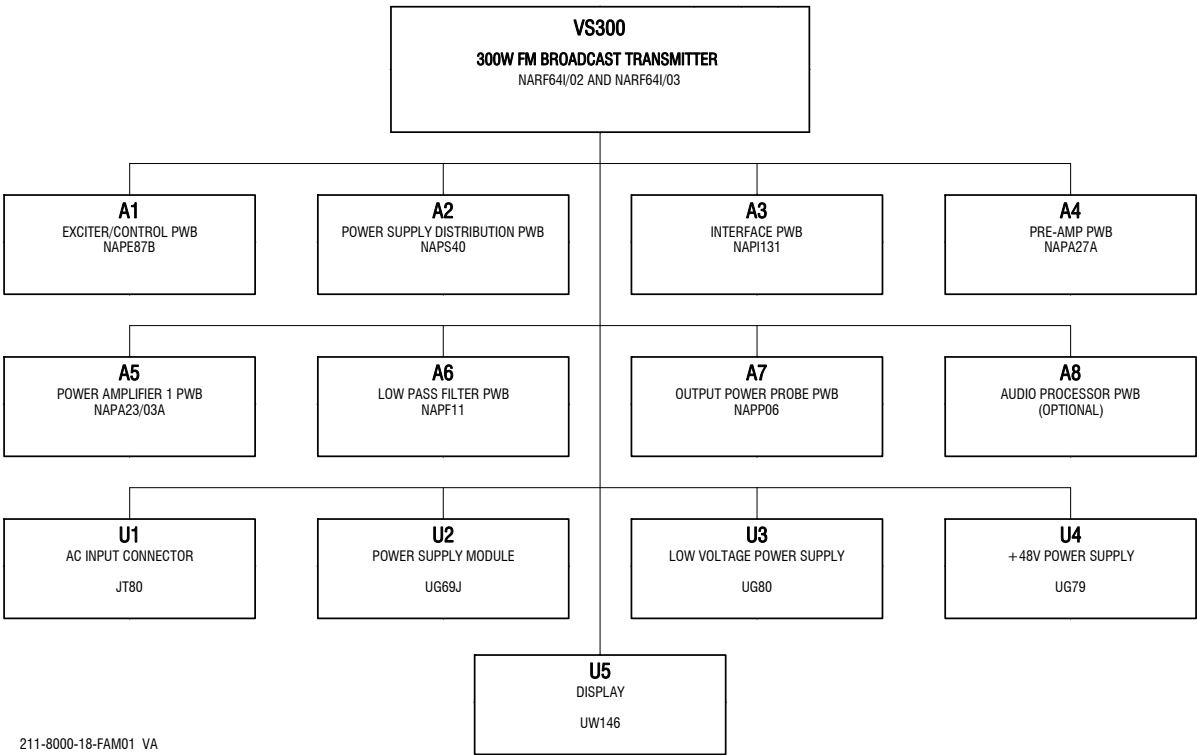
The Reference Designation column contains the reference designation(s) for a specific part. When multiple reference designations apply to a part, they are sorted alphanumerically. These designations are assigned in accordance with the requirements of American Society of Mechanical Engineers ASME Y14.44-2008.

COMMON ABBREVIATIONS/ACRONYMS

The following abbreviations/acronyms may appear in the *Description* column:

- SMT: Denotes item is designed to be installed using Surface Mount Technology.
- MTA: Denotes item is a Mass Termination Assembly connector.
- SIP: Single In-line Package
- DIP: Dual In-line Package
- IDC: Denotes item is an Insulation Displacement connector for ribbon cable.

Figure 3.1: VS300 Family Tree



StockCode: NARF64I/02

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
01	200-5112	USB Mod, Programmed VS (Handbook)	
01	211-8004-04	Cableset Assy - VS300	
02	HAM69	Conn,Quick-Dis,F,1/4 Tab 14-16 Shrink	P01, P02, P05, P06, P07, P08
02	HS60	Connector, Quick-Dis, F, 1/4 TAB, 12-10	P03, P04
02	JDP24	Conn, Coax, BNC, Plug, 50ohm, Crimp	W5P1
02	JN61	Conn, 16 Pin, Dual Row Crimp	P09
02	JP45	Conn, Recept, Ribbon Cable, 20 pin	W2P1, W2P2, W4P1, W4P2
02	JP51	Conn, Recept, Ribbon Cable, 40 pin	W1P1, W1P2
02	JT60	Conn, Coax, BNC, Recept, Bulkhead, RG188	J01, J02
02	JU02	MTA, Standard Dust Cover, 4 pi n	P10
02	JU27	MTA, Keyed Closed End Housing, 4 pin,22AWG	P10
02	JU58	Conn, Contact for Socket DF11, 22AWG	P09
01	211-8972-06	Packing Supplies, VS300	
02	211-8005-08	Ancillary Kit (VS300, VS1, VS2.5)	
02	211-8978-05	Installation Kit, VS300/VS1	
03	211-5060	Interlock Jumper Wire	
01	CBP08	Capacitor, Feed-Thru, Ceramic, 1000pF	C01
01	JDP21	Conn, Coax, N, Recept, Panel, 50ohm	J03
01	JT80	Conn,Recept,AC,250V,20A, Quick-Dis	U01
01	NAPA23/03A	PA PWB Assy, VS Series	A05
02	CAP16	Capacitor, Ceramic, 1.0uF 100V	C05, C08
02	CAP81	Cap, Electrolytic, 1000uF, +/- 20%, 63V Radial Lea	C16
02	CCG04	Capacitor, Ceramic, 0.01uF 10% 100V	C10
02	CT38	Capacitor, Metal, Polyester, 1 0uF 100V	C01, C03
02	CT47	Capacitor,SMT,Ceramic,15pF,50V ,5%	C02, C17
02	CT48	Capacitor,SMT,Ceramic,56pF,50V ,5%	C07
02	CT49	Capacitor,SMT,Ceramic,100pF,50 V,5%	C06
02	CT50	Capacitor,SMT,Ceramic,0.01uF, 100V,10%	C09, C12
02	CT51	Capacitor,SMT,Ceramic,0.1uF, 100V,10%	C11
02	CT52	Capacitor,SMT,Ceramic,470pF, 200V,10%	C13
02	CT53	Capacitor,SMT,Ceramic,0.001uF, 50V,10%	C14, C15
02	LA42	Core, Ferrite, 2 hole, 4B1 mtl	L01
02	LA45	Core, Ferrite, 2 Hole, K Mtl	L06, L07

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<u>Component Lvl. StockCode</u>		<u>Description</u>	<u>Reference Designation</u>
02	LA50	Inductor, Horseshoe, used with PA NAPA16 & 20	L04, L05
02	LA51	Inductor, used with PA NAPA16 & 20	L03
02	QAP58	Transistor, (BeO), FET, N Channel, Dual	Q01
02	RAD39	Resistor, SMT, MF, 15K Ohms, 1%, 1/4W	R01, R02
02	RAD45	Resistor, SMT, MF, 47.5K Ohms, 1% 1/4W	R11
02	RAD50Z	Resistor,SMT,MF,20ohms, 1%,2W	R03, R04, R05, R08, R09, R10
02	RBP01	Resistor, Film, 10 Ohms, 5%, 2 W	R12, R13
02	WB05	Wire, 16 AWG, Stranded, White	L01
02	WE38	Cable, Coax, 50ohm, Strand, RG 188A/U	T01
02	WE46	Cable,Coax,50 ohm,82.5% VP,SR Jacket,NEWcel-GX16	T04
02	WF17	Wire, 22 AWG, Stranded, 1-cond /shield,Tef	T02A, T02B
02	WF22	Wire, 16 AWG, 1-Cond/Shield, T eflon	T03A, T03B
<hr/>			
01	NAPA27A	PA PWB Assy, VS300 Pre-Amp	A04
02	CCFS28	Cap,SMT,Ceramic,47pF,2%,50V, C0G,0603	C05
02	CCFS60	Cap,SMT,Ceramic,1uF,10%,100V, X7R,1210	C03, C04
02	CCFS66	Cap, SMT, Ceramic, 10+/-0.5pF, 100V COG, 1206	C10, C16
02	CCFS67	Cap, SMT, Ceramic, 12+/-0.5pF, 100V COG, 1206	C12
02	CT20	Capacitor, SMT, Ceramic, 1000p F, 5%, 63V	C01, C08, C14, C17
02	CT61	Capacitor, SMT, Ceramic, 0.022 uF, 100V, 10%, 1206	C06, C11
02	CT66	Capacitor, SMT, Ceramic, 0.1uF 10%, 100V	C07, C09
02	CT68	Cap, SMT, Electrolytic, 68uF, 20%, 63V	C15
02	LA56	Bead, Ferrite, SMT, 95 ohm, 2.85mm H x 9.6mm Lg	L02, L05
02	LS26	Inductor, SMT, 82nH, 2%, 2.5A, 4.20mm H x 4.95mm	L04
02	LS27	Inductor, SMT, 120nH, 2%,1.5A, 4.20mm H x 4.95mm	L06
02	LS29	Inductor, SMT, 43nH, 2%, 4A, 3.15mm H x 6.86mm Lg	L01, L03
02	LS34	Inductor, SMT, 28nH, 2%, 4A 3.15mm H x 6.86mm L	L07, L08
02	QAP60	Transistor, FET, N-Channel, LDMOS, 10W, 50V	Q01
02	RAD13	Resistor, SMT, MF, 100 Ohms, 1% 1/4W	R01
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01	NAPE87B	Exciter/Controller PWB Assy, VS/NVLT w/CE	A01
02	BBHT01	Holder, 20mm Coin Cell, PWB Mt	XBT01
02	BBLT01	Battery, Lithium, 3V,20mm Coin Cell	BT01

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02	CCFS01	Cap,SMT,Ceramic,0.001uF,10%,50 V,X7R,0603	C008, C033, C122, C125, C127, C152, C158, C159, C161, C162, C175, C176, C180, C182, C183, C185,, C188, C189, C193, C194, C198, C199, C200, C203, C205, C206, C222, C223, C224, C225, C228, C229,, C230, C233, C234, C237, C251, C253, C255, C353, C354, C355, C360, C364, C366, C369, C370, C382,, C383, C384, C386, C387, C392, C393, C398, C399, C400, C401, C502, C503, C539, C591 C128
02	CCFS02	Cap,SMT,Ceramic,0.0022uF,10%, 50V,X7R,0603	C022, C035, C063, C069
02	CCFS03	Cap,SMT,Ceramic,0.0047uF,10%, 50V,X7R,0603	C243, C256, C257, C258, C259, C273, C274, C275, C276, C286, C287, C288, C296, C297, C299, C300,, C305, C306, C310, C311, C315, C316, C319, C320, C323, C324, C325, C326, C411
02	CCFS04	Cap,SMT,Ceramic,0.01uF,10%,50V ,X7R,0603	C034, C067
02	CCFS06	Cap,SMT,Ceramic,0.047uF,10%,50 V,X7R,0603	C174, C177, C266, C280
02	CCFS10	Cap,SMT,Ceramic,1uF,10%,25V, ,X7R,1206	C018, C021, C027, C028, C062, C066, C073, C079, C134, C141, C171, C173, C464, C473, C544, C578,, C585
02	CCFS23	Cap,SMT,Ceramic,18pF,2%,50V, C0G,0603	C014, C017, C039, C046, C047, C053, C054, C058, C059, C077, C106, C107, C108, C109, C112, C129,, C133, C142, C534, C579, C580, C582
02	CCFS24	Cap,SMT,Ceramic,22pF,2%,50V, C0G,0603	C020, C030, C042, C051, C061, C083, C088, C093, C094, C097, C098, C104, C110, C138, C208, C210,, C220, C227, C289, C290, C292, C293, C437, C459, C467, C485, C499, C505, C518, C542, C543, C570, C587
02	CCFS32	Cap,SMT,Ceramic,100pF,2%,50V, C0G,0603	C445
02	CCFS33	Cap,SMT,Ceramic,150pF,1%,50V, C0G,0603	C029, C068
02	CCFS34	Cap,SMT,Ceramic,220pF,2%,50V, C0G,0603	C529
02	CCFS37	Cap,SMT,Ceramic,390pF,2%,50V, C0G,0603	C015, C016, C023, C038, C045, C048, C052, C055, C057, C060, C071, C074, C078, C115, C116, C117,, C118, C119, C120, C130, C143, C155, C409, C429, C434, C435, C525, C548, C550, C574, C575, C581, C593
02	CCFS38	Cap,SMT,Ceramic,470pF,2%,50V, C0G,0603	C090, C092, C095, C096, C099, C105, C191, C192, C196, C271, C367, C368
02	CCFS42	Cap,SMT,Ceramic,1000pF,2%,50V, C0G,0805	C436
02	CCFS47	Cap,SMT,Ceramic,3900pF,2%,50V, C0G,1206	

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02	CCFS52	Cap, SMT, Ceramic, 0.1uF, 10% 25V X7R, 0603	C002, C003, C011, C013, C019, C025, C026, C037, C040, C050, C056, C065, C070, C072, C075, C076,, C080, C082, C087, C091, C111, C113, C114, C121, C124, C126, C132, C137, C139, C146, C147, C148,, C149, C151, C153, C154, C156, C163, C164, C165, C166, C167, C168, C170, C172, C178, C184, C187,, C195, C201, C202, C207, C209, C216, C217, C218, C219, C226, C231, C232, C235, C238, C239, C240,, C241, C244, C245, C246, C247, C248, C249, C250, C254, C261, C262, C264, C268, C269, C270, C277,, C281, C282, C283, C284, C285, C291, C294, C295, C298, C301, C302, C303, C304, C307, C308, C309,, C312, C313, C314, C318, C321, C322, C327, C328, C329, C331, C334, C338, C339, C340, C341, C342,, C343, C344, C349, C350, C356, C357, C358, C359, C361, C362, C363, C371, C372, C373, C374, C375,, C376, C377, C378, C379, C380, C381, C385, C388, C389, C390, C394, C395, C402, C403, C404, C407,, C410, C412, C413, C415, C416, C417, C419, C421, C422, C423, C424, C426, C427, C432, C433, C438,, C439, C440, C441, C442, C443, C444, C446, C447, C448, C449, C456, C457, C458, C461, C462, C463,, C465, C466, C468, C469, C470, C471, C472, C474, C475, C476, C477, C478, C479, C480, C481, C482,, C483, C484, C486, C487, C488, C489, C490, C491, C492, C493, C494, C495, C496, C497, C498, C500,, C501, C506, C507, C508, C509, C510, C511, C512, C513, C514, C515, C516, C517, C520, C521, C522,, C524, C526, C528, C530, C531, C532, C533, C536, C541, C545, C546, C547, C549, C551, C553, C554,, C555, C556, C557, C560, C562, C563, C564, C566, C568, C573, C583, C584, C586, C588, C589, C592
02	CCFS53	Cap, SMT, Ceramic, 47uF, 20%, 6.3V, 1210	C009, C010, C012, C043, C044, C049, C430, C460, C576, C577
02	CCFS57	Cap, SMT, Ceramic, 10uF, 20%, 6.3V, X5R, 0805	C001, C005, C006, C007, C081, C084, C086, C089, C131, C150, C179, C181, C337, C347, C348, C504,, C523, C527, C569, C571, C572
02	CCFS58	Cap, SMT, Ceramic, 22uF, 20%, 6.3V, X5R, 1206	C140, C186, C330, C332, C333, C336, C346, C397, C405, C406
02	CCFS60	Cap, SMT, Ceramic, 1uF, 10%, 100V, X7R, 1210	C031, C123, C214, C215, C236, C558, C567
02	CCFS62	Cap, SMT, Ceramic, 10uF, 10%, 25V	C265, C418, C425, C537, C538, C540
02	CCFS73	Cap, SMT, Ceramic, 1uF, 10%, 16V, X5R, 0603	C024, C041, C064, C085, C135, C136, C144, C145, C157, C160, C204, C252, C345, C351, C352, C365,, C391, C519, C590
02	CT51	Capacitor, SMT, Ceramic, 0.1uF, 100V, 10%	C032, C197, C213, C221, C561, C565

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02	CT85	Cap, SMT, Ceramic, 3 Terminal, 22pF, 16vDC, 600mA	C100, C101, C102, C103, C260, C263, C267, C272, C278, C279, C335, C396, C408, C414, C450, C451,, C452, C453, C454, C594
02	CT86	Cap, SMT, Ceramic, 3 Terminal, 1000pF, 16vDC, 600m	C242, C317, C420, C428, C431, C455
02	CTFS04	Cap,SMT,Tantalum,100uF,10%,10V ,2917	C004, C036, C190, C535, C552
02	CX38	Cap,SMT,Ceramic,4.7uF,10%,10V, X5R, 1206	C169, C559
02	HAJ66	Terminal, SMT, Test Point, PWB	TP04, TP06, TP07, TP15, TP18, TP19, TP20
02	JF47	Conn, Header,Square Post,Gold, Dual,40-pin	J17, J19
02	JM44	Conn, Modular Jack, RJ45, Shld , Side, PWB, 50u	J01
02	JM49	Conn, Socket, 1xMag RJ45 + 2x USB-A	J08
02	JQ15	Conn, Post Shunt, 2 Pos, .10 C entreline	E01, E02
02	JQ16	Conn, Header, SIP,12 Pin Break away,.10 Ctr	J16, J21, XE01, XE02
02	JQ53	Conn, Header, Ribbon Cbl, 40- Pin	J15
02	JQ55	Conn, Header, Ribbon Cbl, 20 Pin	J11, J12
02	JQ76	Conn, Header, Ribbon Cable 14 pin	J13
02	JS21	Conn, BNC, Recept, Rt Angle, P WB Mt	J14
02	JT100	Conn, Dual, BNC, PWB, Rt Angle	J04, J06
02	JT121	Conn, Dual, D-Sub, F/M, 9 pin, Rt. Angle, PWB	J05
02	JT61	Conn, BNC, Recept, 50ohm,Insul , Rt Angle	J07
02	JT78	Connector,Dual,D-Sub,M/F, 25-pin,Rt Agl,PWB	J02
02	JT87	Conn,3-pin,PWB Mount, Fem, XLR	J03
02	JU25	MTA, Keyed Square Post Header Assy, 4 pin	J10
02	JU74	Conn, 2mm, Shrouded Header, PH Series, Top, White	J09
02	LCFS01	Inductor, SMT, Choke, 600ohms, 2A, 0805	L002, L004, L005, L006, L007, L010, L011, L012, L016, L017, L018, L019, L020, L023, L024, L025,, L028, L029, L030, L031, L033, L035, L036, L037, L038, L039, L040, L042, L043, L044, L045, L046,, L047, L048, L049, L050, L051, L052, L053, L054, L055, L056, L057, L058, L059, L060, L061, L062,, L064, L069, L071, L073, L074, L075, L076, L077, L078, L080, L081, L082, L083, L084, L086, L087,, L088, L089, L090, L097, L098, L099, L100, L102, L103, L110, L111, L122, L123, L124, L125, L129,, L130, L131, L132, L133, L134, L137, L138, L140, L144, L145, L146, L147, L154, L155, L156, L157,, L158, L159, L160, L161, L162, L163, L164, L171, L174, L176, L177
02	LCFS02	Inductor, SMT, Choke, 2000 ohm s, 80mA, 0805	L022, L034, L093, L095, L105, L106, L107, L108, L109, L126, L127, L128, L135, L136, L139, L141,, L142, L143, L148, L149, L150, L151, L152, L153, L165, L166, L167, L168, L169, L170, L172, L173,, L175, L179

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<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
02	LS17	Inductor,SMT,Pwr,Shielded,P116 7 Series,3.5A,3.6uH	L003, L013
02	LS20	Inductor,SMT,560nH,325mA,2520	L008, L009, L021, L041
02	LS22	Choke,SMT,Common Mode,2200 ohm ,200mA,1206	L117, L119
02	LS24	Inductor, SMT, 10uH, 2.4A, RMS	L027
02	LS48	Choke, SMT, Common Mode, 600 ohm, 260mA	L063, L065, L066, L067, L068, L070, L072, L079, L085, L091, L092, L094, L096, L101, L104, L112,, L113, L114, L115, L116, L118, L120, L121, L178, L180
02	QBNS01	Transistor,SMT,NPN,Switch/Amp ,SOT-23	Q01, Q02, Q04
02	QDDS02	Diode, SMT, Schottky, 40V, 1A, SMA	CR01
02	QDRS01	Diode,SMT,Switching,250V,0.2A, SOD-323	CR04, CR05, CR06, CR07, CR08, CR09, CR10, CR11, CR12, CR13, CR14, CR15, CR16, CR17, CR18, CR19
02	QDSS01	Diode,SMT,Schottky,30V,0.2A, SOD-323	CR02, CR03, CR22, CR23
02	QM48	Diode,SMT,Transient Suppr,10V, SMB	CR20, CR21
02	QS26	Transistor, SMT, P-Channel FET 130mA	Q03
02	RAD26	Resistor, SMT, MF, 1210 Ohms, 1% 1/4W	R085, R086, R093, R094
02	RAD33	Resistor, SMT, MF, 4750 Ohms, 1%, 1/4W	R172, R173, R174, R175, R176, R180, R181, R183, R184, R187, R188
02	RAD44	Resistor, SMT, MF, 39.2K Ohms, 1% 1/4W	R399, R402, R407, R410
02	RAD53	Resistor,SMT,MF,49.9ohms,1%, 1/10W,0603	R170
02	RAD57	Resistor, SMT, 25.5 ohms, 1%, 2512	R182, R197
02	RAE25	Resistor,SMT,MF,3.74K,1%,1/10W ,0603	R021
02	RAE31	Resistor,SMT,MF,6.49K,1%,1/10W ,0603	R003
02	RAE34	Resistor,SMT,MF,49.9R,1%,1/10W 0603	R240, R241, R465, R469, R473, R474
02	RFFS01	Resistor,SMT,MF,0.0ohms,Jumper ,0603	R207, R208, R325
02	RFFS02	Resistor,SMT,MF,1.00ohms,1%, 1/10W,0603	R119, R120, R121, R132, R186, R346, R347, R356, R357, R379
02	RFFS10	Resistor,SMT,MF,4.75ohms,1%, 1/10W,0603	R019, R028, R030, R039, R128, R136, R222, R236, R242, R247, R249, R250, R252, R256, R257, R265,, R419, R431, R446, R457, R459, R475
02	RFFS15	Resistor,SMT,MF,12.1ohms,1%, 1/10W,0603	R142, R143, R144, R145, R146, R147, R152, R153, R157, R158, R160, R161, R162, R163, R167, R168
02	RFFS18	Resistor,SMT,MF,22.1ohms,1%, 1/10W,0603	R063, R067, R075, R076, R077, R079, R083, R097, R113, R117, R122, R124, R125, R149, R166, R178,, R198, R210, R253, R254, R262, R303, R324, R337, R370, R384, R386, R390, R406, R422, R424, R436,, R438, R444, R445, R454, R483
02	RFFS19	Resistor,SMT,MF,27.4ohms,1%, 1/10W,0603	R015, R016, R023, R024, R464, R470
02	RFFS21	Resistor,SMT,MF,39.2ohms,1%, 1/10W,0603	R082, R089, R090, R098, R479, R480, R481, R482

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02	RFFS23	Resistor,SMT,MF,56.2ohms,1%, 1/10W,0603	R335, R336
02	RFFS26	Resistor,SMT,MF,100ohms,1%, 1/10W,0603	R046, R048, R060, R064, R069, R072, R116, R118, R129, R150, R151, R193, R215, R220, R227, R228,, R229, R243, R244, R259, R260, R263, R288, R319, R320, R321, R322, R327, R328, R329, R330
02	RFFS27	Resistor,SMT,MF,121ohms,1%, 1/10W,0603	R139
02	RFFS28	Resistor,SMT,MF,150ohms,1%, 1/10W,0603	R070, R071
02	RFFS29	Resistor,SMT,MF,182ohms,1%, 1/10W,0603	R223, R238
02	RFFS30	Resistor,SMT,MF,221ohms,1%, 1/10W,0603	R025, R044
02	RFFS31	Resistor,SMT,MF,274ohms,1%, 1/10W,0603	R022, R050, R058, R099, R100, R103, R104, R134, R397, R405, R409, R412, R414, R426, R434, R440,, R484
02	RFFS33	Resistor,SMT,MF,392ohms,1%, 1/10W,0603	R052, R054, R055, R065, R066, R068, R073, R074, R420, R427, R428
02	RFFS34	Resistor,SMT,MF,475ohms,1%, 1/10W,0603	R001, R007, R012, R013, R029, R031, R033, R034, R035, R040, R059, R105, R106, R107, R108, R114,, R127, R209, R221, R237, R239, R361, R363, R371, R375, R380, R382, R388, R430, R451, R460, R461, R466
02	RFFS36	Resistor,SMT,MF,681ohms,1%, 1/10W,0603	R396, R404, R408, R411
02	RFFS37	Resistor,SMT,MF,825ohms,1%, 1/10W,0603	R360
02	RFFS38	Resistor,SMT,MF,1000ohms,1%, 1/10W,0603	R017, R037, R042, R043, R062, R078, R081, R087, R088, R095, R096, R115, R189, R196, R199, R205,, R211, R218, R219, R224, R225, R226, R232, R233, R234, R235, R255, R258, R264, R266, R268, R271,, R272, R274, R276, R277, R278, R281, R282, R310, R311, R333, R352, R364, R393, R394, R395, R400,, R413, R416, R417, R468
02	RFFS39	Resistor,SMT,MF,1210ohms,1%, 1/10W,0603	R004, R005, R006, R036, R140
02	RFFS40	Resistor,SMT,MF,1500ohms,1%, 1/10W,0603	R201, R202, R365, R366, R367, R447
02	RFFS42	Resistor,SMT,MF,2210ohms,1%, 1/10W,0603	R126, R131, R203, R204, R348, R350, R376, R381, R389, R391, R392
02	RFFS45	Resistor,SMT,MF,3920ohms,1%, 1/10W,0603	R027, R047
02	RFFS46	Resistor,SMT,MF,4750ohms,1%, 1/10W,0603	R101, R111, R130, R156, R309, R312, R334, R351, R425

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<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
02	RFFS50	Resistor,SMT,MF,10.0Kohms,1%, 1/10W,0603	R002, R008, R011, R018, R026, R032, R045, R049, R051, R053, R057, R061, R080, R084, R091, R092,, R102, R110, R133, R137, R138, R154, R155, R159, R164, R165, R169, R171, R177, R179, R185, R190,, R191, R192, R195, R200, R206, R212, R213, R214, R217, R261, R267, R284, R285, R286, R287, R289,, R290, R291, R292, R293, R294, R295, R296, R297, R298, R299, R300, R301, R302, R304, R305, R306,, R307, R308, R313, R315, R316, R317, R338, R345, R349, R353, R372, R385, R415, R418, R421, R423,, R429, R432, R433, R435, R437, R439, R441, R442, R443, R448, R449, R453, R462, R463, R485, R486, R487 R014, R450, R452, R455, R456, R458, R471, R472 R010, R112 R216 R194, R269, R270, R279, R280 R383 R056 R020, R038, R467 R403 R109 R009 R123 R041 R135, R141, R355, R359 R148 R344, R476, R477, R478, R488 RT01 S01 T02, T03 T04 T01 U105 U013 U056, U075 U103 U087 U090
02	RFFS52	Resistor,SMT,MF,15.0Kohms,1%, 1/10W,0603	
02	RFFS54	Resistor,SMT,MF,22.1Kohms,1%, 1/10W,0603	
02	RFFS57	Resistor,SMT,MF,39.2Kohms,1%, 1/10W,0603	
02	RFFS58	Resistor,SMT,MF,47.5Kohms,1%, 1/10W,0603	
02	RFFS59	Resistor,SMT,MF,56.2Kohms,1%, 1/10W,0603	
02	RFFS60	Resistor,SMT,MF,68.1Kohms,1%, 1/10W,0603	
02	RFFS62	Resistor,SMT,MF,100Kohms,1%, 1/10W,0603	
02	RFFS63	Resistor,SMT,MF,121Kohms,1%, 1/10W,0603	
02	RFFS65	Resistor,SMT,MF,182Kohms,1%, 1/10W,0603	
02	RFFS66	Resistor,SMT,MF,221Kohms,1%, 1/10W,0603	
02	RFFS74	Resistor,SMT,MF,1.00Mohms,1%, 1/10W,0603	
02	RFFS83	Resistor,SMT,MF,28.7K Ohms,1%, 1/10W,0603	
02	RFFS87	Resistor, SMT, 200ohm, 1%, 1/10W, 0603	
02	RFFS88	Resistor, SMT, MF, 10.0Mohms, 1%, 1/10W, 0603	
02	RT50	Resistor,SMT,MF,0.0 ohms, Jumper,0805	
02	RX62	Thermistor, PTC, SMT, 1206, 125mA Hold	
02	SD77	Switch, SMT, SPST, Momentary, w/ESD gnd	
02	TZ102	Transformer, SMT, Balun, 4.5- 1000MHz	
02	TZ103	Transformer, SMT, 4:1, 2-300 MHz	
02	TZ88	Transformer,SMT,50 ohms,0.03 to 125MHz	
02	UC77	IC, Temp, Sensor, 3.3V, 1-Wire MSOP-8	
02	UD65	IC,SMT,Differential Line Receivr, 100dB CMR	
02	UD80	IC, SMT, Inverter, UHS, Dual, UnBFR, 6p SC70 1.2mm	
02	UDLS03	IC,SMT,CMOS,Hex Schm,Trig,Inv, SOIC-14	
02	UDLS04	IC,SMT,CMOS,8-Bit Shft Reg,Par I/P, SOIC-16	
02	UDLS05	IC,SMT,CMOS,8-Bit Shft Reg,Par O/P, SOIC-16	

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
02	UDLS09	IC,SMT,CMOS,Hex Inverter,Unbuf f,SO-14	U001
02	UDMS11	IC. SMT, NAND Flash 4Gb, x8, 1b ECC, TSOP-48	U015
02	UDOS01	IC,SMT,Dual Optocoupler,SOIC-8	U079, U080, U085, U086, U092, U093
02	UDTS05	IC,SMT,RS-232 Transceiver,3.3V ,SO-16	U050
02	UDTS06	IC, SMT, USB-OTG Transceiver, QFN-24	U011
02	UDTS07	IC, SMT, Full Duplex RS485 RxTx, SOIC-8	U100, U102
02	ULAS01	IC,SMT,Opamp,Quad,Single Suppl y,SOIC-14	U077, U095, U096
02	UM100	LC Filter, SMT, 0603, 200MHz, 16Vdc, 150mA, 25pF,	U044, U045, U046, U047, U116, U117, U118, U121, U122
02	UM102	Filter LC, SMT, 0603, 500MHz, 16Vdv, 200mA, 10pF,	U107, U119
02	UM86	Filter, SMT, Band Pass FM, 20MHz BW	U076
02	UMDS01	IC,SMT,DAC,8-Bit,4-ch,SPI, SOIC-14	U073, U088, U089
02	UP104	IC, SMT, Voltage Regulator, Dual, ADJ TSSOP16	U066
02	UP105	IC, SMT, DC-DC Converter, Boost/Inverting MSOP8	U052
02	UP108	IC, SMT, Quad USB Power Contro ller, SOIC-16	U009
02	UP93	IC,SMT,Op Amp,Audio,Dual,SO-8	U017, U018, U030, U037, U038, U059
02	US06	IC, SMT, CMOS, PLL, 6GHz, TSSOP-16	U065
02	US07	IC, SMT, ADC, 1.25MSPS, 16bit, TQFP-48	U019
02	US08	IC, SMT, Blackfin DSP, 500MHz, bga-316	U063
02	US09	IC, SMT, Battery Backup,SOIC-8	U002
02	US12	Bridge Rectifier, 400V, 0.5A, SOIC-4	U110, U111, U113, U120
02	US13	IC, SMT, SDRAM, 16Mx16, 3.3V, TSOP-54	U104, U108, U109
02	US16	IC, SMT, Differential Audio Am p, MSOP-8	U021, U031, U036
02	US19	IC, SMT, Digital Step Attenator, QFN-20	U094
02	US20	IC, SMT, stereo Volume Control , SOIC-16	U014
02	US21	IC, SMT, SiGe Gain Block, 20dB , SOT-89-3	U099
02	US23	IC, SMT, Power Shift Register, SOIC-16	U060, U068
02	US25	IC, SMT, ADC, 11-ch, 10-bit, 3.3V, SPI, SSOP-20	U098
02	US30	IC, SMT, CMOS, Quad And Gate, SOIC-14	U016, U020, U054
02	US31	IC, SMT, CMOS, Quad Tri-State Buff, SOIC-14	U106, U112
02	US35	IC, SMT, RF QDUC, 1GSPS, TQFP- 100	U062
02	US37	IC, SMT, Audio DAC, 24-bit, 96 KHz, SSOP-16	U067
02	US39	IC, SMT, Stereo ADC, 24-bit, 216KHz, SSOp-28	U033
02	US43	Oscillator, SMT, VCSO, 983.04 MHz Fund, LVPECL	Y04
02	UT100	Oscillator,SMT,25MHz,3.3V	Y05
02	UT110	IC, Voltage Regulator, 1.5A, ADJ, Low Drop	U003

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
02	UT114	IC, Voltage Regulator, +8V, 1A DPAK	U091
02	UT115	IC, SMT, ARM Processor, 266MHz TFBGA296	U029
02	UT116	Oscillator, SMT, TCVCXO, 3.3V, 2ppm, 5x3.2mm	U082
02	UT83	IC,SMT,Ultrafast Single Supply Comparator,TSSOP	U055, U097
02	UT93	IC,SMT,Voltage Regulator,5V, 1A, D2PAK	U012
02	UW110	Res, SMT Network, 0402x8, 4.7K , 5%	U022, U023, U024, U032, U078, U081, U084
02	UW125	IC, SMT, SPI Flash, 32Mbit, SOIC8W	U053, U115
02	UW63	Res,SMT Network,0402x8,39R	U005, U007, U025, U028, U034, U035, U039, U040, U041, U042, U043, U057, U058, U061, U064, U069,, U070, U071 U072
02	UW80	IC,SMT,SRC,Async,2-ch,TQFP-48	U048, U051, U101, U114
02	UW90	IC,SMT,Quad 2 TO 1 DATA Sel/ Mux 3 States Output,3	U049
02	UW91	IC,SMT,SPI UART,3.3V	U008
02	UX123	IC, SMT, 4-port USB Hub, LQFP- 32	U074
02	UX124	IC, SMT, CPLD, 3.3V, 144 Macro cell, 100-TQFP	U026
02	UX64	IC,SMT,Power Supervisor,Dual I/P,33/1.5V,MSOP	U006, U010
02	UX65	IC,SMT,3A Sync Buck Converter, SO-20 w/pwr pad	U027, U083
02	UX83	IC,SMT,2.5V Reference,0.1%,SOT -23-6	U004
02	UX93Z	IC,SMT,Ethernet Phy,3.3V,LQFP 48	Y03
02	XFPS07	Crystal, SMT, Fund, 12MHz	Y02, Y07
02	XFPS10	Crystal,SMT,Fund,ParRes,32.768 kHz, 20ppm, 12.5pF,	
01	NAPF11	RF LPF PWB Assy, VS300	A06
02	CS89	Capacitor, SMT, Porcelain,27pF 500V, 2%	C01
02	CS93	Capacitor, SMT, Porcelain,33pF 500V, 2%	C07
02	LA59	Inductor, Filter Coil, 88nH, 4 turns	L01, L02, L03, L04
02	LA62	Inductor, Staic Drain Choke, 550nH, 14 turns, 16 A	L05
01	NAPI131	Interface PWB Assy, VS300	A03
02	CCFS04	Cap,SMT,Ceramic,0.01uF,10%,50V ,X7R,0603	C04, C05, C06, C07
02	CT50	Capacitor,SMT,Ceramic,0.01uF, 100V,10%	C01, C03
02	CT66	Capacitor, SMT, Ceramic, 0.1uF 10%, 100V	C02
02	JQ53	Conn, Header, Ribbon Cbl, 40- Pin	J02
02	JU60	MTA, Keyed Square Post Header Assy, 3 pin	J01
02	LS23	Choke, SMT, Common Mode, 7000 ohm, 700mA	L01
01	NAPP06	Output Power Probe PWB Assy, VS300	A07
02	CCFS04	Cap,SMT,Ceramic,0.01uF,10%,50V ,X7R,0603	C04, C10
02	CCFS07	Cap,SMT,Ceramic,0.1uF,10%,50V, X7R,0805	C06, C07

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl. StockCode</u>		<u>Description</u>	<u>Reference Designation</u>
02	CCFS10	Cap,SMT,Ceramic,1uF,10%,25V, ,X7R,1206	C03, C09
02	CCFS62	Cap, SMT, Ceramic, 10uF, 10%, 25V	C05, C08
02	CX38	Cap,SMT,Ceramic,4.7uF,10%,10V, X5R, 1206	C01
02	RAD05	Resistor, SMT, MF, 22.1 Ohms, 1% 1/4W	R05, R25
02	RAD11	Resistor, SMT, MF, 68.1 Ohms, 1% 1/4W	R22
02	RAD12	Resistor, SMT, MF, 82.5 Ohms, 1% 1/4W	R06, R23, R24
02	RAD14	Resistor, SMT, MF, 121 Ohms, 1% 1/4W	R03, R07, R12
02	RAD15	Resistor, SMT, MF, 150 Ohms, 1% 1/4W	R11, R14, R15, R16, R17, R30, R31, R32
02	RAD17	Resistor, SMT, MF, 221 Ohms, 1% 1/4W	R04, R13
02	RAD18	Resistor, SMT, MF, 274 Ohms, 1% 1/4W	R18, R27
02	RAD19	Resistor, SMT, MF, 332 Ohms, 1% 1/4W	R02, R09, R19, R21, R26, R28
02	RAD25	Resistor, SMT, MF, 1000 Ohms, 1% 1/4W	R08
02	RAD29	Resistor, SMT, MF, 2210 Ohms, 1% 1/4W	R01, R10, R20, R29
02	UM96	Surge Arrestor, 350Vdc, +/-15 PC	E01
02	UX122	IC, SMT, tru RMS power detecto r, 5.5V	U01, U02
<hr/>			
01	NAPS40	PS Distribution PWB Assy,VS300	A02
02	CCFS04	Cap,SMT,Ceramic,0.01uF,10%,50V ,X7R,0603	C01, C02, C03, C04, C06, C07, C08, C09, C10, C11, C15, C18, C24, C33, C35, C38, C39, C40, C41
02	CCFS07	Cap,SMT,Ceramic,0.1uF,10%,50V, X7R,0805	C14, C16, C20, C25, C26, C27, C28, C29, C30, C31, C32, C34
02	CCFS52	Cap, SMT, Ceramic, 0.1uF, 10% 25V X7R, 0603	C05, C17, C19, C21, C23
02	CCFS60	Cap,SMT,Ceramic,1uF,10%,100V, X7R,1210	C43
02	CT50	Capacitor,SMT,Ceramic,0.01uF, 100V,10%	C12, C42, C45
02	CT66	Capacitor, SMT, Ceramic, 0.1uF 10%, 100V	C13, C44, C46
02	CTFS01	Cap,SMT,Tantalum,10uF,10%,16V, 1411	C37
02	CTFS02	Cap,SMT,Tantalum,1uF,10%,35V, 1411	C22
02	CTFS03	Cap,SMT,Tantalum,10uF,10%,35V, 2917	C36
02	FA46	Fuse,SMT,Fuse Block,3A Very Fast Acting,Installed	F01
02	FA56	Fuse, SMT, Fuse Block, 7A VeryFast Acting Installe	F02
02	HAC55	Terminal,PC Screw 10-32,30 Amp	E03
02	HAI66	Terminal, SMT, Test Point, PWB	TP03, TP04, TP07, TP13, TP14
02	HR26	Connector, Quick-Dis, M, 1/4 Tab, PWB	E01, E02
02	JA95	Conn, 47 Contact, F, 90 deg, PWB Mt	J01
02	JQ55	Conn, Header, Ribbon Cbl, 20 Pin	J02, J03
02	JT48	Terminal Block, 6-Pos, Dual Ba rrier, 20A	TB01
02	QBNS01	Transistor,SMT,NPN,Switch/Amp ,SOT-23	Q01

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
02	QDLS01	Diode, SMT, LED, Green, (560nm), 0603	DS01, DS02, DS03
02	QR70	Suppressor, Transient Voltage, SMT 60V Clamp	CR01, CR02, CR03, CR04, CR05, CR06
02	QR71	Transistor, FET, P-channel, D2Pak	Q02
02	RAD13	Resistor, SMT, MF, 100 Ohms, 1% 1/4W	R03, R06, R07, R11
02	RAD27	Resistor, SMT, MF, 1500 Ohms, 1% 1/4W	R36
02	RAD33	Resistor, SMT, MF, 4750 Ohms, 1%, 1/4W	R01, R02, R04, R05, R08, R09, R10, R12
02	RAD37	Resistor, SMT, MF, 10.0K Ohms, 1%, 1/4W	R34
02	RAD41	Resistor, SMT, MF, 22.1K Ohms, 1% 1/4W	R14
02	RAD48	Resistor, SMT, MF, 82.5K Ohms, 1% 1/4W	R15
02	RAD74	Resistor, SMT, 0.1ohms, 1206, 1% 1/4W	R42
02	RFCS01	Resistor,SMT,MF,0.005ohms,1%, 1W,2512	R43
02	RFFS26	Resistor,SMT,MF,100ohms,1%, 1/10W,0603	R44, R45, R46
02	RFFS32	Resistor,SMT,MF,332ohms,1%, 1/10W,0603	R38
02	RFFS38	Resistor,SMT,MF,1000ohms,1%, 1/10W,0603	R13
02	RFFS40	Resistor,SMT,MF,1500ohms,1%, 1/10W,0603	R16
02	RFFS46	Resistor,SMT,MF,4750ohms,1%, 1/10W,0603	R19, R23
02	RFFS48	Resistor,SMT,MF,6810ohms,1%, 1/10W,0603	R27
02	RFFS50	Resistor,SMT,MF,10.0Kohms,1%, 1/10W,0603	R17, R18, R21, R22, R25, R28, R32, R35, R37
02	RFFS52	Resistor,SMT,MF,15.0Kohms,1%, 1/10W,0603	R26
02	RFFS53	Resistor,SMT,MF,18.2Kohms,1%, 1/10W,0603	R24
02	RFFS54	Resistor,SMT,MF,22.1Kohms,1%, 1/10W,0603	R29
02	RFFS61	Resistor,SMT,MF,82.5Kohms,1%, 1/10W,0603	R31
02	RFFS62	Resistor,SMT,MF,100Kohms,1%, 1/10W,0603	R30, R33
02	RFFS63	Resistor,SMT,MF,121Kohms,1%, 1/10W,0603	R20
02	RFFS70	Resistor,SMT,MF,475Kohms,1%, 1/10W,0603	R39, R41
02	RFFS77	Resistor,SMT,MF,1.82Mohms,1%, 1/10W,0603	R40.
02	RT16	Thermistor, PTC, .50-.77 Ohms, 0.5A Hold	RT01
02	RT17	Thermistor, PTC, .15-.25 Ohms, 1.1A Hold	RT02
02	UDLS04	IC,SMT,CMOS,8-Bit Shft Reg,Par I/P, SOIC-16	U01
02	ULAS02	IC,SMT,Opamp,Quad,Rail-To-Rail ,SOIC-14	U03
02	ULRS02	IC,SMT,4.096V Reference,0.1%, SOT-23-6	U04
02	UMAS01	IC,SMT,ADC,10-Bit,11-ch,SPI, SOIC-20	U02
02	UT74	IC, Amplifier, Instrumentation	U05, U06
01	RX49	Thermistor,-30/105°C,10Kohms@ 25°C,Neg,Bvalue 3435	RT01
01	SB64	Circuit Breaker, 240V, 8A, Thermal, 2-Pole No rele	CB01

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Description: Final Assy, VS300, Type N (w/o JA55), RLS 10,

<u>Component Lvl.</u>	<u>StockCode</u>	<u>Description</u>	<u>Reference Designation</u>
01	UG69J	Pwr Sply, 7-53Vdc, 2000W, 50A 90-264Vac, Hi-Eff (8	U02
01	UG79	Power Supply, 48V, 50W Univ. Input	U04
01	UG80	Power Supply, 5V, +/-15V, 50W, Univ Input	U03
01	UW146	Display, 20x4 LCD, 3.3 - 5V, -20/+70	U05
01	ZAP50	Fan, 80mm, Brushless, 48Vdc, EMI Caps, Tach w/conn	B01

SECTION 4: WIRING/CONNECTOR LISTS

This section contains the wiring information for the hard-wired assemblies of the transmitter, and applicable connector mating information.

WIRING LISTS PROVIDED

Wiring lists are provided in tabular format. [Table 4.1 on page 4-2](#) lists the tables containing wiring information. These tables provide non-printed wiring pattern, point-to-point (source and destination) interconnection information.

WIRING LISTS NOT PROVIDED

Separate wiring lists are not provided for some assemblies, including:

- Assemblies that have a separate maintenance manual. Refer to the appropriate maintenance manual for detailed wiring information for these assemblies, if provided.
- Assemblies that have their wiring information shown in tables on their assembly detail drawing(s). Refer to the *Mechanical Drawings* section of this manual for detailed wiring information for these assemblies.

CONNECTOR MATING INFORMATION

Where applicable, a connector mating table is provided after the corresponding wiring list. [Table 4.2 on page 4-2](#) identifies all provided connector information.

WIRE COLOURS

Every effort is made to manufacture assemblies using the wire colour shown in the **Colour** column of the wiring list tables. Sometimes, a white wire will be substituted for the listed colour. In such cases, wires must be identified by their assigned numbers.

PRINTED WIRING BOARD PATTERNS

Printed wiring pattern information for printed wiring boards (PWBs) is beyond the scope of this manual, and therefore not provided.

Table 4.1: Wiring Lists Provided

Table #	Description
Table 4.3	Wiring List - VS300 Transmitter (page 4-3)

Table 4.2: Connector Mating Information Provided

Table #	Description
Table 4.4	Connector Mating Information - VS300 Transmitter (page 4-4)

Table 4.3: Wiring List - VS300 Transmitter

Source	Destination	Wire #	Colour	Size	Remarks
U3-(COM)	U4-(-V)	1	Black	14	
A2TB1-2	C1E1	2	White	16	
A2TB1-3	A2TB1-1	3	Black	14	
E2-(GND)	A2E3	4	Grn/Yel	14	
E2-(GND)	U3-(GND)	5	Grn/Yel	14	
U1-L	CB1-P1	6	Grey	14	
P9-1	P10-2	7	White	22	
P9-15	P10-4	8	Black	22	
P9-16	P10-1	9	White	22	
P9-2	P10-3	10	White	22	
CB1-3	A2E1	11	Grey	14	
CB1-3	U3-L	12	Grey	14	
CB1-4	A2E2	13	Grey	14	
CB1-4	U3-N	14	Grey	14	
U1-N	CB1-P2	15	Grey	14	
U1-(GND)	E2-(GND)	16	Grn/Yel	14	
E3-(GND)	E2-(GND)	17	Grn/Yel	14	
A2TB1-3	U3-(COM)	18	Black	14	
U3-(GND)	U4-(GND)	19	Grn/Yel	14	
U3-L	U4-L	20	Grey	14	
U3-N	U4-N	21	Grey	14	
U3-(+5V)	A2TB1-5	22	Red	14	
U3-(+V2)	A2TB1-6	23	White	16	
U4-(+V)	A2TB1-4	24	White	16	
C1E2	A5-B	-	White	16	Jumper
A3-A	A4-B	-	-	24	Link
A3-B	A4-C	-	-	24	Link
A3-C	A5-A	-	White	24	Jumper
A3-E	A7-B	-	-	24	Link
A4-D	A5-F	25	Conductor	RG188	Coaxial Cable
A4-GND	A5-G	25	Shield	-	Coaxial Cable
A5-C	A6-A	26	Conductor	20	Coaxial Cable
A5-D	A6-B	26	Shield	-	Coaxial Cable
A6-C	A7-D	-	-	20	Link
A7-A	A3-D	-	-	24	Link

Table 4.3: Wiring List - VS300 Transmitter

Source	Destination	Wire #	Colour	Size	Remarks
A7-C	A3-F	-	-	24	Link
J3-Center	A7-F	-	-	20	Link
W5P1-Center	A4-A	27	Conductor	RG188	Coaxial Cable
W5P1-Shield	A4-E	27	Shield	-	
J1-Center	A7-J	28	Conductor	RG188	Coaxial Cable
J1-Shield	A7-K	28	Shield	-	
J2-Center	A7-M	29	Conductor	RG188	Coaxial Cable
J2-Shield	A7-L	29	Shield	-	

Table 4.4: Connector Mating Information - VS300 Transmitter

Connector	Mate	Remarks
B1P1	A3J1	Fan connection
P1	Not Used	
P2	Not Used	
P3	Not Used	
P4	Not Used	
P5	Not Used	
P6	Not Used	
P7	Not Used	
P8	Not Used	
P9	U5H1	LCD
P10	A1J10	LCD
W1P1	A1J15	Interface I/O
W1P2	A3J2	Interface I/O
W2P1	A1J12	Power DAC I/O
W2P2	A2J2	Power DAC I/O
**W3P1	A1J13	Audio processor (optional)
**W3P2	A8J1	Audio processor (optional)
W4P1	A2J3	Power I/O
W4P2	A1J11	Power I/O
W5P1	A1J14	RF Drive Out

SECTION 5: READING ELECTRICAL SCHEMATICS

This section contains electrical schematics and logic diagrams for the transmitter. Block diagrams, simplified electrical schematics, and logic diagrams may be included. Refer to [Table 5.1 on page 5-4](#) for an itemized listing.

COMPONENT VALUES

Unless otherwise specified on the logic or schematic diagram, the following defaults apply:

- Resistor values are shown in ohms (K = 1,000 and M = 1,000,000)
- Resistor power ratings are not shown when less than 0.5 W
- Capacitor values are shown in microfarads (uF)
- Unidentified diodes are part number 1N4938 (Nautel Part # QAP29)

GRAPHIC SYMBOLS

The graphic symbols used on electrical schematics are in accordance with *American National Standard ANSI Y32.2-1975 - Graphic Symbols for Electrical and Electronic Diagrams*.

LOGIC SYMBOLS

The logic symbols used on electrical schematics and logic diagrams are in accordance with *American National Standard ANSI Y32.14-1975 - Graphic Symbols for Logic Diagrams*.

REFERENCE DESIGNATIONS

Referenced designations were assigned in accordance with *American Society of Mechanical Engineers ASME Y14.44-2008 - Reference Designations for Electrical and Electronic Parts and Equipment*.

Each electrical symbol is identified with its basic reference designation. To obtain the full reference designation for a specific part, prefix this basic identifier with the reference designation assigned to all higher assemblies. For example, the complete designation for a resistor (R1) on a printed wiring board (A1), that is part of a larger board (A2), would be A2A1R1.

UNIQUE SYMBOLS

Nautel uses unique symbols on electrical schematics to describe logic (two-state) signals. These signals differ from single-state signals or analog signals that may have multiple values.

TYPE OF INPUTS AND OUTPUTS

On electrical schematics, names used to describe logic (two-state) input and output signals are prefixed with a # symbol.

LOGIC LEVEL CONVENTION

The # prefix identifies an input or output signal that has two distinct states: **high** and **low**.

The suffix on an input or output signal name identifies the *active* (true) state of the signal. The *high suffix* (+) indicates the more positive of the two levels used to represent the logic states. The *low suffix* (-) indicates the less positive of the two levels.

Two types of logic, positive and negative, may be represented on a particular schematic. In positive logic, **high** represents the *active* (true) state, and **low** represents the *inactive* (false) state. In negative logic, **low** represents the *active* (true) state, and **high** represents the *inactive* (false) state.

IDENTIFYING SCHEMATIC DIAGRAMS

Each electrical schematic in this section is identified by a number that is both the figure number and the page number. The numbers are assigned sequentially and are prefixed by the letters SD. The electrical schematics and logic diagrams included in this section are listed in [Table 5.1 on page 5-4](#).

STRUCTURE OF SCHEMATICS

The electrical schematics are structured in a hierarchical format that is based on function and signal flow. Wherever practical, the signal flow is from left to right. Normally, inputs originate on the left-hand side and outputs extend to the right-hand side. Exceptions are shown by an arrow indicating the direction of signal flow.



Note: The physical location of a part or assembly was not necessarily a factor during creation of the schematic. The full reference designation assigned to a part or assembly, in conjunction with the family tree (see [Section 3, “Parts Lists” on page 3-1](#)) and the assembly detail drawings (see [Section 6, “Mechanical Drawings” on page 6-1](#)), will identify its location.

Figures SD-1 and SD-2 identify each major stage and its detailed interconnection. Each stage contains cross-references that identify which blocks are the signal sources for inputs, or the destinations for outputs.

When a sub-function is treated as a block in figures SD-1 and SD-2, its detailed circuit information is included in its own schematic drawing(s), which is also included in this section.

LOCATING SCHEMATIC DIAGRAM(S) FOR A FUNCTIONAL BLOCK

The text inside a functional block provides the key to locating its schematic diagram(s).

1. When a functional block is assigned a reference designation (e.g., A2A1), refer to the family trees in [Section 3, “Parts Lists” on page 3-1](#). Follow the family tree branches to the block that contains the desired reference designation, and associated Nautel nomenclature (e.g., NAPA23/03A PA PWB). Note the reference designations and Nautel nomenclatures of all higher assemblies in the path, if applicable.
Example: A5 NAPA23/03A PA PWB.
2. Refer to [Table 5.1 on page 5-4](#) and use the reference designation and Nautel nomenclature to identify the appropriate schematic diagram(s).
Example: NAPA23/03A PA PWB is shown on schematic SD-5.
3. If necessary, refer to the referenced figure in the schematics at the end of this section and locate the next, lower-level assembly. Then, repeat this procedure until the desired schematic diagram is found.

LOCATING A PART OR ASSEMBLY ON A SCHEMATIC

The full reference designation assigned to a part or assembly is the key to physically locating that part or assembly.



Note: Full reference designations contain the assembly hierarchical coding. When the end item is divided into units (cabinets), the first coding is a unit number (1, 2, 3, etc.). When the end item is divided into assemblies, the first coding is an assembly number (A1, A2, A3, etc.). If a unit or an assembly is divided into sub-assemblies, assembly coding that identifies assembly relationship (1A1, A2A1, A2A1A1, etc.) is added.

1. Refer to the family trees in [Section 3, “Parts Lists” on page 3-1](#).
2. Follow the family tree branches to the block that contains the desired reference designation, while noting the Nautel nomenclatures and names of all higher assemblies in the path, as applicable. **Example:** A5 NAPA23/03A PA PWB.



Note: The drawings in the Mechanical Drawings section depict the assembly detail of the transmitter and its modules and assemblies.

3. Refer to [Table 6.1 in Section 6, “Mechanical Drawings” on page 6-1](#). Use the Nautel nomenclature and name of each family tree block in the path, starting at the highest assembly – this is normally Figure MD-1 – to determine the figure number(s) for that assembly.
Example: NAPA23/03A Interface PWB is shown on MD-6.
4. Refer to the referenced figure (e.g., MD-6) in [Table 6.1 on page 6-2](#) to locate the desired part or assembly.

Table 5.1: List of Electrical Schematics

Figure #	Title
SD-1	VS300 Transmitter - Ac-Dc and Exciter/Control Stages
SD-2	VS300 Transmitter - RF Drive and RF Power Stages
SD-3	NAPS40 PS Distribution PWB
SD-4	NAPA27A Pre-Amp PA PWB
SD-5	NAPA23/03A PA PWB

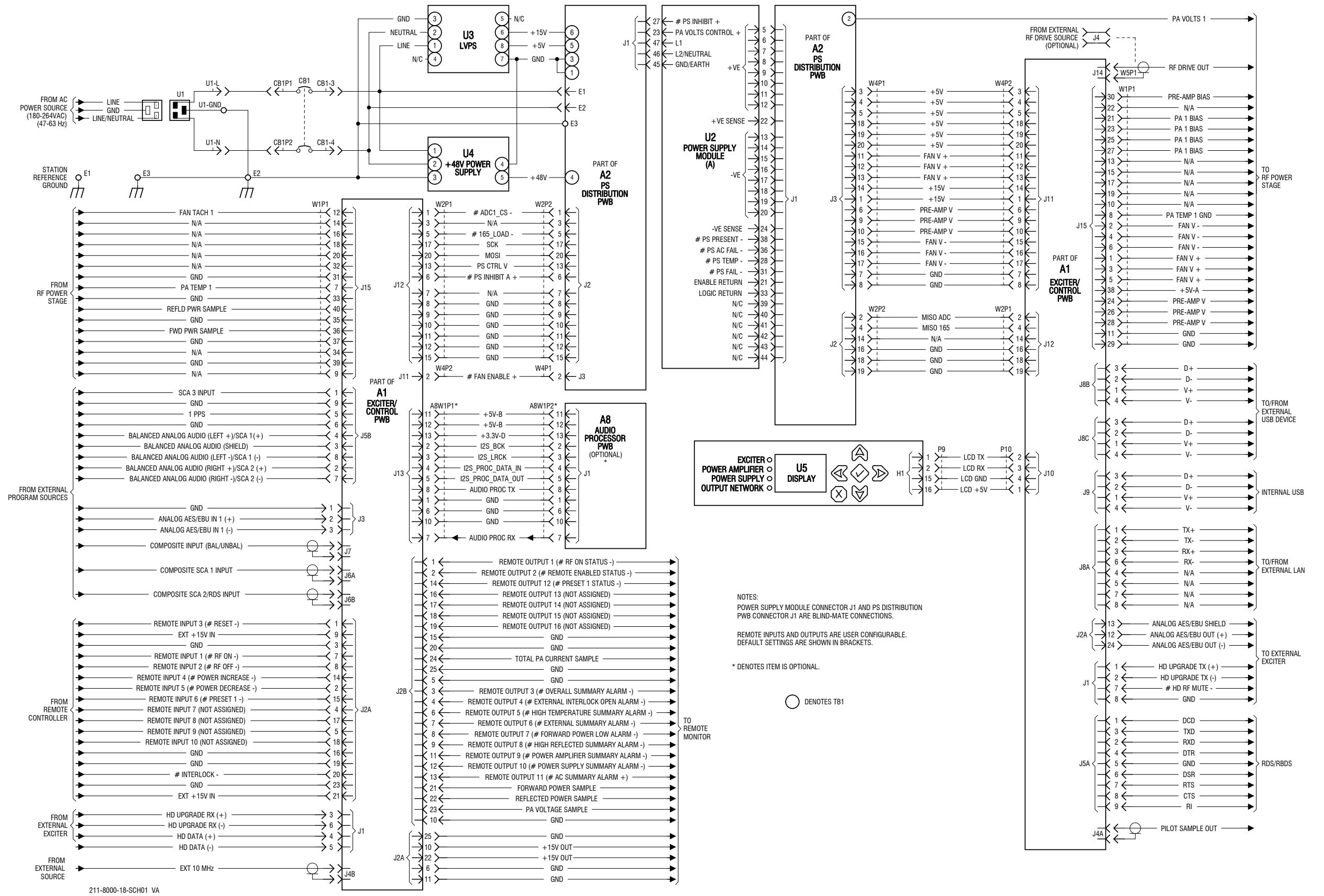


Figure SD-1: VS300 Transmitter - Ac-Dc and Exciter/Control Stages

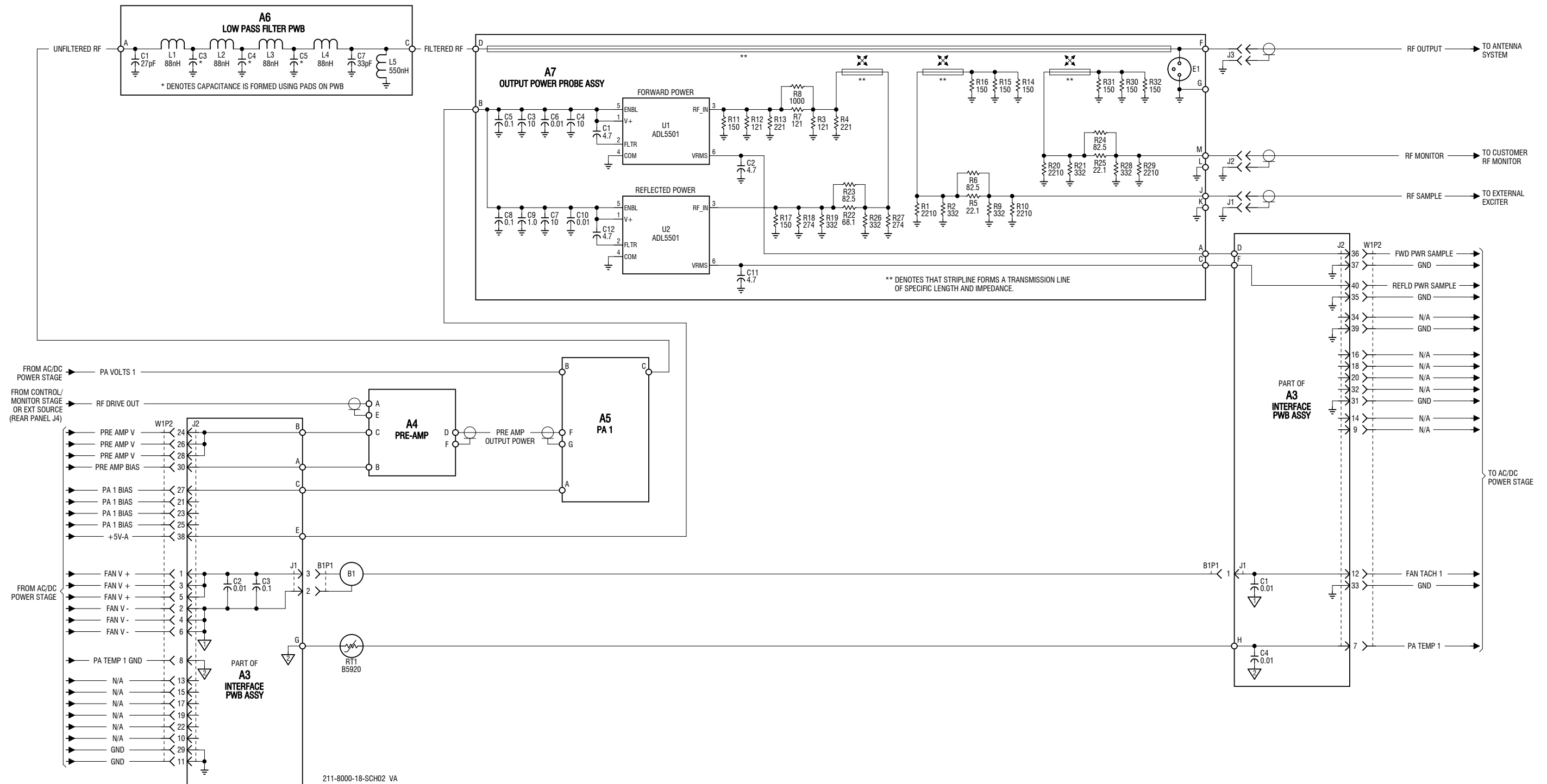


Figure SD-2: VS300 Transmitter - RF Drive and RF Power Stages

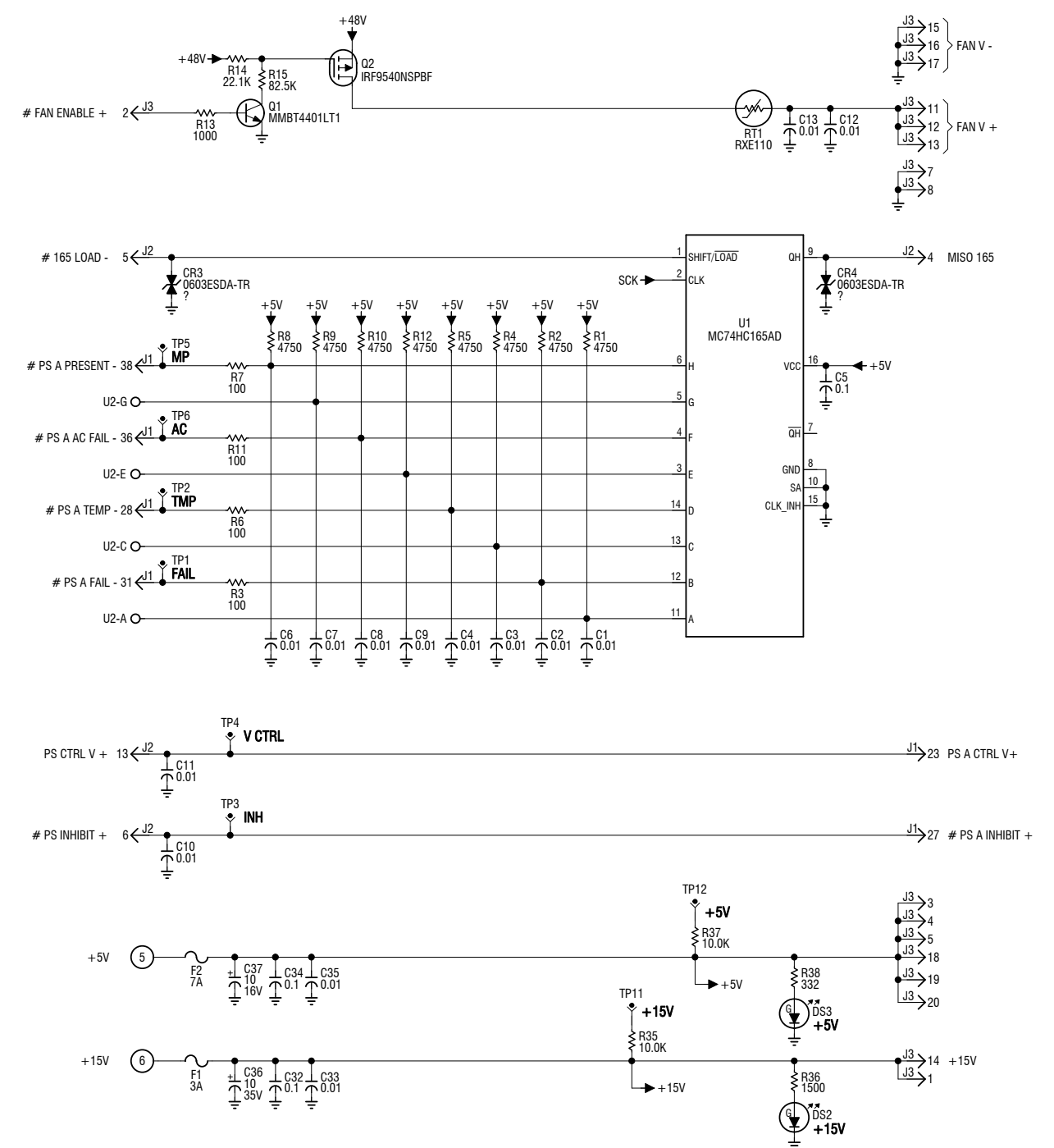
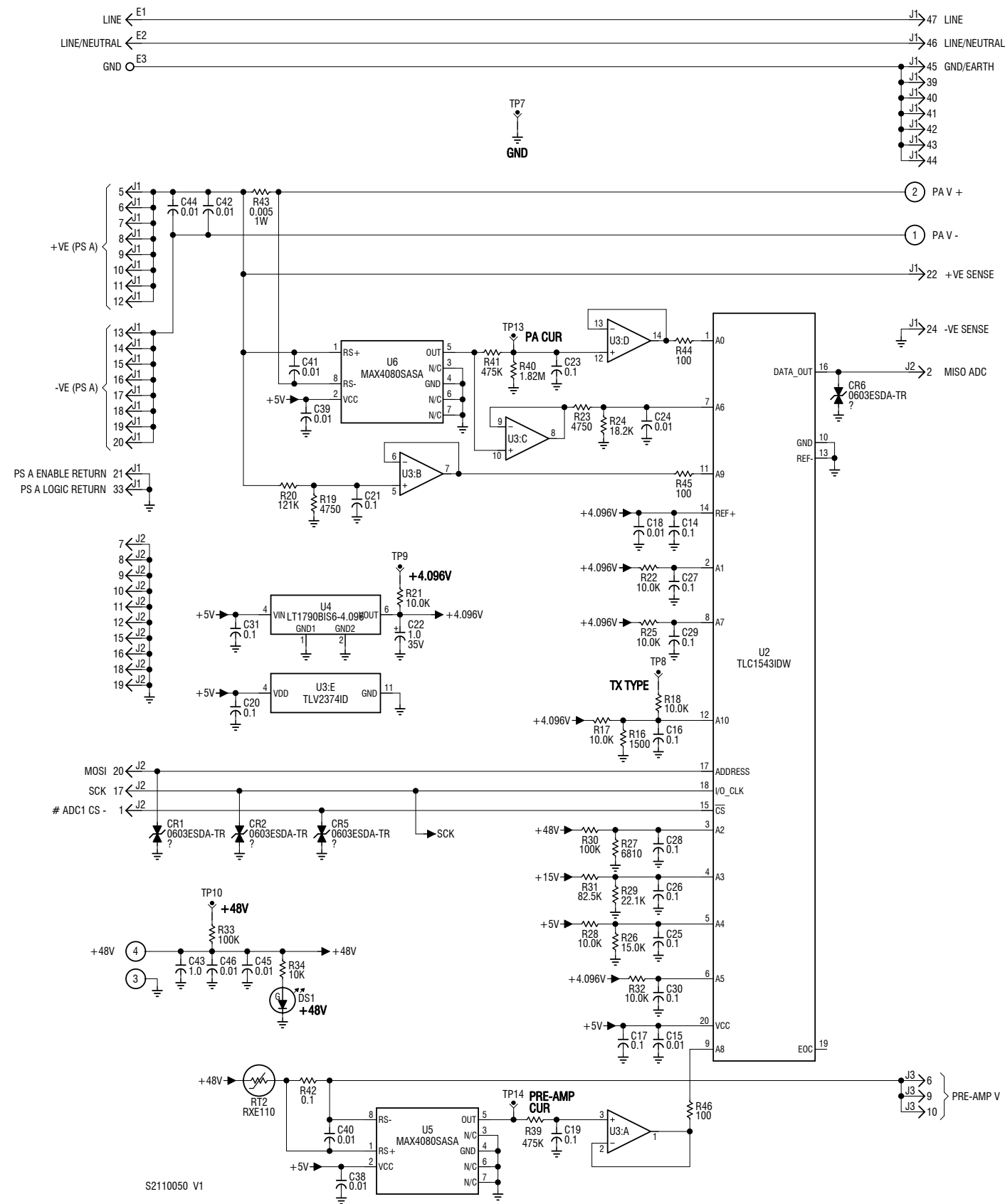


Figure SD-3: NAPS40 PS Distribution PWB

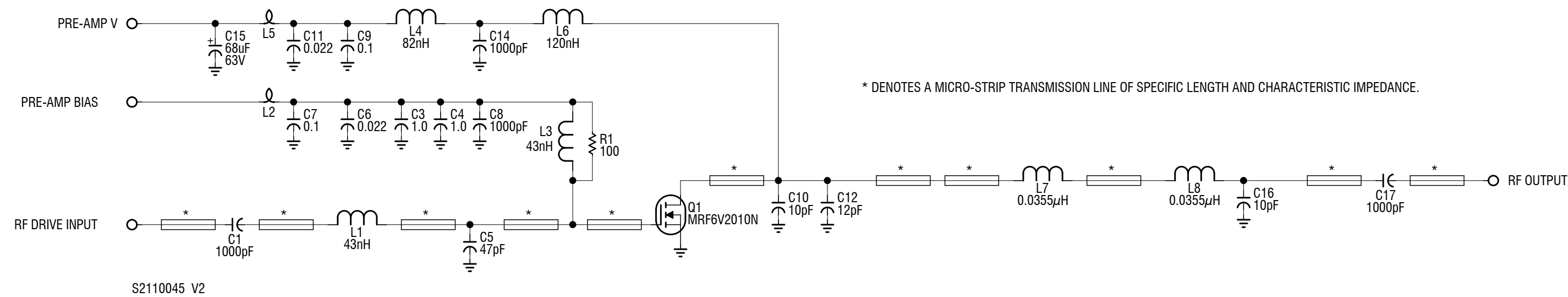


Figure SD-4: NAPA27A Pre-Amp PA PWB

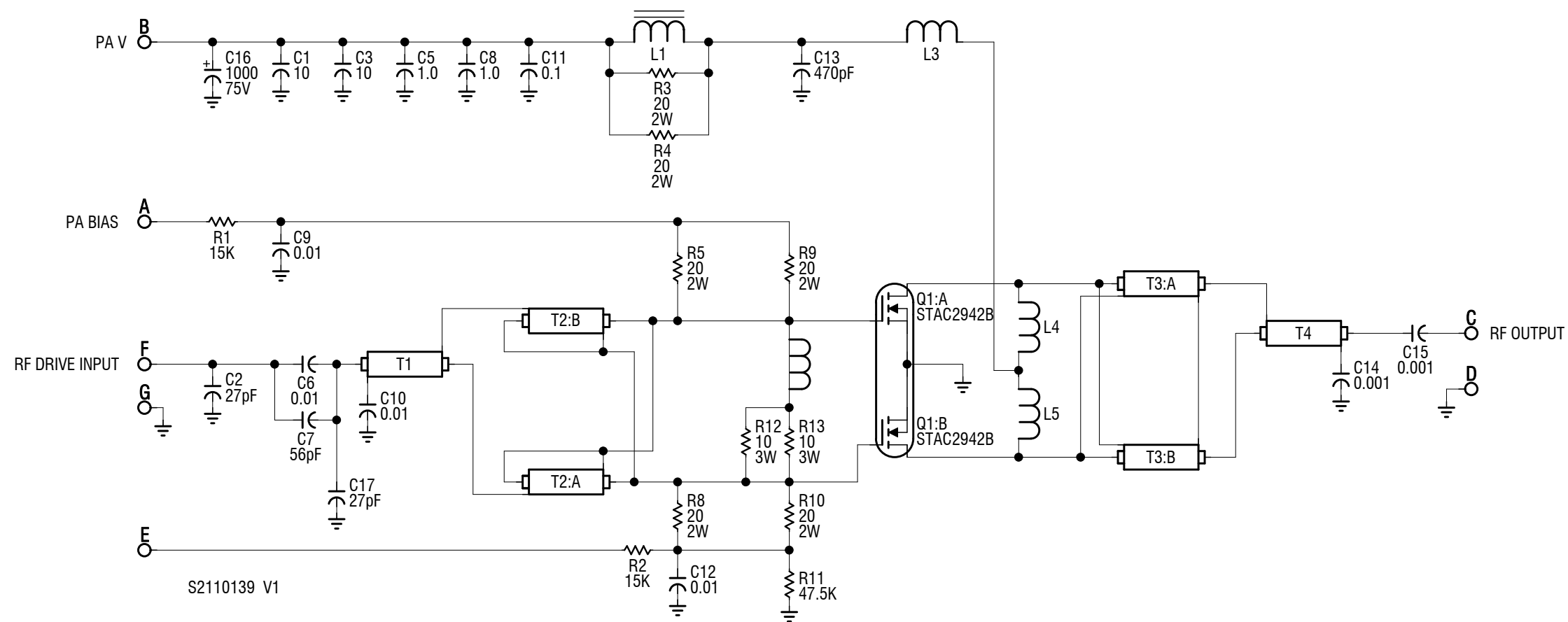


Figure SD-5: NAPA23/03A PA PWB

SECTION 6: MECHANICAL DRAWINGS

This section contains mechanical drawings for assemblies of the transmitter. Dimensional drawings may be included. Refer to [Table 6.1 on page 6-2](#) for an itemized list.

Assembly detail drawings for assemblies and modules that have separate manuals are not included. Refer to the appropriate maintenance manual for the assembly detail of these assemblies.

IDENTIFYING MECHANICAL DRAWINGS

Each mechanical drawing in this section is identified by a number that is both the figure number and the page number. The numbers are assigned sequentially and are prefixed by the letters MD. Drawings in this section are listed in [Table 6.1 on page 6-2](#).

CONTENT OF MECHANICAL DRAWINGS

Mechanical drawings are illustrations that depict the location of electrical components and show assembly outline detail. Dimensional information is included, where appropriate.

When a module or assembly is the subject of its own assembly detail drawing, and it is also shown in a higher level assembly, the detail depicted in the higher level assembly may have minor differences from the module or assembly actually installed. In this case, always refer to the assembly detail drawing of the module or assembly for detailed information.

LOCATING A PART OR ASSEMBLY ON A MECHANICAL DRAWING

1. When a part or assembly is assigned a reference designation (e.g., A2 or A2R1), refer to the family trees in [Section 3, “Parts Lists” on page 3-1](#). Follow the family tree branches to the block that contains the desired reference designation and Nautel nomenclature (e.g., NAPA23/O3A PA PWB). Note the reference designations and Nautel nomenclatures of all higher assemblies in the path, as applicable.
Example: A5 NAPA23/O3A PA PWB.
2. Refer to [Table 6.1 on page 6-2](#). Use the reference designation and Nautel nomenclature to identify the appropriate mechanical drawing.
Example: NAPA23/O3A PA PWB is shown on schematic MD-6.

3. If necessary, refer to the referenced figure (e.g., MD-6) in the mechanical drawings at the end of this section and locate the next, lower-level assembly. Then, repeat this procedure until the desired part or assembly is found.

Table 6.1: List of Mechanical Drawings

Figure #	Title
MD-1	VS300 Transmitter (Top and Bottom Views)
MD-2	NAPE87B Exciter/Control PWB
MD-3	NAPS40 PS Distribution PWB
MD-4	NAPI131 Interface PWB
MD-5	NAPA27A Pre-Amp PA PWB
MD-6	NAPA23/03A PA PWB
MD-7	NAPF11 RF Low Pass Filter PWB
MD-8	NAPP06 Output Power Probe PWB

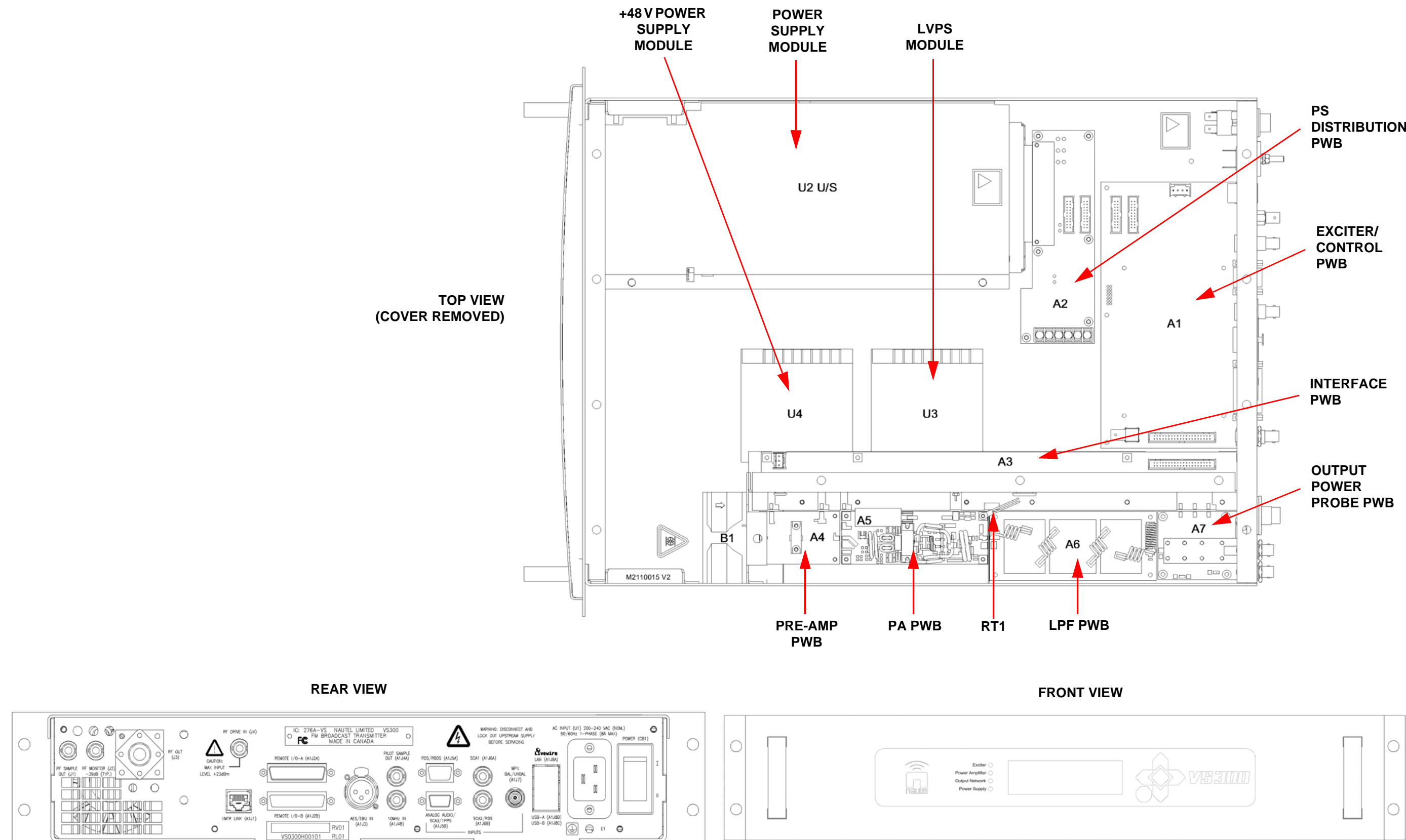


Figure MD-1: VS300 Transmitter (Front and Top Views)

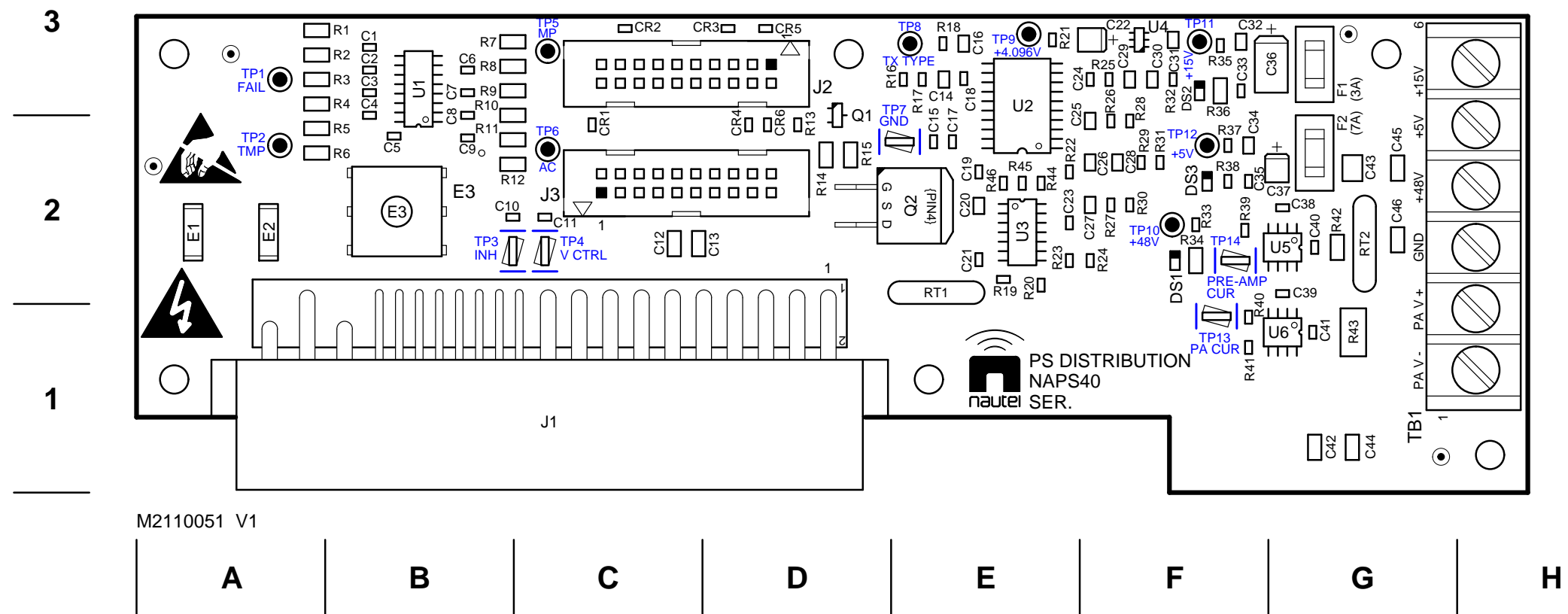


Figure MD-3: NAPS40 PS Distribution PWB

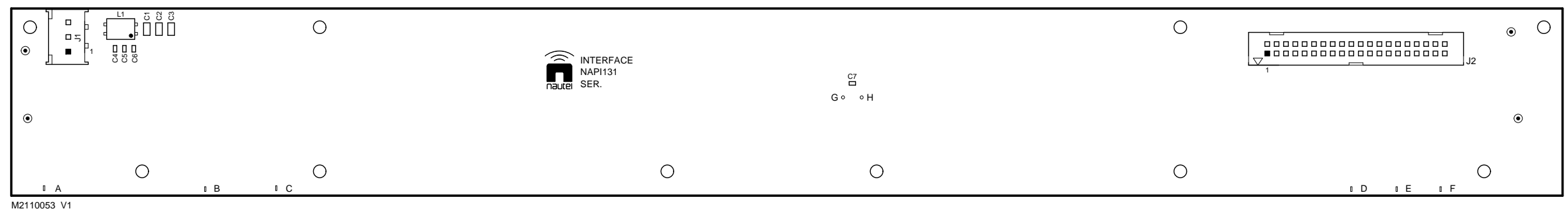


Figure MD-4: NAPI131 Interface PWB

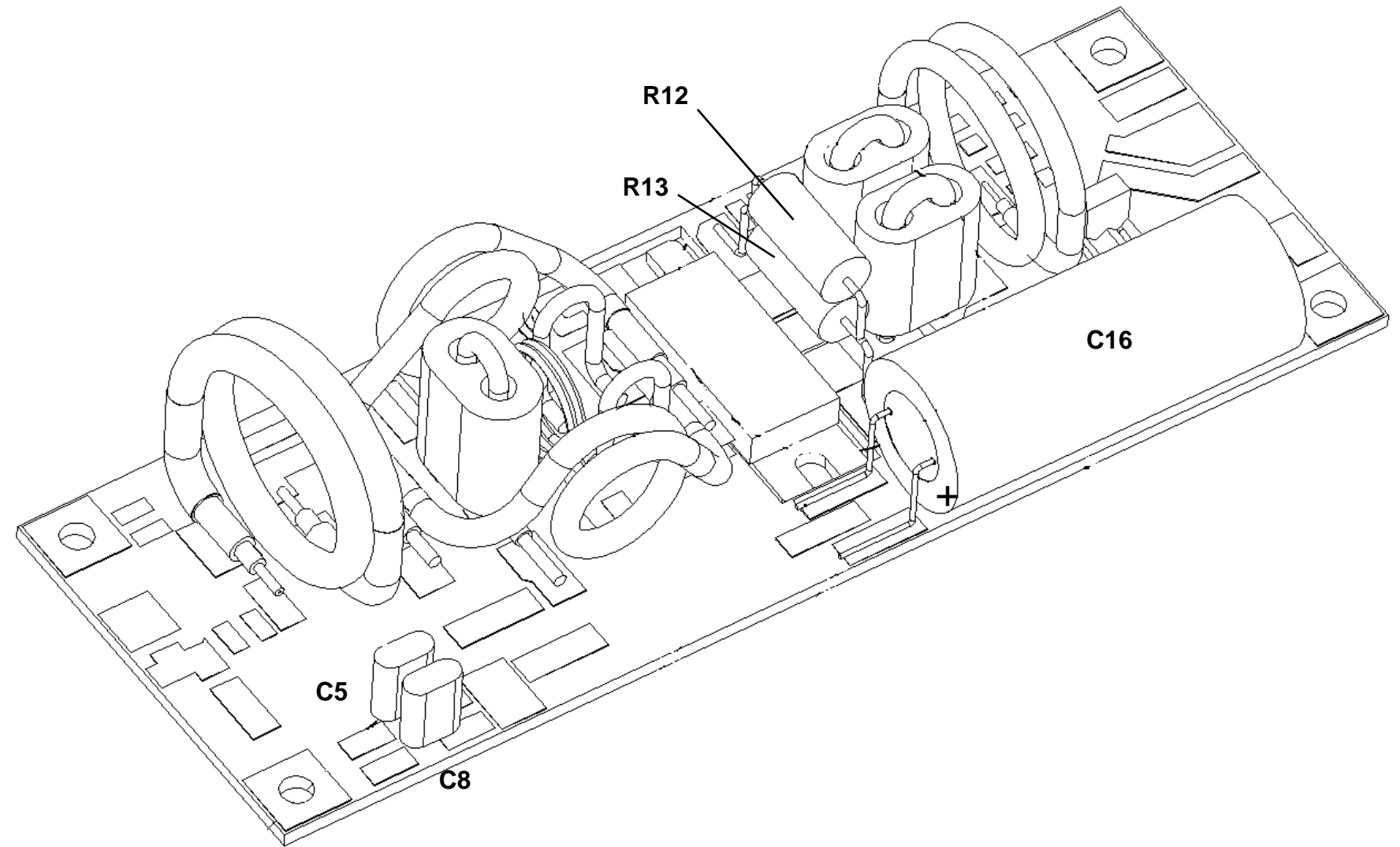
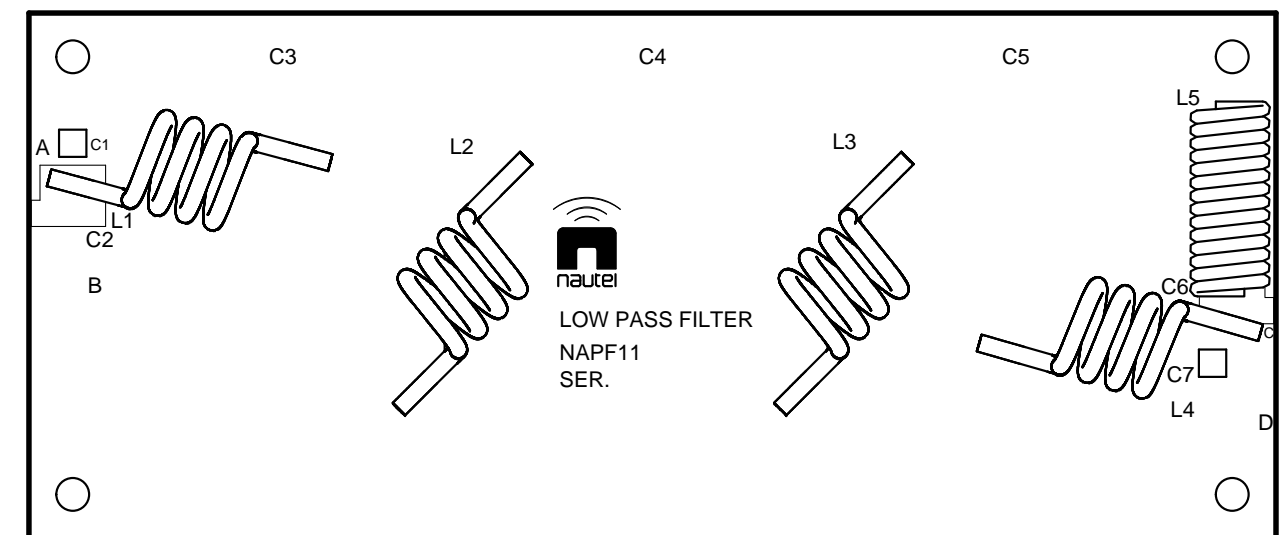


Figure MD-6: NAPA23/03A PA PWB



M2110044 V1

Figure MD-7: NAPF11 RF Low Pass Filter PWB

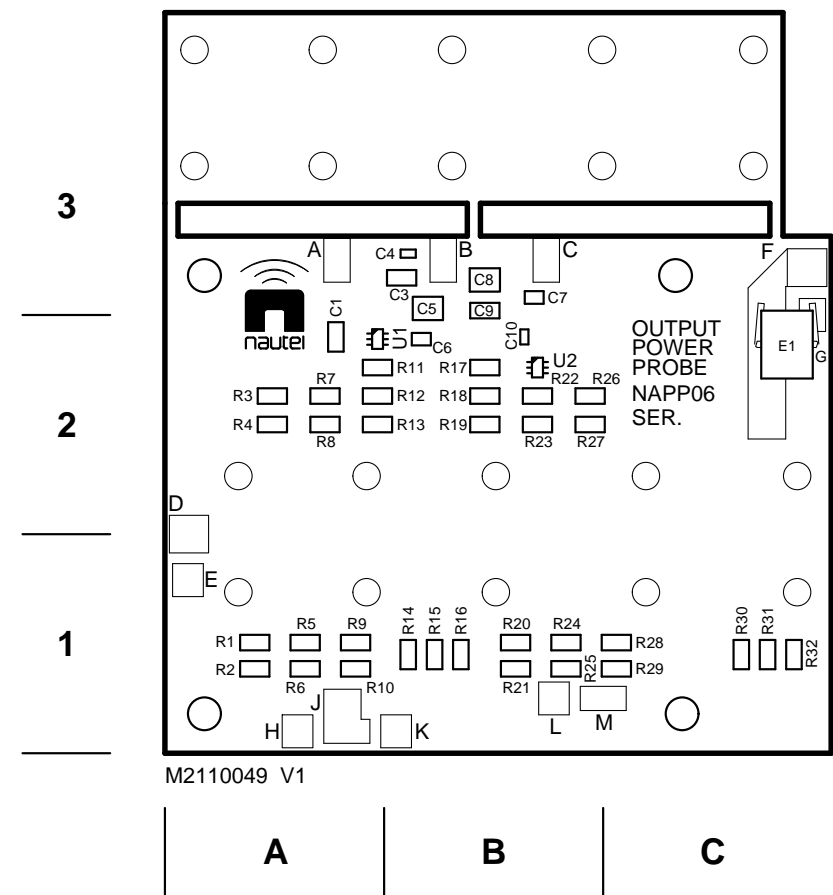


Figure MD-8: NAPP06 Output Power Probe PWB

SECTION 7: LIST OF TERMS

This section defines some of the terms that are used in Nautel documentation.

AES-EBU. Audio Engineering Society/European Broadcasting Union (AES/EBU) is the name of a digital audio transfer standard. The AES/EBU digital interface is usually implemented using 3-pin XLR connectors (the same type connector used in professional microphones). One cable carries both left-channel and right-channel audio data to the receiving device.

ARM. Advanced RISC (Reduced Instruction Set Computer) Machine. The specific ARM used in VS transmitters is ARM926, and is used for remote AUI functionality.

AUI. The Advanced User Interface is the web interface that allows for extensive control and monitoring of the transmitter.

CUTBACK. A reduction in RF output power, caused by the occurrence of multiple shutbacks within a pre-defined period.

CYCLING AC POWER. Turning off (disabling), then turning on (enabling) the ac power source.

DHCP. Dynamic Host Carrier Protocol.

DSP. Digital Signal Processing. Used for transmitter control and signal processing.

EEPROM. Electrically Erasable Programmable Read-Only Memory.

FOLDBACK. A reduction in RF output power, caused by adverse load conditions (high VSWR). No shutbacks or cutbacks have occurred.

INTERMEDIATE POWER AMPLIFIER (IPA). Refers to circuitry within the transmitter that amplifies the exciter's RF output to a level sufficient to drive the final RF amplifiers.

LATCHING ALARM. An alarm that, while active, keeps the transmitter in an 'RF inhibited' state. This type of alarm (e.g., High SWR Shutdown) require a reset - via the front panel or remote AUI - to attempt to restore transmitter operation.

LED. Light Emitting Diode (also referred to as lamp).

LUT. Look-Up Table.

MPX. Refers to the multiplexed baseband signal. Also referred to as the composite signal.

PRESET. A setting that controls power level, frequency and audio parameters. The VS300 allows you to pre-program multiple presets.

PWB. Printed Wiring Board.

SHUTBACK. A complete, but temporary loss of RF output power, caused by any one of a variety of faults, including high VSWR, high reject load power, RF drive failure, or an open external interlock.

SHUTDOWN. A complete and permanent loss of RF output power. Typically follows repeated cutback, foldback or shutback events.

SPI. Serial Peripheral Interface. A synchronous serial data link standard that operates in full duplex mode. Devices communicate in master/slave mode where the master device initiates the data frame. Multiple slave devices are allowed with individual slave select (chip select) lines. Also referred to as a "four wire" serial bus.

SURGE PROTECTION PANEL. An electrical panel that protects equipment from electrical surges in the ac power supply, antenna or site ground caused by lightning strikes.

VSWR. Voltage standing wave ratio. This is an expression of the ratio of forward voltage to reverse voltage on the feedline and antenna system. An ideal VSWR of 1:1 provides maximum transmitter-antenna efficiency.

VS300 TROUBLESHOOTING MANUAL

Document: NHB-VS300-TRB

Issue: 10.0 2019-01-18

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