Section 1: Responding to alarms

This section provides instructions you need when performing troubleshooting on the NX25/NX15 transmitter. This section includes the following topics:

If none of the procedures and alarms described in this section address your problem, contact Nautel for assistance.

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, 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 an alarm" on page 1-4 to determine the remedial action required 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 an alarm" on page 1-4 to determine the remedial action required 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 power module may be deferred to a convenient time.

A defective RF power module may be removed from the transmitter for servicing, while the transmitter is operating, provided that the conditions in the removal instructions detailed in "Removing an RF power module" on page 1-45 are met.

Off-air troubleshooting

Off-air troubleshooting must be performed when the replacement of a defective RF power amplifier module, or 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 1.5 times the maximum transmitter power rating) before starting off-air troubleshooting procedures. If an appropriate dummy load is not available, troubleshooting for a majority of faults can be performed with RF power stage turned off. The transmitter may remain connected to its antenna system for these procedures.

NOTE:
Reduce the RF output level to a minimal value when troubleshooting faults in the power amplifier stage while the transmitter's RF output 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 for contact with static sensitive semiconductor devices.

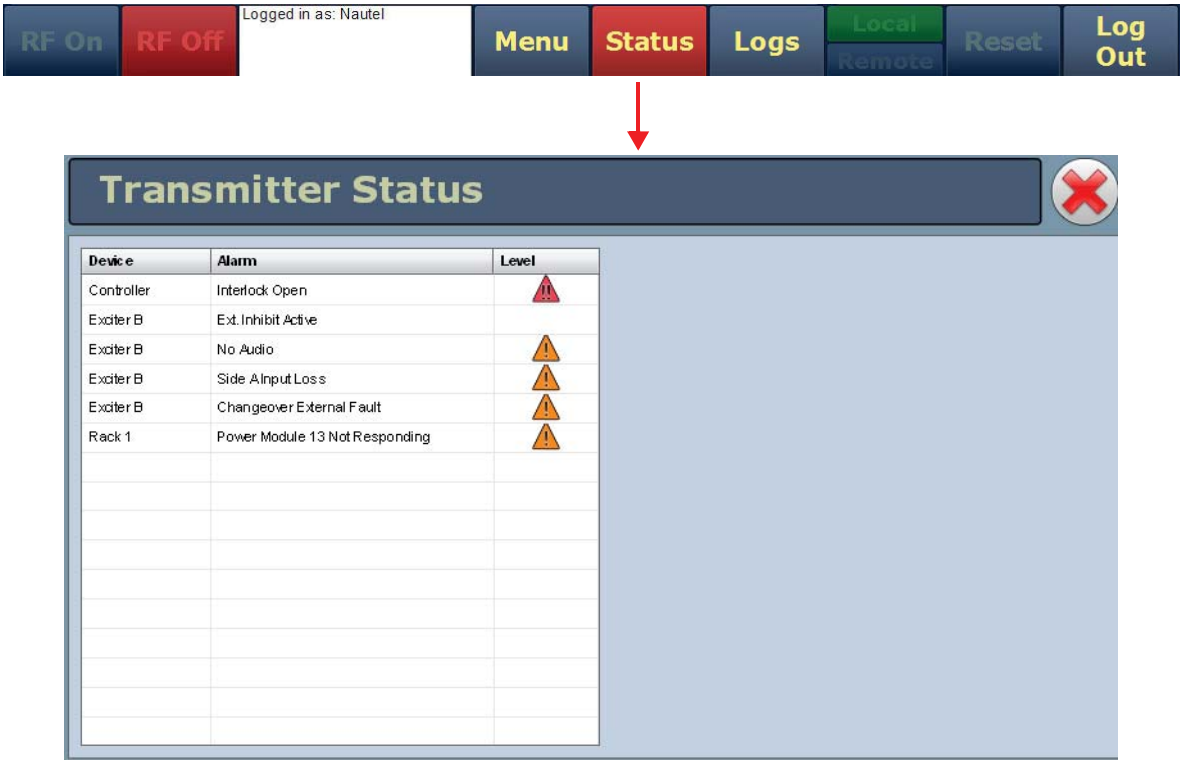
Stress current protection

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 an alarm

The best way to identify an alarm is by viewing the front panel's **Transmitter Status** page (Figure 1.1). If an alarm exists, the **Status** button at the bottom of the AUI display will be red. Press or click the **Status** button to go to the **Transmitter Status** page.

Figure 1.1: Transmitter Status Page



1. View the list of active faults by pressing the **Alarms** tab. Alarms are listed by their origin (**Device** column), then by name (**Alarm** column), and then by severity [a single yellow ! indicates low severity (RF output not affected), a single orange ! indicates medium severity (RF output is reduced), two red ! indicates high severity (RF output is inhibited); see **Level** column]. See "List of current alarms" on page 1-5.

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. Refer to Table 1.1 on page 1-6 for troubleshooting tips on the offending alarm(s), which may also reference replacement and subsequent re-calibration procedures. Note the origin of the alarm (i.e., contained within Controller, Exciter, Rack # or Module # sub-system folders).

4. Refer also to Table 1.2 on page 1-35 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 local or remote AUI's Remote I/O -> Remote Outputs menu (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 local or remote AUI for an offending trigger alarm and refer to its troubleshooting information for more details.*

5. If the troubleshooting and subsequent replacement of a suspect PWB or RF power module does not remove the fault condition, contact Nautel.

> *NOTE:*
> *Before undertaking any troubleshooting, record all AUI meter readings and note if any other alarms are displayed on the* Transmitter Status *page. Record all alarms. The most convenient way to do this is by using a web browser over a LAN connection to save screen shots of critical status, meter and alarm pages. From the* Meters *page, press the information* (!) *button for each sub-device (Controller, Exciter and Module) to view (and save) detailed information.*

List of current alarms

If an alarm exists and is being recognized by the transmitter, it is displayed under the Alarms tab of the transmitter status page (see Figure 1.1 on page 1-4). 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 A: All alarms in this sub-system apply to exciter A.
- Exciter B: All alarms in this sub-system apply to exciter B.
- Rack #: All alarms in this sub-system apply to the associated rack (or cabinet).
- Module #: All alarms in this sub-system apply to the associated RF power module.

Table 1.1 on page 1-6 contains a column for most Alarms that can occur, sorted alphanumerically for each sub-system. The Description and Troubleshooting Action column provides a brief description of the alarm, troubleshooting tips and a cross-reference to more detailed troubleshooting, as applicable.

Table 1.1: Troubleshooting Alarms

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Audio Loss Shutdown	This alarm occurs if the modulation level is below the preset threshold for the designated period of time set in the Audio Loss settings of the current preset, and the desired action was set to RF Inhibit. This will cause the transmitter to shut down its RF output until the exciter determines that the modulation source has returned. If this alarm is unexpected, check the audio inputs specified in the preset and verify there is signal present.
Controller: Arc Shutback	This alarm indicates the transmitter has entered a shutback (see Shutback on page 3.1.10 of the Operations & Maintenance Manual for a description of the shutback routine) due to one of the rack controller's arc detectors being activated. When this fault occurs, the transmitter immediately inhibits PDM and the transmitter's output power drops to 0 W. Once the fault clears the transmitter will automatically recover, either to the power setpoint, or to a reduced power as determined by the cutback routine (see "Cutback:" on page 1-8 of the Operations & Maintenance Manual for a description of the cutback routine). Visually inspect the inside of the transmitter to locate the fault causing the arc detector to trigger.
Controller: Brownout Reset	This alarm is only visible in the transmitter logs, and indicates the controller was reset because its +5 V power supply voltage was less than +4.3 V, but remained above +1.4 V, and then subsequently recovered. This alarm should occur concurrently with other alarms. Follow the troubleshooting information for the associated alarms. If the alarm persists without the presence of other alarms, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Combiner Interlock Open	This alarm will only occur if the transmitter is connected in a combined system. The alarm indicates that the interlock signal from the combiner is open. When this alarm occurs, the transmitter immediately inhibits the PDM and the transmitter's output power drops to 0 W. If this condition persists for more than 10 seconds, the transmitter will inhibit the RF power modules, fans and B+ power supply. The transmitter will automatically recover when the condition is cleared. Check the combiner for a condition that may cause it to open the interlock to the transmitter. If so, troubleshoot the cause of that condition. If not, inspect the wiring between the combiner and the transmitter and verify there is no damage. If the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: Controller Reset	This alarm is only visible in the transmitter logs, and indicates the controller was reset because its +5 V power supply voltage was less than 1.4 V, which normally happens due to a loss of ac power. If the controller is rebooting without losing ac power to the transmitter, check for the presence of other alarms at the time of the controller reset and follow the troubleshooting information for those alarms. Otherwise, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: EEPROM Failure: Config	This alarm occurs when the transmitter is unable to read the following settings from EEPROM upon boot-up. The transmitter will revert to its initial default settings, which may be different from the values set before the transmitter was shipped. The alarm will remain asserted until at least one of the settings are changed. Affected settings are: – Main Exciter (Defaults to A) – Standby Exciter Installed (Defaults to Yes) – Exciter Sync (Defaults to None) – Active Max Power Lockout (Defaults to 1) – RF Monitor Select (Defaults to forward power) – Host Watchdog Enable (Defaults to OFF, should be turned ON) – Network Configuration Configure the affected settings as desired. Cycle (turn off, then on) ac power to the transmitter. If the alarm persists, replace the battery on the control/interface PWB and retry the above steps. If the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: EEPROM Failure: Thresholds	This alarm occurs when the transmitter is unable to read its configuration for transmitter type and rack interface serial numbers from EEPROM upon boot-up. The transmitter will revert to its initial default settings, which may be different from the values set before the transmitter was shipped. The alarm will remain asserted until the setting is changed. Change the transmitter type to the correct setting.Remove and re-apply the ac power to the transmitter. If the alarm persists, replace the battery on the control/interface PWB and retry the above steps. If the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: EEPROM Failure: Potentiometers	This alarm occurs when the transmitter is unable to read its RF Symmetry Adjustment calibration from EEPROM upon boot-up. The alarm will remain asserted until the RF Symmetry has been re-calibrated. When this alarm occurs, the transmitter will load a default level of exactly mid-scale for the symmetry adjustment potentiometers. Set the RF Symmetry Adjust per the factory configuration. Cycle (turn off, then on) ac power to the transmitter. If the alarm persists, replace the battery on the control/interface PWB and retry the above steps. If the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: EEPROM Failure: Remotes	This alarm occurs when the transmitter is unable to read its remote I/O configuration from EEPROM upon boot-up. The transmitter will revert to the initial default remote I/O settings and the alarm will remain asserted until a new remote input/output is configured. Reconfigure the remote I/O settings as desired. Cycle (turn off, then on) ac power to the transmitter. If the alarm persists, replace the battery on the control/interface PWB and re-try the above steps. If the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: EEPROM Failure: Schedule	This alarm occurs when the transmitter is unable to read its schedule configuration from EEPROM upon boot-up. The transmitter will establish a new, completely blank schedule. The alarm will remain asserted until at least one new scheduled event is created. Recreate the desired schedule settings. Cycle (turn off, then on) ac power to the transmitter. If the alarm persists, replace the battery on the control/interface PWB and retry the above steps. If it still persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Exciter A (or B) Not Responding	This alarm occurs when the controller is configured to expect exciter A (or B) is installed, and it has failed to receive any serial response from that exciter. The alarm is cleared if the controller is configured to expect that same exciter is not installed, or if it receives a serial response from the exciter. When this alarm occurs on the standby exciter, automatic changeover will be inhibited. When this alarm occurs on the main exciter, if automatic changeovers are enabled and the main exciter is active and the standby exciter is responding to serial communication, an automatic changeover will occur. If there are two exciters in the transmitter, swap exciter positions. If the alarm follows the exciter, or there is only one exciter in the system, replace the digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55). If the alarm persists, or the alarm remains with the position, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: Exciter Changeover	This alarm indicates that an automatic exciter changeover has occurred. This alarm will occur as a result of another alarm triggering the automatic exciter changeover. Follow the troubleshooting information for the associated alarm.
Controller: Exgine Not Responding	This alarm indicates the transmitter is configured for an IBOC mode of operation and the controller has not received any communication from the Exgine over a set period of time. The alarm will clear if the transmitter is configured for a non-IBOC mode of operation, or the controller receives a response from the Exgine. If the Exgine is operating normally, ignore this alarm. If the Exgine is not operating normally, cycle ac power to the transmitter. If the alarm persists, inspect the cabling between the Exgine and the transmitter controller. If the cabling is acceptable and the alarm persists, replace the Exgine PWB (see “Exgine PWB replacement” on page 1-61). If the alarm persists, or the alarm remains with the position, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: External PDM Inhibit	This alarm occurs if the external PDM inhibit circuit, wired to the control/interface PWB, is closed. When this alarm occurs, the transmitter immediately inhibits the PDM and the transmitter's output power drops to 0 W. The transmitter will automatically recover when the condition is cleared. Ensure the transmitter is set to RF Off and disconnect the PDM inhibit circuit from the transmitter. Measure the impedance of the interlock circuit. If the impedance measures short circuit (low impedance) the PDM inhibit is closed, and it will be necessary to locate the external device that is causing this condition. If the impedance does not measure short circuit, verify the PDM inhibit circuitry has been properly configured. If the PDM inhibit circuitry is properly configured and the alarm persists, replace the control PWB (see “Controller: External PDM Inhibit” on page 1-41).
Controller: External Reset	This alarm is only visible in the transmitter logs, and indicates the controller was reset by triggering the controller's reset pin. If this alarm continues to occur unexpectedly, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: Fast SWR Shutback	This alarm indicates the peak reflected power measured by the directional coupler at the output of the transmitter has exceeded the factory-set threshold. When this alarm occurs, the transmitter immediately inhibits the PDM and RF drive (see “Shutback:” on page 1-8 of the Operations & Maintenance Manual). Once the fault clears, the transmitter will automatically recover, either to the power setpoint, or to a reduced power as determined by the cutback routine (see “Cutback:” on page 1-8 of the Operations & Maintenance Manual). If this alarm occurs in conjunction with the Exciter's SWR Shutback alarm, it generally indicates a fault in the transmitter's external RF output network (e.g., rigid-line, antenna, etc.). If this alarm is occurring while the Exciter's SWR Shutback alarm is not, verify the wiring between the directional coupler and the control/interface PWB is not damaged. If not, verify the Fast SWR Shutback threshold is set properly (contact Nautel to obtain the correct setting for your transmitter). If this threshold is set correctly and the alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: GPS Not Responding	This alarm indicates the transmitter is configured to use a GPS sync PWB as a frequency and phase reference, but the controller is not receiving communication from the GPS sync PWB. The alarm will clear when the transmitter is configured to not use the GPS sync PWB as the frequency and phase reference, or the controller receives communication from the GPS sync PWB. Inspect the wiring between the GPS sync PWB and the control/interface PWB, if applicable. If the wiring is acceptable, replace the GPS sync PWB (see “GPS Sync PWB replacement” on page 1-61).
Controller: GPS PLL Unlocked	This alarm indicates the timing phase-lock-loop between the 1 PPS signal from the GPS and the 10 MHz reference is not locked. This can occur due to a power failure, or because the GPS receiver is not locked to the GPS satellites. Verify the GPS antenna is installed and is located in a spot where it is possible to obtain a GPS satellite lock. If the alarm persists, replace the GPS sync PWB (see “GPS Sync PWB replacement” on page 1-61).
Controller: GPS Receiver Not Responding	This alarm occurs when the GPS receiver is not responding to serial commands on the GPS sync PWB. When this occurs, the GPS sync PWB's phase-lock-loop will not be locked, and the timing signals will be free-running. Cycle (turn off, then on) the ac power to the transmitter. If the alarm persists, replace the GPS sync PWB (see “GPS Sync PWB replacement” on page 1-61).
Controller: GPS Sync No 1-PPS	The alarm occurs when the 1 PPS output from the GPS receiver is not present. This occurs when the GPS receiver is not locked to the GPS satellites. When the 1 PPS input is not present, the phase-lock-loop cannot lock properly to discipline the 10 MHz reference. Verify the GPS antenna is installed and is located in a spot where it is possible to obtain a GPS satellite lock. If the alarm persists, replace the GPS sync PWB (see “GPS Sync PWB replacement” on page 1-61).
Controller: GPS Unlocked	This alarm occurs when the GPS module on the GPS sync PWB does not have a valid satellite lock. When this alarm occurs, the phase-lock-loop is no longer running to discipline the 10 MHz oscillator, and it is allowed to free-run at the last valid setting. Verify the GPS antenna is installed and is located in a spot where it is possible to obtain a GPS satellite lock. If the alarm persists, replace the GPS sync PWB (see “GPS Sync PWB replacement” on page 1-61).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: High RF Drive	This alarm indicates the controller's RF Drive Duty Cycle meter has risen above 60% for longer than 10 seconds. This alarm will cause an exciter changeover, if automatic changeover is enabled and the transmitter is operating on the main exciter. If there are two exciters in the transmitter, swap exciter positions. If the alarm follows the exciter, or there is only one exciter in the system, replace the digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55). If the alarm persists, or the alarm remains with the position, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).
Controller: Host Network Down	This alarm indicates the transmitter is configured to have networking enabled, but the host is indicating there is no network connectivity. If the transmitter is not connected to a network, the alarm can be inhibited by changing the network settings to static IP and setting the IP address to 0.0.0.0. If the transmitter is connected to a network, verify the network settings are configured properly, and the network cable is connected to the correct port on the transmitter.
Controller: Host Not Booted	This alarm indicates that the controller has not received any communication from the host since the last time the controller booted (i.e., was powered up). The occurrence of this alarm is normal for approximately one to five minutes while the host is booting, immediately after ac power has been applied to the transmitter. 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 SBC or control/interface PWB (see "Control/interface PWB replacement" on page 1-60).
Controller: Host Not Responding	This alarm indicates that the controller has not received any communication from the host in a set period of time. The occurrence of this alarm is normal for approximately one to five minutes while the host is booting, immediately after ac power has been applied to the transmitter. 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 SBC or control/interface PWB (see "Control/interface PWB replacement" on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Internal Watchdog Reset	This alarm will only be seen in transmitter logs, and indicates that the controller was reset by its internal watchdog. If this alarm persists, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: Interlock Open	This alarm indicates that the external interlock input wired to the control/interface PWB is open. An alarm will be triggered by user-set conditions (e.g., the state of the door to the transmitter room). When this alarm occurs, the transmitter immediately inhibits the PDM and the transmitter's output power drops to 0 W. If this condition persists for more than 10 seconds, the transmitter will inhibit the RF power modules, fans and B+ power supply. The transmitter will automatically recover when the condition is cleared. With the transmitter set to RF Off, disconnect the interlock circuit from the transmitter. Measure the impedance of the interlock circuit. If the impedance measures open circuit (high impedance) the interlock is open, and it will be necessary to locate the external device that is causing this condition. If the impedance does not measure open circuit, verify the interlock circuitry has been properly configured. If the interlock circuitry is properly configured, make a temporary jumper and use it to short out the interlock circuit. If the alarm disappears, the transmitter is operating as expected and it will be necessary to locate the external device that is causing this condition. If the alarm persists, replace the control PWB. See “Controller: Interlock Open” on page 1-41.
Controller: Jumped to Bootloader	This alarm is only visible in the transmitter logs, and indicates the controller was reset due to performing a firmware upgrade. If this alarm is occurring when a firmware upgrade is not being performed, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Controller: Low Battery	This alarm occurs if the voltage of the backup battery has fallen below an acceptable level. Replace the battery (BT1) on the control/interface PWB while ac power is on. If the alarm persists after replacing the battery, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Low RF Drive	This alarm indicates the controller's RF Drive Duty Cycle meter has fallen below 40% for longer than 10 seconds. This alarm will cause an exciter changeover, if automatic changeover is enabled and the transmitter is operating on the main exciter. If there are two exciters in the transmitter, swap exciter positions. If the alarm follows the exciter, or there is only one exciter in the system, replace the digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55). If the alarm persists, or the alarm remains with the position, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).
Controller: Out of Memory Reset	This alarm is only visible in the transmitter logs, and indicates the controller automatically reset because it ran out of the memory required to continue normal operation. If the alarm persists, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).
Controller: PDM Latch	This alarm indicates that the PDM latch circuitry on the control/interface PWB has tripped, causing the transmitter to shut down and latch off. If automatic changeovers are enabled and the transmitter is operating on the main exciter, an automatic changeover will occur, and the latch will be cleared, allowing the transmitter to return to the current preset settings. If automatic changeovers are disabled, or if the transmitter was already operating on the standby exciter when this event occurred, try resetting the transmitter alarms. If the alarm persists, press RF Off, press the Reset button (S1) on the digital AM exciter PWB, then press RF On. If the alarm persists, check modulation levels being applied to the selected input and verify they are as expected. If the alarm persists, replace the digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).
Controller: Power Loss	This alarm indicates that the controller lost power at the time the event was logged. The alarm should occur concurrently with other alarms. Follow the troubleshooting action for the associated alarm(s). Otherwise, if the alarm persists without the presence of other alarms, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).

Alarm (with Prefix)	Description and Troubleshooting Action
Controller: Rack 1 Not Responding	This alarm indicates that the controller is no longer receiving serial communication from Rack 1. No action is taken. Check the wiring and connections between the control/interface PWB and the rack interface PWB and verify there is no damage. If the wiring is OK, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60). If the alarm persists, replace the affected cabinet’s rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Controller: Unknown Reset Cause	This alarm is only visible in the transmitter logs, and indicates the controller was reset, but it was unable to determine the cause of the reset. If the controller is rebooting unexpectedly, check for the presence of other alarms at the time of this alarm and follow the troubleshooting action for the associated alarm(s). Otherwise, replace the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Exciter A/B: AES1 (or 2) Unlocked	This alarm indicates there is no AES data detected on the applicable AES (1 or 2) input and that same input is selected as the active input in either Analog or Digital settings for the active preset. Verify there is valid AES data being applied to the corresponding input on the control/interface PWB. If there is data being applied to the correct input and the alarm persists, replace the digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55) or the control/interface PWB (see “Control/interface PWB replacement” on page 1-60).
Exciter A/B: AM Input Loss	This alarm occurs if the input signal being used to generate the analog AM modulation is low or not present. This alarm will be triggered immediately if the AES input is unlocked, or after 2 minutes if the incoming modulation level is below 10%. The presence of this alarm will trigger an exciter changeover if automatic changeover is enabled and the transmitter is operating on the main exciter. Verify that the active preset is calling up the correct audio input and is set for the correct input level. Verify that there is a valid audio signal on the audio input being used. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: Audio Loss	This alarm occurs as a result of the modulation being below the specified threshold for the designated period of time set in the remote AUI's Audio Loss tab for the current preset. This will cause the action specified in the preset to be taken. Check the audio inputs specified in the preset and verify there is signal present.
Exciter A/B: Audio Overmod Protection	This alarm indicates that the exciter has reduced the output signal due to overmodulation on the audio input. This alarm is typically caused by low frequency or excessive modulation, although it can also occur if the DRM AES input sensitivity is incorrectly configured, resulting in too much signal level. The alarm will clear and allow the gain to return to 100% once the excessive modulation condition disappears. Check the input signal being applied to the exciter and reduce the level as necessary.
Exciter A/B: B+ Sample Uncalibrated	This alarm indicates that the associated exciter's B+ sample has never been calibrated. This alarm should only occur when replacing an exciter, and indicates the configuration file was not properly uploaded (see "Digital AM exciter PWB replacement" on page 1-55).
Exciter A/B: Carrier Sync Unlocked	This alarm occurs when the transmitter's Sync Source is set to GPS Sync Card or Combiner and the exciter cannot lock to the 1 kHz signal used for phase synchronization. If the Sync Source is set to Combiner, this alarm will cause the transmitter to be inhibited, otherwise this alarm is displayed for information only. If the transmitter's Sync Source is set to GPS Sync Card, check the connection between the GPS sync PWB and the control/interface PWB. If the connection looks OK, replace the GPS sync PWB (see "GPS Sync PWB replacement" on page 1-61). If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55) or the control/interface PWB (see "Control/interface PWB replacement" on page 1-60). If the transmitter's Sync Source is set to Combiner, check the connection between the combiner and the control/interface PWB. If the connection looks OK, troubleshoot the combiner's synchronization signal source.

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: Cutback	The forward power has been reduced due to multiple shutbacks. See “Cutback:” on page 1-8 of the Operations & Maintenance Manual for a description of the cutback routine. Check for associated alarms and refer to their troubleshooting information to determine the specific cause of the cutback.
Exciter A/B: Digital Input Loss	This alarm indicates the input signal being used to generate the digital modulation is too low or no longer present. This alarm will be triggered immediately if the AES input (DRM) is unlocked or the Exgine stream (IBOC) is missing, or if the DSP is receiving zeroes on the AES (DRM) or Exgine (IBOC) input for more than 100 ms. The presence of this alarm will trigger an exciter changeover, if automatic changeover is enabled and the transmitter is operating on the main exciter. Verify that the active preset is calling up the correct input and is set for the correct input level. Verify that there is a valid signal on the input being used. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: Entered Firmware Upgrade	This alarm indicates that the exciter firmware is being upgraded, and it has inhibited the RF output until complete. The alarm will clear when the upgrade is complete and the exciter reboots. If a firmware upgrade has not been initialized intentionally, try resetting the exciter. If the alarm continues to persist, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: External Inhibit Active	This alarm indicates that the transmitter controller has inhibited the exciters. Transmitter output power is reduced to 0 W. It is normal to see this alarm when the transmitter is in an RF OFF state. If this alarm occurs while RF is turned on, there should be a corresponding alarm indicated by the transmitter controller. Follow the troubleshooting information for that alarm.
Exciter A/B: FPGA Test Failed	This alarm indicates there was a programming failure with the FPGA. Cycle the power (off, then on) to the transmitter. If the alarm persists, replace the affected digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: High B+ Voltage	This alarm indicates that the B+ voltage measured by the exciter exceeded the B+ setpoint by more than 20 V for at least ten (10) seconds. If the rack interface's High B+ voltage alarm is present, see the troubleshooting action for that alarm. If the rack interface's alarm is not present, compare the exciter's B+ voltage meter with the rack's B+ voltage meter. If they are different, calibrate the exciter's B+ voltage sample using a multimeter to measure the B+ voltage. If after calibrating the exciter's B+ voltage sample the meters continue to read the incorrect voltage, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).
Exciter A/B: High DC Current Foldback	This alarm indicates that the transmitter's forward power is being reduced because the total dc current being drawn from the B+ power supply, as measured by the transmitter controller's Total B+ Current meter, exceeded 122.5A. The alarm will clear once the transmitter's forward power is no longer being reduced. This alarm indicates the transmitter's efficiency is much lower than expected, most likely due to a poor load being presented to the RF power modules. Ensure the load impedance being presented to the transmitter by the antenna network is within specification.
Exciter A/B: High Forward Foldback	This alarm occurs when the transmitter's forward power has been reduced because the average forward power increased above 150% of the transmitter's rated carrier power. The alarm will clear when the forward power is no longer being reduced. The alarm will generally occur due to excessive modulation. Reduce the level of modulation applied to the transmitter.
Exciter A/B: High Power Lockout	This alarm occurs when the exciter has reduced the power set point due to the currently active high power lockout limit being lower than the active preset's power set point.

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: High Temperature Foldback	This alarm indicates either the average temperature of the 10 hottest power modules in the transmitter has exceeded 80 degrees Celsius, or the rectifier heatsink temperature has exceeded 80 degrees Celsius, and the transmitter's forward power is being reduced to maintain temperatures that are below the above thresholds. Once the high temperature condition has cleared, it may take up to an hour for the transmitter to return to its power setpoint, and the alarm will clear when the power is no longer being reduced. Otherwise, pressing the reset button will cause the alarm to clear. Check the transmitter's output network and verify that the air filter in the back of the cabinet is clean. Verify the temperature of the transmitter building is within specifications.
Exciter A/B: Low B+ Voltage	This alarm occurs when the B+ voltage measured by the exciter drops below 75% of the B+ setpoint for more than 10 seconds. When this alarm is present the exciter will not allow the PDM duty cycle to be increased to compensate for fluctuations in B+. This alarm will clear when the B+ voltage measurement exceeds 81.25% of the B+ setpoint. Generally this alarm indicates that the B+ voltage cannot be increased because the ac voltage is too low. Check the ac mains voltage connected to the transmitter and verify the power transformer is tapped correctly.
Exciter A/B: Low Forward Power 1 (or 2)	This alarm occurs when the output power of the transmitter is below the corresponding user-defined Low Forward Power Threshold (1 or 2). This alarm should occur with other alarms indicating why the transmitter's output power has dropped. See the troubleshooting information with associated alarms.
Exciter A/B: No B+ Sample	This alarm indicates the exciter's B+ voltage sample is below 40 V for more than 10 seconds. If there is an associated Low B+ voltage alarm, follow the troubleshooting information for that alarm. If there are no additional alarms and there is a second exciter installed, switch exciters and check if the alarm is present on the other exciter. If the alarm is present on the second exciter, check the cabling between the B+ sampling point and the control/interface PWB. If the connection is OK, replace the control/interface PWB (see "Control/interface PWB replacement" on page 1-60). If the alarm is not present on the second exciter, or there is no second exciter in the transmitter, replace the digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: No Carrier Sync Signal Present	This alarm will occur when the transmitter's Sync Source is set to GPS Sync Card or Combiner and the 10 MHz or 1 kHz synchronization signal is either not present or out of specification. If the Sync Source is set to Combiner, this alarm will cause the transmitter to be inhibited, otherwise this alarm is displayed for information only. If the transmitter's Sync Source is set to GPS Sync Card, check the connection between the GPS sync PWB and the control/interface PWB. If the connection is OK, replace the GPS sync PWB (see "GPS Sync PWB replacement" on page 1-61). If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55) or the control/interface PWB (see "Control/interface PWB replacement" on page 1-60). If the transmitter's Sync Source is set to Combiner, check the connection between the combiner and the control/interface PWB. If the connection looks OK, troubleshoot the combiner's synchronization signal source.
Exciter A/B: No External 10 MHz	This alarm indicates the transmitter is set to run on an external 10 MHz source, but the exciter has determined the frequency of the external source to be outside of the range 9.9 MHz to 10.1 MHz. This will cause the exciter to revert to using its internal 10 MHz reference until it determines the external 10 MHz is in range. This may also cause an exciter changeover if a backup exciter is installed and automatic changeover is enabled. Check the integrity and signal level of the external 10 MHz source. If the external source is acceptable and the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).
Exciter A/B: No IBOC Data	This alarm indicates there is no modulation data being provided by the embedded Exgine when the transmitter is running in an IBOC mode of operation. This alarm will trigger the Digital Input Loss alarm. Verify the transmitter is operating in the intended mode. Verify the embedded Exgine is connected to the control/interface PWB and the wiring connections are intact. Verify the Exporter is connected to the Exgine and the Exgine is receiving data from the Exporter. If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55) or the Exgine PWB (see "Exgine PWB replacement" on page 1-61).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: Over Current Shutback	This alarm indicates the peak RF current at the output of the transmitter has exceeded the Peak RF Current Limit. This alarm causes the transmitter to immediately shut down its RF output and then recover. If this alarm occurs in conjunction with the Controller's Fast SWR Shutback alarm, there may be a fault in the transmitter's external RF output network (i.e, rigid-line, antenna, etc.). If this alarm is occurring without the presence of the Controller's Fast SWR Shutback alarm, verify the RF current sample, RF voltage sample and the wiring between the sample point and the control/interface PWB is not damaged. If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).
Exciter A/B: PLL Unlocked	This alarm indicates the exciter's phase lock loop, which locks the transmitter's carrier frequency to a 10 MHz reference, is no longer locked to the reference. If an external 10 MHz source is being used, the exciter will fall back to using its internal 10 MHz clock. Otherwise, the exciter will inhibit its output. If an external 10 MHz source is being used, check the integrity and signal level of the source. If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).
Exciter A/B: Power Below Setpoint	This alarm indicates that the transmitter cannot achieve the desired output power. For the alarm to occur, the power must be at least 10% below the setpoint for more than four (4) seconds, and the exciter is not able to increase the output power because it has reached maximum gain, or the output is being limited by a foldback condition. The alarm is typically accompanied by other alarms. See the troubleshooting action for the associated alarms.
Exciter A/B: Precorrection Inhibited	This alarm indicates that the exciter has disabled its pre-correction compensation. This alarm will occur because the transmitter's B+ voltage is too low. See the troubleshooting action for the associated low B+ voltage alarm.
Exciter A/B: Protection Mechanisms Disabled	This alarm indicates that the exciter's protection (shutback, foldback, cutback) has been turned off by the user. The state should only be required when calibrating the transmitter after a frequency change. If this state is not intentional, press the reset button on the associated digital AM exciter PWB. If the alarm persists, replace the associated digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: Reboot for Settings Needed	This alarm indicates that the exciter needs to reboot itself to reconfigure its settings. The exciter should automatically reboot itself, however if the alarm persists, press the reset button on the associated digital AM exciter PWB. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: RF Probes Uncalibrated	This alarm indicates that the associated exciter has not been calibrated for the transmitter’s current operating frequency. If the operating frequency has been changed inadvertently, change the frequency back to its original setting. If a frequency change has been performed, recalibrate the exciter per the Nautel provided frequency change procedure.
Exciter A/B: SWR Foldback	This alarm indicates the average reflected power has exceeded the acceptable limit, and the transmitter’s RF output is being reduced to maintain the maximum acceptable reflected power. This alarm normally occurs due to a poor impedance being presented to the transmitter. Inspect the antenna network and check the tuning to ensure the impedance being presented to the transmitter is within specification.
Exciter A/B: SWR Shutback	This alarm indicates the transmitter’s peak reflected power has exceeded the factory set peak reflected limit. This alarm causes the transmitter to immediately shut down its RF output, then recover. If this alarm occurs in conjunction with the Controller’s Fast SWR Shutback alarm, it generally indicates a fault in the transmitter’s external RF output network (e.g., rigid-line, antenna, etc.). If this alarm occurs without the presence of the Controller’s Fast SWR Shutback alarm, verify the RF current sample, RF voltage sample and the wiring between the sample point and the control/interface PWB is not damaged. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: Transmitter Gain Too Low	This alarm occurs when the power gain of the transmitter falls below 63%. This alarm is latching and requires pressing the reset button to clear the alarm. This alarm normally occurs because there is a significant number (greater than 37%) of disabled power modules. Try resetting transmitter alarms to clear power module faults. If the alarm persists, repair or replace RF power modules to clear this alarm (see “RF power module troubleshooting” on page 1-43).

Alarm (with Prefix)	Description and Troubleshooting Action
Exciter A/B: Transmitter Type Not Set	This alarm indicates that the associated exciter has not been informed of the type of transmitter it has been installed in. If the affected exciter is a replacement, follow the digital AM exciter PWB replacement procedure to clear the alarm (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: Unsigned DSP Image	This alarm indicates that the software installed on the exciter is invalid or corrupt and it is inhibiting its output. Try pressing the reset button on the digital AM exciter PWB. If the alarm persists, perform a software upgrade on the transmitter. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exciter A/B: Unsigned FPGA Image	This alarm indicates that the software installed on the exciter is invalid or corrupt. Press the reset button on the digital AM exciter PWB. If the alarm persists, perform a software upgrade on the transmitter. If the alarm persists, replace the associated digital AM exciter PWB (see “Digital AM exciter PWB replacement” on page 1-55).
Exgine: AM/FM Mode Mismatched	This alarm indicates the Exporter mode does not match the Exgine mode. Reconfigure the Exporter or Exgine to the correct mode.
Exgine: DPLL Unlocked	This alarm occurs when the Exgine phase-locked loop can no longer follow the reference input within 1 ppm of its calibrated value. When using Ethernet sync, this can be triggered by excessive jitter on the Ethernet link or a sudden change in throughput delay of the E2X signal path (e.g., switched IP circuits). This alarm can be temporary, in this case, once the delay has been compensated for and a new equilibrium has been found. This alarm can also be caused by Exgine crystal aging, which can be resolved by recalibrating the Exgine crystal. Ensure the alarm is not temporary and persists for at least one (1) hour. Verify the disciplining input (Exporter clock) is correct. If Exgine crystal aging is suspected, widen the VCXOPPM limits to 5 ppm. Restart the system, operate for 24 hours and ensure the alarm clears. Configure the calibrated VCXO value with the new DAC value as reported from the Exgine status screen. Set the limits back to 0.95 ppm. Restart the system and ensure the alarm is cleared.

Alarm (with Prefix)	Description and Troubleshooting Action
Exgine: Lost External 10MHz	This alarm is occurs when the Exgine's external 10 MHz signal disappears during an active E2X connection. When this alarm is present, the Exgine will run on the internal oscillator. This can eventually lead to diversity delay drifts and FIFO Overflow or Underflow conditions. If an external 10 MHz signal is being intentionally applied to the Exgine, verify a valid 10 MHz signal is being applied to the Exgine. If an external 10 MHz signal is not being applied to the Exgine, cycle (turn off, then on) ac power to the transmitter. If the alarm persists in either condition, replace the Exgine PWB (see “Exgine PWB replacement” on page 1-61).
Exgine: Network Down	This alarm indicates the Exgine has no network connectivity. Verify the Exgine's network settings are configured properly, and the network cable is connected to the correct port on the Exgine PWB.
Exgine: Network Misconfigured	This alarm indicates that invalid Exgine network parameters have been configured. Review and correct all exgine network settings including the IP address, netmask and gateway.
Exgine: System Error	This alarm acts as a summary alarm for a number of unexpected Exgine system conditions, such as failed memory checks or internal configuration errors. Contact Nautel Customer Service to troubleshoot this issue.
Module: +15V Fail	This alarm indicates the RF power module’s +15 V power supply is below +13.5 V or above +16.5 V. This alarm will cause the RF power module to be immediately disabled. If other alarms are present at the same time this alarm is active, see the troubleshooting action for the associated alarms. Otherwise, replace the RF power module (see “Removing and reinstalling RF power modules” on page 1-45).
Module #: EEPROM Failure	This alarm indicates the RF power module was not able to load valid data from its EEPROM. Try removing and re-inserting the RF power module. If the alarm persists, replace the RF power module (see “Removing and reinstalling RF power modules” on page 1-45).

Alarm (with Prefix)	Description and Troubleshooting Action
Module #: External Disable Active	This alarm indicates the PDM cable has been disconnected from the front of the RF power module, which causes the power module to be immediately disabled. If this alarm occurs, reconnect the PDM drive cable associated with that RF power module. If the problem persists, swap the affected RF power module with an operational RF power module's position. If the fault follows the RF power module, replace the RF power module (see "Removing and reinstalling RF power modules" on page 1-45). If the fault remains with the position, try replacing the PDM drive cable. If the alarm persists, replace the source of the PDM signal (see "PDM Drive Distribution PWB replacement" on page 1-62).
Module #: High B+ Voltage	This alarm indicates the RF power module's B+ meter has exceeded 450 V. If high B+ voltage alarms are present for other system components, see the troubleshooting action for those alarms. If the alarm persists, replace the RF power module (see "Removing and reinstalling RF power modules" on page 1-45).
Module #: High DC Current	This alarm indicates that the RF power module's DC Current meter has exceeded 22 A, or the RF power module's peak DC current has exceeded the threshold applied to the microcontroller's comparator. This alarm will immediately disable the RF power module, and latch it off. If this alarm occurred in conjunction with an Overmodulation alarm, follow the troubleshooting action for that alarm. Otherwise, try resetting the alarms using the AUI. If the alarm persists, replace the RF power module. If the alarm clears, troubleshoot the suspect RF power module for RF FET failures (see "Troubleshooting RF power modules" on page 1-48). If the alarm persists, suspect that the associated RF relay is not opening, or the associated gas discharge tube has activated.
Module #: High PA Voltage	This alarm occurs because of one of two conditions: (1) the PA voltage is at least 10% above the product of the B+ level and the PDM duty cycle; or (2) the PA voltage has exceeded 95% of the B+ value for more than 50 ms. The alarm is latching and will cause the associated RF power module to disable itself. This alarm generally indicates that a modulator FET has failed. See "Troubleshooting RF power modules" on page 1-48 to determine whether to replace the affected RF power module or to repair damaged parts.

Alarm (with Prefix)	Description and Troubleshooting Action
Module #: High RF Drive	This alarm indicates the RF drive duty cycle as measured by the RF power module is above 65%. The affected RF power module is immediately disabled. Try swapping the affected RF power module with an operational RF power module in another position. If the fault follows the RF power module, replace the RF power module (see “Removing an RF power module” on page 1-45). If the fault remains with that position, and is also present on an adjacent power module, try replacing the associated RF Drive cable. If the alarm persists, replace the RF Drive Distribution PWB (see “RF drive distribution PWB replacement” on page 1-63).
Module #: High Temperature	This alarm indicates the power module's measured heatsink temperature has exceeded 90 degrees Celsius. The affected RF power module is immediately disabled. If this alarm occurs with another alarm, troubleshoot that alarm first. Otherwise, see “Troubleshooting RF power modules” on page 1-48 to determine whether to replace the affected RF power module or to repair damaged parts.
Module #: Invalid Thermistor Sample	This alarm indicates there is a problem with the associated RF power module's temperature sample. When this alarm occurs, the associated RF power module will disable itself until the condition is cleared. Inspect R1 on the RF power module, which is soldered to pads G and H of A1, and repair or replace as necessary. Otherwise replace the entire RF power module (see “Removing an RF power module” on page 1-45).
Module #: Low B+ Voltage	This alarm indicates the B+ level of the associated RF power module is below 75% of its nominal value. If the Rack Interface’s Low B+ Voltage alarm is present, follow the troubleshooting action for that alarm. Otherwise, try swapping the affected RF power module with an operational RF power module in another position. If that fault follows the RF power module, replace the RF power module (see “Removing an RF power module” on page 1-45). If the fault remains with that position, check the B+ fuse associated with the RF power module and replace as necessary (see “Module #: Low B+ voltage” on page 1-43).

Alarm (with Prefix)	Description and Troubleshooting Action
Module #: Low Fan 1 (or 2) Speed	This alarm occurs if the RF power module is expected to produce RF power and the fan (1 or 2) tachometer drops below 1650 RPM. The affected RF power module is immediately disabled. If only one RF power module reports this alarm, replace the affected RF power module (see “Removing and reinstalling RF power modules” on page 1-45). If multiple RF power modules (above the same fan tray) report this alarm, replace the associated fan or fan tray assembly (see “RF Power Module Fan Tray replacement” on page 1-69). If the alarm persists, replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Module #: Low PA Voltage	This alarm indicates the RF power module's PA Voltage meter has dropped 10% below the expected value - determined by multiplying the power module's B+ Voltage meter by the PDM Duty Cycle meter - for more than 500 ms. This alarm can only be triggered if the RF power module PDM Duty Cycle meter is above 10%, causing the affected RF power module to be immediately disabled, and latched off. Try resetting the alarm using the AUI. If the alarm persists, replace the affected RF power module (see “Removing and reinstalling RF power modules” on page 1-45).
Module #: Low RF Drive	This alarm indicates the RF drive duty cycle of the affected RF power module is below 35%. The affected RF power module is immediately disabled. Try swapping the affected RF power module with an operational RF power module in another position. If the fault follows the RF power module, replace the RF power module (see “Removing and reinstalling RF power modules” on page 1-45). If the fault remains with that position, and is also present on n adjacent power module, try replacing the associated RF Drive cable. If the alarm persists, replace the RF Drive Distribution PWB (see “RF drive distribution PWB replacement” on page 1-63).
Module #: No Controller Communications	This alarm indicates the RF power module has not received any communication from the rack interface for 10 seconds. Try swapping the affected RF power module with an operational RF power module in another position. If the alarm follows the RF power module, replace the RF power module (see “Removing and reinstalling RF power modules” on page 1-45). If the alarm remains with the position, replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).

Alarm (with Prefix)	Description and Troubleshooting Action
Module #: Overmodulation	This alarm indicates the RF power module's PDM Duty Cycle meter is above 95%. Verify the modulation being applied to the transmitter is not too high. Try swapping the RF power module with an RF power module that is not showing this alarm. If the alarm follows the RF power module, replace the RF power module (see "Removing and reinstalling RF power modules" on page 1-45). If the alarm remains with the original position, try replacing the digital AM exciter PWB (see "Digital AM exciter PWB replacement" on page 1-55) or the control/interface PWB (see "Control/interface PWB replacement" on page 1-60).
Module #: Residual PA Voltage Present	This alarm indicates the PA voltage of the RF power module is higher than expected with either the modulator or the RF amplifier disabled. See "Troubleshooting RF power modules" on page 1-48 to determine whether to replace the affected RF power module or to repair damaged parts, suspecting a failure of one of the FETs.
Module #: RF Drive Fault	This alarm indicates that the duty cycle of the RF drive or the dead time between RF drive signals on the associated RF power module is not as expected. This alarm causes the RF power module to be immediately disabled and latched off. Try resetting the alarm using the AUI. If the alarm persists, try swapping the affected RF power module with an operational RF power module in another position. If the fault follows the RF power module, replace the RF power module (see "Removing and reinstalling RF power modules" on page 1-45). If the fault remains with that position, and is also present on an adjacent power module, try replacing the associated RF Drive cable. If the alarm persists, try replacing the RF Drive Distribution PWB (see "RF drive distribution PWB replacement" on page 1-63).
Rack #: AC Phase Loss	This alarm occurs when the SCR rectifier assembly detects a significant imbalance in the ac phase voltages. The rectifier will shut down when this condition exists and prevent the transmitter from generating RF. In a safe manner, measure the voltage of each phase of the ac mains. If a phase is missing, check the ac mains fuses. If the ac mains phases are normal and the alarm persists, check the Phase Loss LED on the rectifier. If it is on, replace the SCR rectifier (see "SCR Rectifier Inspection/ Replacement" on page 1-66). If the Phase Loss LED is off, replace the rack interface PWB (see "Rack Interface PWB replacement" on page 1-64).

Alarm (with Prefix)	Description and Troubleshooting Action
Rack #: Arc Detector 1	This alarm indicates that the transmitter's arc detector has detected an arc and caused the transmitter to shut back. Due to the sensitivity of the arc detector, it is possible for an external UV source to cause this alarm. Check and remove all external UV sources. If the alarm persists, perform a visual inspection inside the rear of the transmitter for signs of corona or arcing.
Rack #: EEPROM Failure	This alarm indicates that the rack controller has failed to load its configuration from EEPROM. Remove and reapply the ac power to the transmitter. If the alarm persists, replace the rack interface PWB (see "Rack Interface PWB replacement" on page 1-64).
Rack #: High AC Voltage	This alarm indicates the rack interface's Ac Sample meter is above 384 V. The alarm clears when the sample falls below this voltage. It can be caused by an improperly tapped power transformer or a transient on the ac mains. Verify the mains transformer is tapped correctly (see "Installing the power transformer" on page 3-1 in the Installation Manual). If so, monitor the ac mains for transient conditions when this alarm occurs.
Rack #: High B+ Shutback	This alarm occurs when the B+ voltage measured by the rack interface exceeds the set threshold (normally 430 V). This causes the transmitter to disable the B+ power supply until the B+ voltage has decreased an additional 15 volts below the threshold. This alarm normally occurs with extreme changes in transmitter power (i.e., preset changes, interlock open, etc.). If the alarm is occurring continuously, or when unexpected, monitor the B+ with an oscilloscope and determine if the B+ is exceeding the shutback limit. If it is not exceeding the limit, verify the ac mains transformer is tapped correctly (see "Installing the power transformer" on page 3-1 in the Installation Manual).

Alarm (with Prefix)	Description and Troubleshooting Action
Rack #: High B+ Voltage	If the B+ voltage is more than 10 V above the B+ voltage set point, the rack interface will attempt to decrease the rectifier's output. If the rack interface reaches the bottom of its adjustment range and the B+ voltage remains 10 V or more above the B+ voltage setpoint for more than 15 seconds, this alarm will occur. The alarm will clear when the B+ voltage changes to within 10 V of the B+ voltage setpoint, or the B+ power supply is inhibited (by turning RF Off, for example). If the alarm persists while the transmitter is producing RF power, check the ac mains voltages and verify they are within ±10% of the nominal voltage for which the transformer is tapped. Verify the mains transformer is tapped correctly (see "Installing the power transformer" on page 3-1 in the Installation Manual). If the alarm persists, replace the rectifier assembly (see "SCR Rectifier Inspection/Replacement" on page 1-66) or the rack interface PWB (see "Rack Interface PWB replacement" on page 1-64).
Rack #: High Rectifier Temperature	This alarm indicates that the rectifier heatsink temperature has exceeded 100 degrees Celsius. The exciter should reduce the transmitter's output power before this alarm occurs (see "Exciter: High Temperature Foldback" alarm). The alarm will clear once the rectifier heatsink temperature drops below 99.5 degrees Celsius. The alarm indicates that there is excessive dissipation in the rectifier, likely due to high current draw. This may be due to the secondary voltage of the power transformer being lower than specified. Verify the mains transformer is tapped correctly (see "Installing the power transformer" on page 3-1 in the Installation Manual). If the alarm persists, replace the rectifier assembly (see "SCR Rectifier Inspection/Replacement" on page 1-66).
Rack #: Low AC Voltage	This alarm indicates the rack interface's Ac Sample meter is below 256 V. The alarm clears when the sample rises above this voltage. It is caused by an improperly tapped transformer, or a transient on the ac mains. Verify the mains transformer is tapped correctly (see "Installing the power transformer" on page 3-1 in the Installation Manual). If so, monitor the ac mains for transient conditions when this alarm occurs. See "Rack #: Low AC" on page 1-44.

Alarm (with Prefix)	Description and Troubleshooting Action
Rack #: Low B+ Voltage	If the B+ voltage falls to more than 15% below the B+ voltage set point, the rack interface will attempt to turn up the rectifier output voltage. If the rack interface reaches the top of its adjustment range and the B+ voltage remains 25% or more below the B+ voltage setpoint for more than two (2) seconds, this alarm will occur. The alarm will clear when the B+ voltage changes to within 25% of the B+ voltage setpoint, or the B+ power supply is inhibited (by turning RF Off, for example). If the alarm persists while the transmitter is producing RF power, check the main B+ fuse and replace as necessary. If the fuse is OK or the alarm persists, check the ac mains voltages and verify they are within ±10% of the nominal voltage for which the transformer is tapped. Verify the mains transformer is tapped correctly (see “Installing the power transformer” on page 3-1 in the Installation Manual). If the alarm persists, replace the rectifier assembly (see “SCR Rectifier Inspection/Replacement” on page 1-66) or the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: Power Module # Not Responding	This alarm indicates that the rack interface PWB is not receiving a response from the associated RF power module. Try swapping the affected RF power module with an RF power module in another location. If the alarm follows the RF power module, replace the RF power module (see “Removing and reinstalling RF power modules” on page 1-45).
Rack #: Rectifier Fan 1 (or 2) Fail	This alarm occurs if the speed of one of the SCR rectifier’s cooling fans is below 3000 RPM for longer than 15 seconds. Inspect the affected fan and, if necessary, replace it (see “SCR Rectifier Inspection/Replacement” on page 1-66).
Rack #: +15 V Fail	This alarm occurs if the +15 V rail is outside the acceptable range (12 V to 18 V). Disconnect the DC output of both +15 V power supplies, and measure the voltage of each. If the output voltage of either power supply measures outside of the acceptable range, replace the affected power supply. If both power supplies measure within the acceptable range, replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).

Alarm (with Prefix)	Description and Troubleshooting Action
Rack #: +15 V A (or B) Fail	The digital fault reporting output of either +15 V power supply (U3 or U4) is active. If the overall +15 V Fail alarm is active, follow the troubleshooting steps for that alarm. Otherwise, check continuity of the cabling between the associated +15 V power supply and the rack interface PWB. If the cabling looks OK, and all connections are tight, replace the associated +15 V power supply (see “Low Voltage Power Supply Replacement” on page 1-68).
Rack #: -15 V Fail	This alarm occurs if the -15 V rail is outside its acceptable range of -12 to -18 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: -15 V A (or B) Fail	This alarm occurs if the associated -15 V power supply’s output voltage is outside its acceptable range of -12 to -18 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: +30 V Fail	This alarm occurs if the +30 V rail has varied outside its acceptable range of 25 to 35 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: +30 V A (or B) Fail	This alarm occurs if the associated 30 V power supply’s output voltage is outside its acceptable range of 25 V to 35 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: +48 V Fail	This alarm occurs if the +48 V rail is outside the acceptable range (44 V to 52 V). Disconnect the DC output of both +48 V power supplies, and measure the voltage of each. If the output voltage of either power supply measures outside of the acceptable range, replace the affected power supply. If both supplies measure within the acceptable range, replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).

Alarm (with Prefix)	Description and Troubleshooting Action
Rack #: +48 V A (or B) Fail	If the overall +48 V Fail alarm is active, follow the troubleshooting steps for that alarm. Otherwise, check continuity of the cabling between the associated +48 V power supply and the rack interface PWB. If the cabling looks OK, and all connections are tight, replace the associated +48 V power supply (see “Low Voltage Power Supply Replacement” on page 1-68).
Rack #: +5 V Fail	This alarm occurs if the +5 V rail has varied outside its acceptable range of 4 to 6 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).
Rack #: +5 V A (or B) Fail	This alarm occurs if the associated +5 V power supply’s output voltage is outside its acceptable range of 4 to 6 V. Suspect a faulty dc-dc converter on the rack interface PWB. Replace the rack interface PWB (see “Rack Interface PWB replacement” on page 1-64).

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name, AUI (front panel UI)	Description and Triggering Alarms
Audio Loss Summary (Audio Loss Summary)	This summary alarm is triggered if any of the following audio loss related alarms occur: Exciter A/B alarms: AES1/2 Unlocked AM Input Loss Audio Loss Digital Input Loss No Host Audio No IBOC Data
Controller Fault Summary (Controller Summary)	This summary alarm is triggered if any of the following Controller related alarms occur: Controller alarms: EEPROM Failure: Config EEPROM Failure: Potentiometers EEPROM Failure: Remotes EEPROM Failure: Schedule EEPROM Failure: Thresholds Host Not Booted Host Not Responding Low Battery PDM Latch
Exciter Fault Summary (Exciter Summary)	This summary alarm is triggered if any of the following Exciter related alarms occur: Controller alarms: Audio Loss Shutdown Exciter Changeover Exciter A or B Not Responding High RF Drive Low RF Drive Exciter A/B alarms: AES 1/ 2 Unlocked AM Input Loss Audio Loss B+ Sample Uncalibrated Carrier Sync Unlocked Digital Input Loss External Inhibit Active FPGA Test Failed Low Forward Power 1/2 No B+ Sample No Carrier Sync Signal No External 10 MHz No IBOC Data PLL Unlocked Power Below Setpoint Precorrection Inhibited RF Probes Uncalibrated Transmitter Gain Too Low Transmitter Type Not Set Unsigned DSP Image Unsigned FPGA Image
Exgine Fault Summary (Exgine Summary)	This summary alarm is triggered if any of the following Exgine related alarms occur: Controller alarms: Exgine Not Responding Exgine alarms: AM/FM Mode Mismatched DPLL Unlocked FIFO Overflow FIFO Underflow Lost External 10 MHz Network Down Network Misconfigured System Error

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name, AUI (front panel UI)	Description and Triggering Alarms
External Fault Summary (External Summary)	This summary alarm is triggered if any of the following external alarms occur: Controller alarms: Combiner Interlock Open External PDM Inhibit Interlock Open Exciter alarms: Audio Overmod Protection
GPS Sync Fault Summary (GPS Sync Summary)	This summary alarm is triggered if any of the following GPS sync related alarms occur: Controller alarms: GPS Not Responding GPS Receiver Not Responding GPS Unlocked GPS PLL Unlocked GPS Sync No 1-PPS
High Reflected Power Summary (Refl Power Summary)	This summary alarm is triggered if any of the following high reflected power related alarms occur: Controller alarms: Fast SWR Shutback Exciter alarms: SWR Foldback SWR Shutback
High Temperature Summary (High Temp Summary)	This summary alarm is triggered if any of the following temperature related alarms occur: Exciter alarms: High Temperature Foldback Rack alarms: High Rectifier Temperature

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name, AUI (front panel UI)	Description and Triggering Alarms
Maintenance Fault Summary (Maintenance Summary)	This summary alarm is triggered if any of the following maintenance related alarms occur: Controller alarms: EEPROM Failure: Config EEPROM Failure: Potentiometers EEPROM Failure: Remotes EEPROM Failure: Schedule EEPROM Failure: Thresholds Exciter A or B Not Responding GPS Receiver Not Responding Exciter Changeover Exgine Not Responding GPS PLL Unlocked GPS Not Responding GPS Sync No 1-PPS GPS Unlocked High RF Drive Host Not Booted Host Not Responding Low Battery Low RF Drive Rack1 Not Responding Exciter alarms: B+ Sample Uncalibrated Carrier Sync Unlocked External Inhibit Active High B+ Voltage Low B+ Voltage No B+ Sample No Carrier Sync Signal No External 10MHz Precorrection Inhibited Exgine alarms: AM/FM Mode Mismatched DPLL Unlocked FIFO Overflow FIFO Underflow Lost External 10MHz Network Down Network Misconfigured System Error Module alarms: External Disable Active Front Panel Inhibit High B+ Voltage High DC Current High PA Voltage High RF Drive High Temperature Invalid Thermistor Sample Low B+ Voltage Low Fan 1/2 Speed Low PA Voltage Low RF Drive No Controller Comms Overmodulation Residual PA Voltage RF Drive Fault +15V Fail Rack alarms: +5V Fail +5V A/B Fail +15V Fail +15V A/B Fail -15V Fail -15V A/B Fail +30V Fail +30V A/B Fail +48V Fail +48V A/B Fail AC Phase Loss EEPROM Failure High AC Voltage High B+ Voltage High Rectifier Temp Low AC Voltage Low B+ Voltage PM 1-10 Not Responding Rectifier Fan 1/2 Fail

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name, AUI (front panel UI)	Description and Triggering Alarms
Off Air Summary (Off Air Summary)	This summary alarm is triggered if any of the following off-air related alarms occur: Controller alarms: Arc Shutback Audio Loss Shutdown Combiner Interlock Open External PDM Inhibit Fast SWR Shutback Interlock Open PDM Latch Exciter alarms: FPGA Test Failed Over-Current Shutback PLL Unlocked RF Probes Uncalibrated SWR Shutback Transmitter Gain Too Low Transmitter Type Not Set Unsigned DSP Image Unsigned FPGA Image Rack alarms: Arc Detector 1 High B+ Shutback Low B+ Shutdown
Output Network Fault Summary (O/P Network Summary)	This summary alarm is triggered if any of the following output network related alarms occur: Controller alarms: Arc Shutback Fast SWR Shutback Exciter alarms: Cutback High Forward Foldback Over-Current Shutback SWR Foldback SWR Shutback Rack alarms: Arc Detector 1
Power Module Fault Summary (PM Summary)	This summary alarm is triggered if any of the following power module related alarms occur: Module alarms: EEPROM Failure External Disable Active Front Panel Inhibit High B+ Voltage High DC Current High PA Voltage High RF Drive High Temperature Invalid Thermistor Sample Low B+ Voltage Low Fan 1/2 Speed Low PA Voltage Low RF Drive No Controller Comms Overmodulation Residual PA Voltage RF Drive Fault +15V Fail Rack alarms: PM 1-10 Not Responding

Table 1.2: Troubleshooting Summary Alarms

Summary Alarm Name, AUI (front panel UI)	Description and Triggering Alarms
Power Supply Fault Summary (PS Summary)	This summary alarm is triggered if any of the following power supply related alarms occur: <u>Exciter alarms:</u> High B+ Voltage High DC Curr Foldback Low B+ Voltage <u>Rack alarms:</u> AC Phase Loss High AC Voltage High B+ Shutback High B+ Voltage High DC Curr Foldback High Rectifier Temp Low AC Voltage Low B+ Shutdown Rectifier Fan 1/2 Fail +5V Fail +5V A/B Fail +15V Fail +15V A/B Fail +30V Fail +30V A/B Fail +48V Fail +48V A/B Fail -15V Fail -15V A/B Fail
Rack Fault Summary (Rack Summary)	This summary alarm is triggered if any of the following rack related alarms occur: <u>Controller alarms:</u> Rack1 Not Responding <u>Rack alarms:</u> EEPROM Failure
Reduced Power Summary (Power Low Summary)	This summary alarm is triggered if any of the following reduced power related alarms occur: <u>Exciter alarms:</u> Audio Overmod Protection Cutback High DC Current Foldback High Forward Foldback High Temp Foldback Low Forward Power 1/2 Power Below Setpoint SWR Foldback

Table 1.3: Module Replacement Procedures

Module	Replacement Procedure
RF Power Module	See page 1-45
Power Amplifier MOSFET	See page 1-51
Modulator MOSFET	See page 1-53
Remote Interface PWB	See page 1-55
Digital AM Exciter PWB	See page 1-55
Control/Interface PWB	See page 1-60
GPS Sync PWB	See page 1-61
Exgine PWB	See page 1-61
PDM Distribution PWB	See page 1-62
RF Drive Distribution PWB	See page 1-63
Rack Interface PWB	See page 1-64
Low Voltage Power Supplies	See page 1-68
RF Power Module Fan Tray	See page 1-69

Responding to alarms

Controller: External PDM Inhibit

The external PDM inhibit is wired to the control/interface PWB.

A **Controller: External PDM Inhibit** alarm indicates that an external PDM inhibit command is present. The alarm could be caused by an short circuit in the external wiring path to the control/interface PWB or a fault in the switching circuitry on the control/interface PWB. Troubleshoot as follows:

1. If the control/interface PWB's shorting jumper E2 is in the **INT** position (shorting pins 2 and 3), verify the dc voltage between J6-4 and ground on the control/interface PWB is approximately 15 V. This signifies there is no external PDM inhibit command.

2. If the control/interface PWB's shorting jumper E2 is in the **EXT** position (shorting pins 1 and 2), verify the dc voltage between J6-3 and J6-4 on the control/interface PWB is 0 V. This signifies there is no external PDM inhibit command.

3. If the conditions in Step 1 and Step 2 are met, suspect the control/interface PWB and if necessary, replace it (see "Control/interface PWB replacement" on page 1-60).

Controller: Interlock Open

A **Controller: Interlock Open** alarm indicates an external interlock is open. The transmitter's RF output will be inhibited.

The external interlock input is wired to the control/interface PWB by the end user and triggered by the conditions that they set (e.g., the state of the door to the transmitter room).

1. Gain access to the control/exciter panel (A11) (see Figure 1.6 on page 1-54) by opening the control cabinet's front door. The door is not latched and just swings open to the left.

2. Connect a digital multimeter (set to measure dc) between J6-2 of the control/interface PWB and ground.

3. If 15 V is present on J6-2, the external interlock circuit is intact and the probable cause of the alarm is a defective monitoring circuit. Suspect the control/interface PWB and if necessary, replace it (see "Control/interface PWB replacement" on page 1-60).

4. If 15 V is not present on J6-2, measure the voltage between J6-5 (external 15 V) of the control/interface PWB and ground, then between J6-1 (+15 V) and ground.

5. If 15 V is present on J6-5 and J6-1, the external interlock circuit is open (normally caused by an open interlock switch).

Module faults

There are many alarms on the AUI, prefixed by the text **Module**, that indicate faults related to one or more of the 10 RF power modules in a cabinet. The number that appears after Module or PM, identifies the serial identification of the affected RF power module. These serial numbers are labeled on the front panel of each RF power module.

1. Check the forward power reading on the AUI. If it is less than the preset level, one or more RF power modules are defective. Proceed to "RF power module fault validation".

2. If the forward power reading in Step 1 is normal press the **Transmitter Status** button on the AUI to check for other alarms that may have triggered the RF power module alarm.

RF power module fault validation

Each RF power module has a multi-colour LED on its front panel, which can help in identifying a fault and allowing you to determine whether remedial action is required now or later.

Identify and isolate a defective RF power module, and verify the nature of the defect by checking the LEDs on the RF power modules' front panels. Note which RF power module is not operating normally and producing RF power (i.e., LED is not solid green). Record which RF power modules are displaying an alarm and the state of its LED (see below).

- amber, off: module is RF off
- solid red: module has a non-latching alarm
- flashing red, then green: module is producing RF, but has an alarm
- long red, short amber: module has a latching alarm
- long red, short off: module has no valid serial number
- short red, long off: module has no valid serial address on the internal bus
- long amber, short green: module is producing RF, but no serial communications
- long amber, short red: module is not producing RF and no serial communications

Except in the case of a **High DC Current**, **High PA Volts** and **Residual PA Volts** alarm, attempt to reset an RF power module by disconnecting and reconnecting the RJ45 plug in the front of the module. If you cannot reset the front panel LED alarm, see "RF power module troubleshooting".

RF power module troubleshooting

Refer to "Removing and reinstalling RF power modules" on page 1-45 for removal and installation instructions and then refer to "Troubleshooting RF power modules" on page 1-48 for detailed troubleshooting information.

> *NOTE:*
> *A defective RF power module can be removed for repair, without turning off the transmitter, as described in "Removing an RF power module" on page 1-45. The transmitter can be operated at a reduced output power level with an RF power module removed.*

Module #: Low B+ voltage

A **Module # Low B+ Voltage** alarm is triggered when the B+ voltage is at least 10% below its expected level.

1. If all RF power modules are reporting this alarm, it is very likely there is also a **Rack #: Low B+** alarm. If so, the fault is not likely associated with an RF power module; proceed to "Rack #: Low AC" on page 1-44 for further troubleshooting information. If not, proceed to Step 2.

2. Check and, if necessary, replace the fuse on the power module interface PWB for the affected RF power module. Each power module interface PWB serves four RF power modules and therefore has four B+ fuses (F1 through F4). Refer to Figures MD-1 and MD-2 in the Mechanical Drawings section of this manual to locate the associated power module interface PWB and then refer to Figure MD-4 or MD-5 to locate the specific fuse.

3. Check and, if necessary, replace the affected RF power module. See "Troubleshooting RF power modules" on page 1-48.

Rack #: Low AC

A **Rack # (1-8): Low AC** alarm is triggered when the ac input voltage is at least 45% below its expected level. Recovery from this alarm is automatic when the ac voltage rises to an acceptable level.

If the transmitter does not automatically recover from this alarm, the low ac voltage is normally caused by low ac mains voltage or improper primary taps on the power transformer. Troubleshoot a **Rack #: Low AC** alarm as follows.

WARNING:
LETHAL VOLTAGES EXIST IN THE POWER SUPPLY COMPARTMENT OF THE TRANSMITTER. USE EXTREME CAUTION IN THIS AREA.

1. Measure the ac input voltage and verify the power transformer is tapped as shown in Section 3, "Installing the power transformer" on page 3-1 of the *NX25/NX15 Installation Manual*. If necessary, turn off the transmitter, lock out the ac input voltage and retap the power transformer for the next highest voltage.

2. If the transformer taps are correct, the monitoring circuit is suspect. Contact Nautel for troubleshooting information.

Removing and reinstalling RF power modules

Removing an RF power module

1. Confirm the location of the RF power module that is being removed. Note the alarm text includes a Module serial address that is also identified on the front panel of each RF power module. See Figure 1.3 on page 1-47 to determine the location for a given RF power module (A15 through A24).

2. If possible, turn off the transmitter before removing an RF power module. If you need to remove a module while "on air", disable the RF power module to be removed using the AUI. From the Meters page, click on the Rack information (i) button. The Power Module status screen (see Figure 1.2 on page 1-46) should appear. Click on the associated RF power module's Front Panel Inhibit icon. The icon colour should change from green to red, indicating the RF power module is disabled.

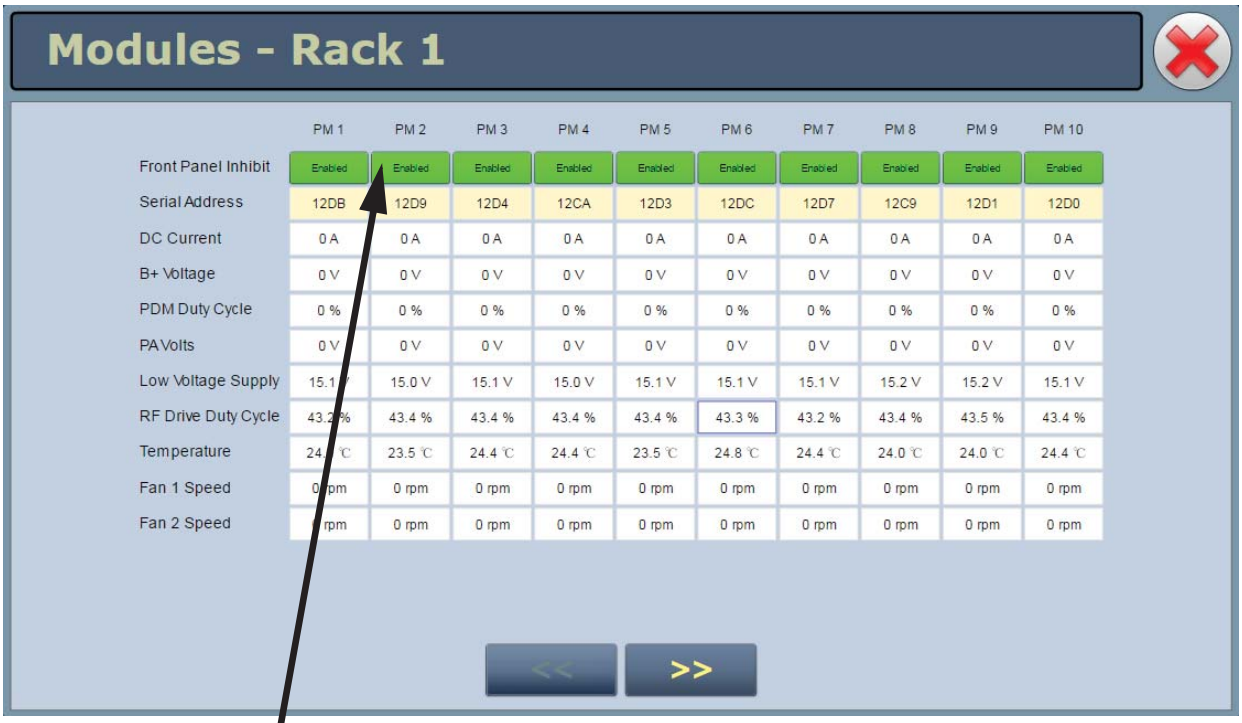
3. After the RF power module is disabled, you should hear a relay in the back of the cabinet drop out (de-energize). If you do not hear the relay de-energize (click), **DO NOT CONTINUE** to Step 4. Try re-enabling and disabling a few times while trying to hear the relay de-energize. If you do not hear the sound, **DO NOT** remove the RF power module while the transmitter is on-air.

4. Disconnect the RJ45 cable from the front of the RF power module. If the module was not disabled in Step 2, you should now hear a relay in the back of the cabinet drop out (de-energize)

5. Remove both mounting screws from the RF power module's front panel.

6. Grasp the handle on the front of the RF power module and carefully pull the RF power module out of the transmitter.

Figure 1.2: Disabling/Enabling an RF Power Module



Green indicates enabled. Click to disable (will turn red); click again to re-enable (will turn green)

Installing an RF power module

1. If possible, turn off the transmitter before installing an RF power module. Grasp the handle on the front of the RF power module and insert it into the transmitter.

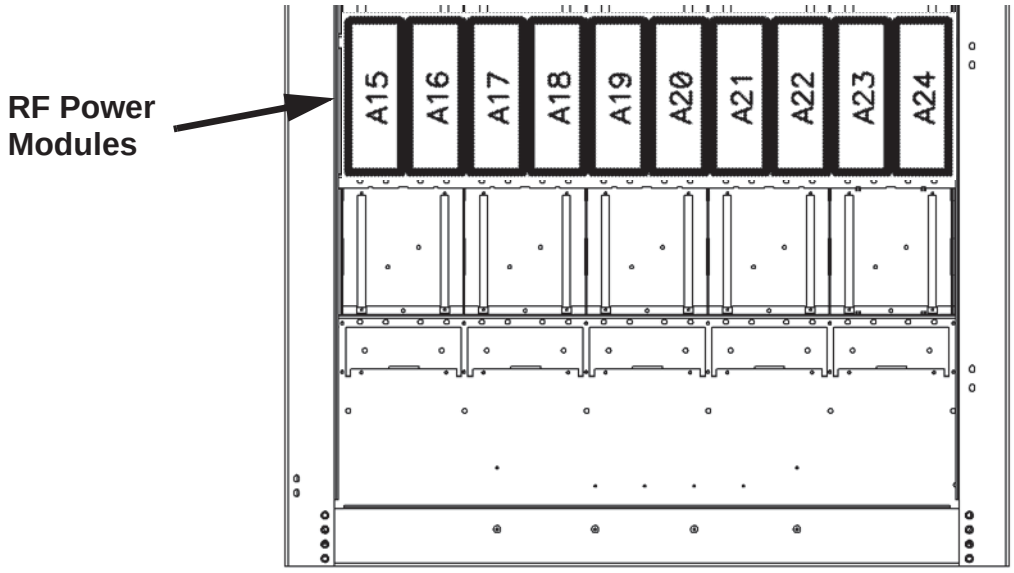
2. Carefully push the RF power module into place so that its card-edge connector mates with the transmitter.

3. Install both mounting screws in the RF power module's front panel.

4. Connect the RJ45 cable to the front of the RF power module. If you are installing the RF power module while the transmitter is "on-air", click on the associated RF power module's **Front Panel Inhibit** icon as shown in Figure 1.2. The icon colour should change from red to green, indicating the RF power module is enabled. You should hear a relay in the back of the transmitter pick up (energize).

5. Upgrade the subsystem software using the AUI's **Upgrade Software** page under the **System Settings** menu. See the *NX25/NX15 Operations and Maintenance Manual* for detailed instructions.

Figure 1.3: RF Power Module Locations



Front Door Removed for Clarity

Troubleshooting RF power modules

Maintenance philosophy

Recommended troubleshooting procedures for RF power modules are limited to "go" or "no-go" resistance or diode measurements on the module's power semi-conductors and replacement procedures for these devices.

Special Tools and Test Equipment

The following test equipment and cables are required to troubleshoot an RF power module.

- A digital multimeter with resistance and diode settings.
- A torque screwdriver with a torque range of 0.0 to 2.26 N-m (0 - 20 in.-lbs). Required for installing MOSFET attaching hardware.
- A soldering iron and desoldering tool.
- An NX25/NX15 spares kit (contains replacement semi-conductors).

Electrostatic Precautions

The RF power module 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 Troubleshooting

1. Follow the procedure in "Removing an RF power module" on page 1-45 to remove the RF power module from the transmitter.
2. Place the RF power module on a suitable work surface.
3. Perform the resistance measurements on the modulator and power amplifier MOSFETs as described in "Resistance measurements" on page 1-49.
4. Perform the diode checks on the free-wheel diodes as described in "Power Amplifier FET replacement" on page 1-51

Resistance measurements

Complete the following resistance measurements for each suspect RF power module. See Figure 1.4 on page 1-50 to identify the power MOSFETs on the RF power module.

1. Remove fuse F1 from its holder and measure its resistance using a digital multimeter. A blown fuse will measure an open circuit. If the fuse is OK, return it to its holder.

2. For each power amplifier MOSFET (Q7 through Q10) and each modulator MOSFET (Q11, Q12 and Q13), use a digital multimeter to make the following resistance measurements. Note that Q7 through Q10 have screw-head terminals and Q11 through Q13 have solder pads (see Figure 1.4 on page 1-50):

   - Check for 1,000 Ω between the gate and source.

   - Check for an open circuit between the gate and drain.

3. If either measurement in Step 2 is not satisfactory, replace the affected power amplifier MOSFET (see "Power Amplifier FET replacement") or modulator MOSFET (see "Modulator FET replacement" on page 1-53).

4. If both measurements in Step 2 are satisfactory, replace the entire RF power module (see "Removing and reinstalling RF power modules" on page 1-45).

Diode checks

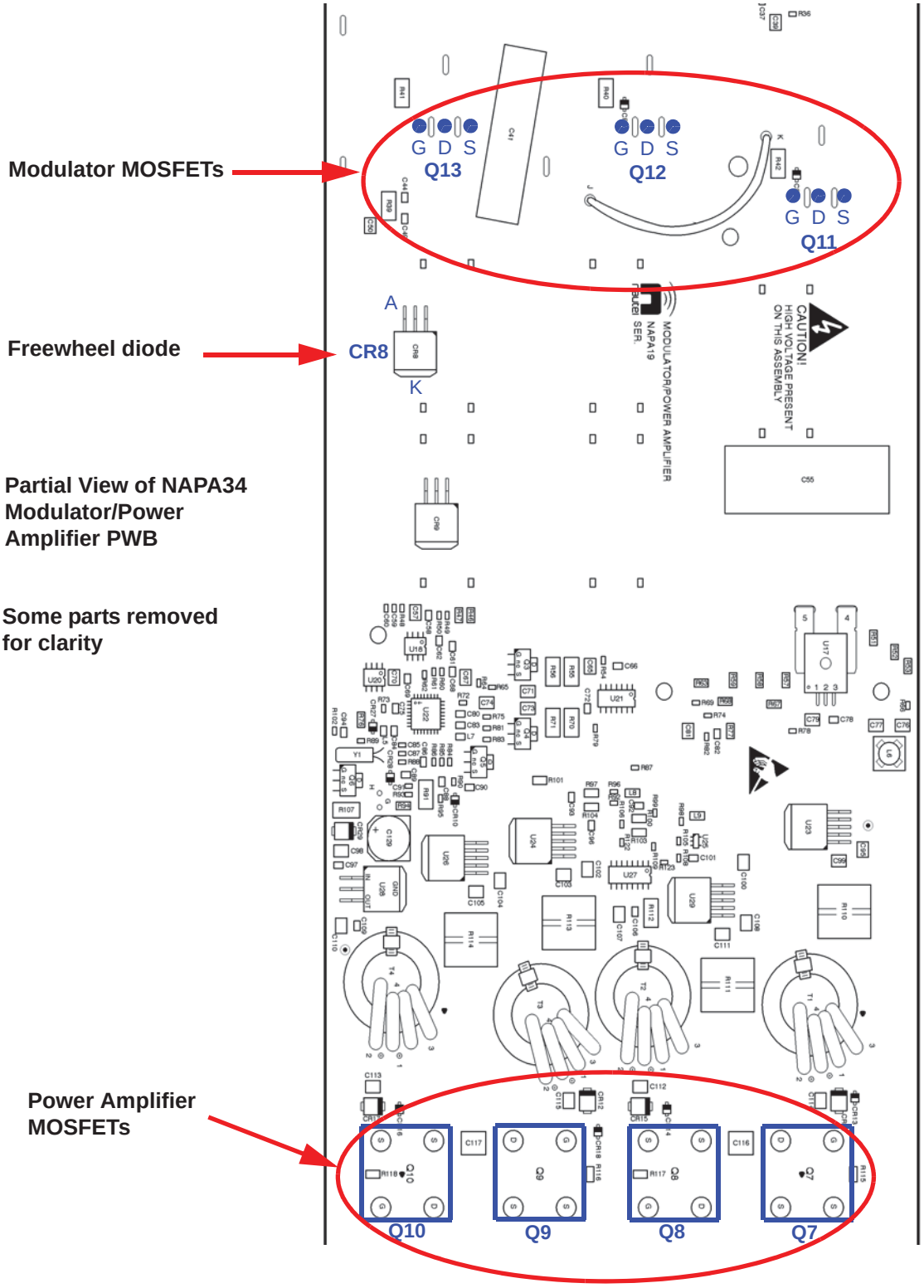
Complete the following diode checks for each suspect RF power module. See Figure 1.4 on page 1-50 to identify the free-wheel diode on the RF power module.

1. Use a digital multimeter (on its diode setting) to check free-wheel diode CR8, noting the anode (A) and cathode (K) markings (see Figure 1.4 on page 1-50):

2. If the diode is not satisfactory, replace the it by desoldering its surface-mount leads and case from the PWB. Locate a replacement diode (Nautel Part # QM54) in the spares kit, if purchased, and solder it to the PWB, noting correct orientation.

3. If the diode is satisfactory, proceed to MOSFET replacement, as necessary, or replace the entire RF power module (see "Removing and reinstalling RF power modules" on page 1-45).

Figure 1.4: RF Power Module MOSFET and Diode Location

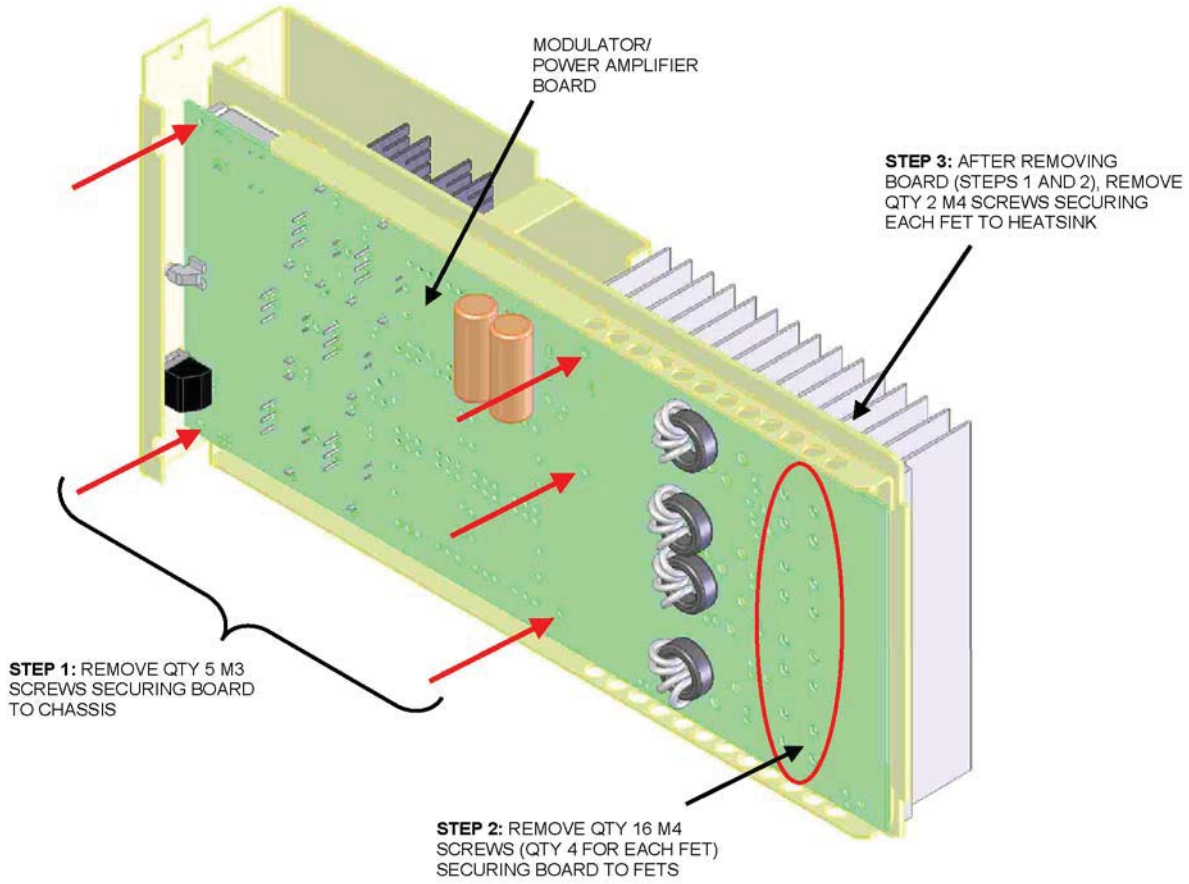


Power Amplifier FET replacement

See Figure 1.5 on page 1-52.

1. Remove five M3 screws that secure the modulator/power amplifier PWB to the chassis.
2. Remove 16 M4 screws (four for each MOSFET) that secure the PWB to the MOSFETs.
3. Swing the PWB away from the chassis and remove two M4 screws that secure the defective MOSFET to the chassis. If necessary, remove the screw securing the thermistor wire to the PWB.
4. Discard the defective MOSFET and its associated thermal pad (between MOSFET and chassis).
5. Ensure the surface of the chassis/heat sink is clean and free of debris.
6. Obtain a replacement MOSFET (Nautel Part # QR) and a new thermal pad (Nautel Part # HAK55) from the spares kit, if purchased, and install them on the RF power module chassis using the two M4 screws removed in step 3. Torque hardware to 12 in-lbs (1.3 N-m).
7. Replace any other defective MOSFETs and then re-install the PWB to the chassis by reversing the instructions in steps 1 through 3. Torque the 16 MOSFET screws (four for each MOSFET) to a maximum of 10 in-lbs (1.1 N-m).
8. Return the power module to service (see "Installing an RF power module" on page 1-47).

Figure 1.5: Power Amplifier FET Replacement



Modulator FET replacement

1. Remove five M3 screws that secure the modulator/power amplifier PWB to the chassis.

2. Remove 16 M4 screws (four for each MOSFET) that secure the PWB to the MOSFETs.

3. Desolder the gate, drain and source connections that secure the defective MOSFET to the PWB (see Figure 1.4 on page 1-50). Also desolder the two connections that secure the defective MOSFET's heatsink to the PWB. Remove the heat sink and MOSFET from the PWB.

4. Remove the heatsink clip that holds the MOSFET on its heat sink. Remove and discard the defective MOSFET.

CAUTION:
The heat sinks of modulator MOSFETs are coated with a film of thermal compound. Use care to ensure the film does not become contaminated with foreign particles.

When installing a replacement MOSFET, visually inspect the mating surfaces of the MOSFET and its heat sink. Ensure the heat sink surface is coated with a thin film of thermal compound. Ensure foreign particles that may affect thermal transfer are not embedded in the compound.

5. Clean the surface of the heat sink and make sure its is free of debris.

6. Apply a thin film of thermal compound to the heatsink.

7. Obtain a replacement MOSFET (Nautel Part # QR75) from the spares kit, if purchased, and install it on the heat sink using the alignment post on the heat sink as an installation aid. Reinstall the heat sink clip removed in Step 4.

8. Replace any other defective MOSFETs and then re-install the heatsink on the PWB, first by soldering the two heatsink connections and then by soldering the MOSFET's gate, drain and source leads.

9. Reinstall the PWB to the chassis by reversing the instructions in steps 1 and 2. Torque the 16 power amplifier MOSFET screws (four for each MOSFET) to a maximum of 10 in-lbs (1.1 N-m) .

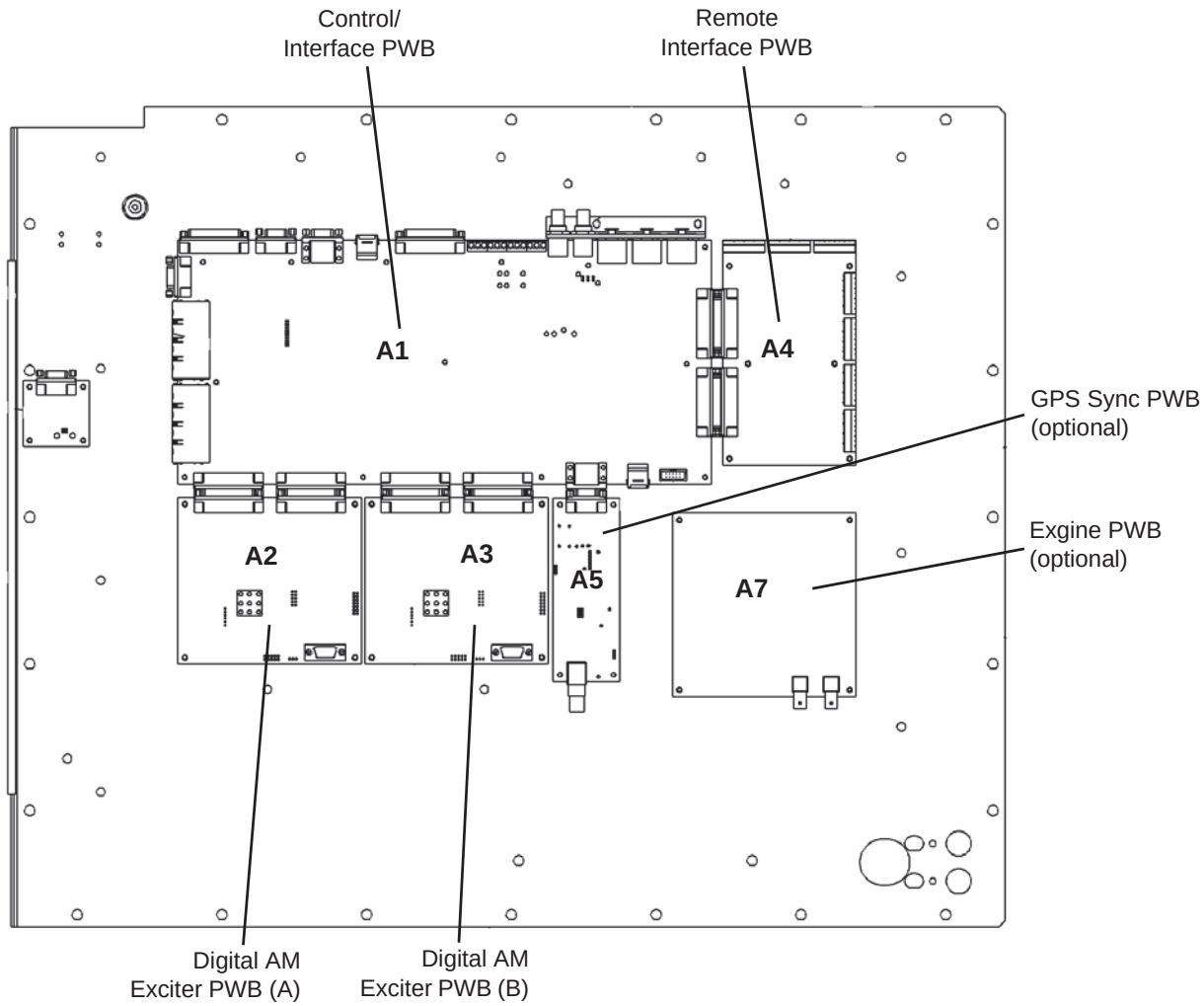
10. Return the power module to service (see "Installing an RF power module" on page 1-47).

Control/exciter panel board removal/replacement

The control/exciter panel (A11, see Figure 1.6) contains the control/interface PWB (A11A1), two digital AM exciter PWBs [A (A11A2) and B (A11A3)], remote interface PWB (A11A4), optional GPS sync PWB (A11A5) and optional Exgine PWB (A11A7). The control/interface PWB physically interconnects with both digital AM exciter PWBs and the remote interface PWB.

> *NOTE:*
> *To remove the control/interface PWB, you must first remove either the remote interface PWB or both digital AM exciter PWBs.*

Figure 1.6: NX25/NX15 Control/Exciter Panel



Remote interface PWB replacement

1. Remove and retain six sets of mounting hardware from the remote interface PWB (A11A4).

2. Pull the remote interface PWB away from the control/interface PWB (A11A1). It may be helpful to gently pry the connector loose with a screwdriver.

3. Set the STATUS/ALARM jumpers (E1 through E16) on the new remote interface PWB to the same positions as the defective PWB.

4. Use an indelible marker to identify the LED and switch labels on the new remote interface PWB to match the labels on the defective PWB.

5. Install the new remote interface PWB by reversing Step 1 and Step 2.

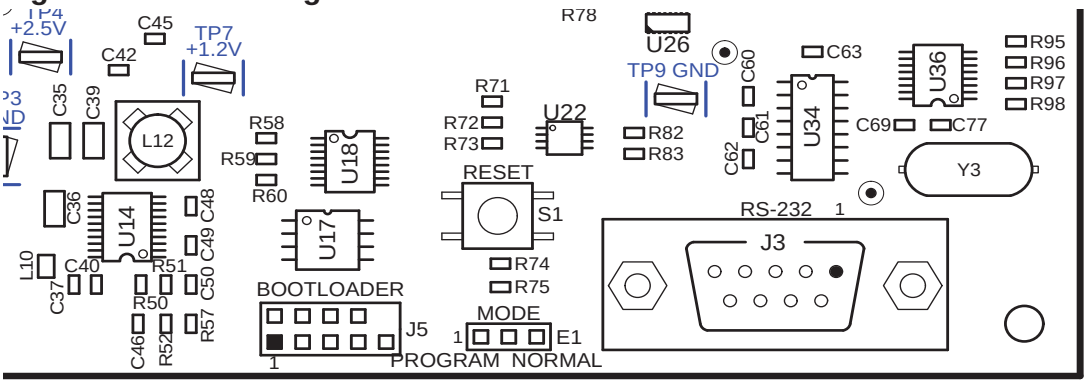
6. Reconnect all interface wiring to the new remote interface PWB.

Digital AM exciter PWB replacement

1. Set the transmitter to its RF Off state.

2. Connect a cable between the defective digital AM exciter PWB's RS-232 connector (9-pin D-sub J3, see Figure 1.7 on page 1-55) and a PC.

Figure 1.7: Part of Digital AM Exciter PWB - Location of RS-232 Connector J3



3. On MODE program header E1 (see Figure 1.7), install the shorting jumper in the PROGRAM position (shorting pins 1 and 2). Press RESET switch S1, located directly above E1.

4. From the PC, run the NCode Uploader application (see Figure 1.8). Click Settings and ensure the COM port reflects the port that the serial cable is connected to on your PC.

Figure 1.8: NCode Uploader Menu

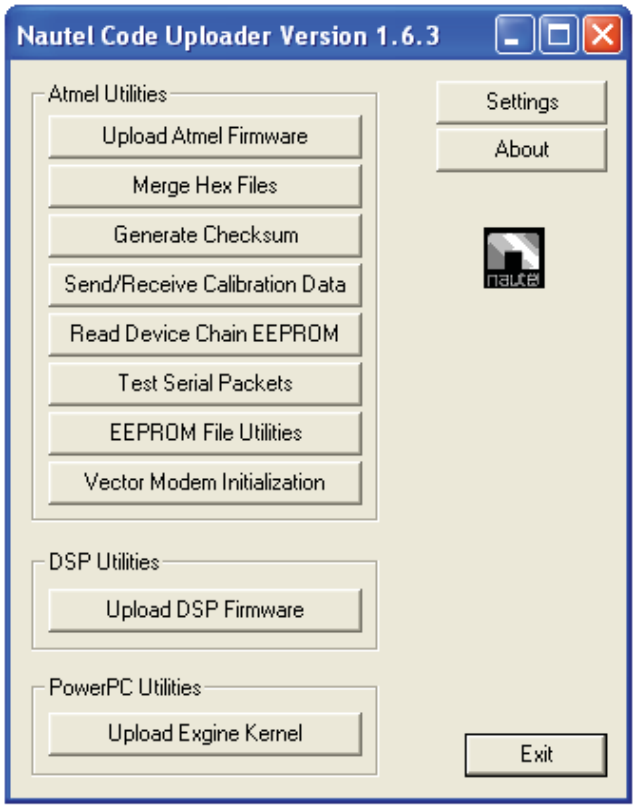
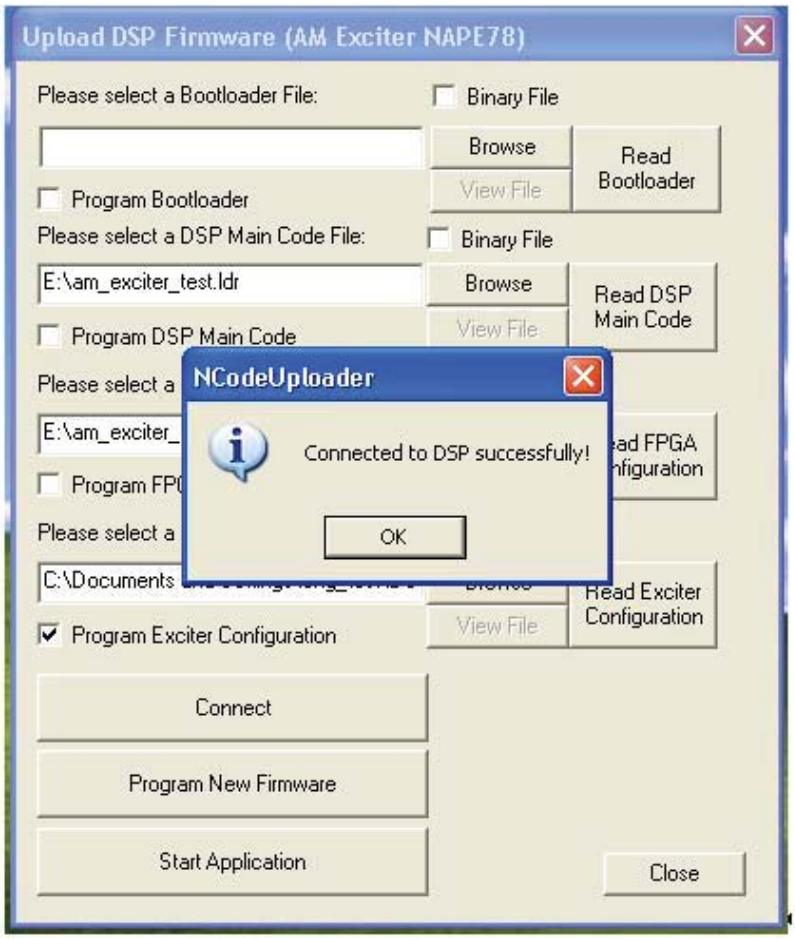


Figure 1.9: Upload DSP Firmware Menu

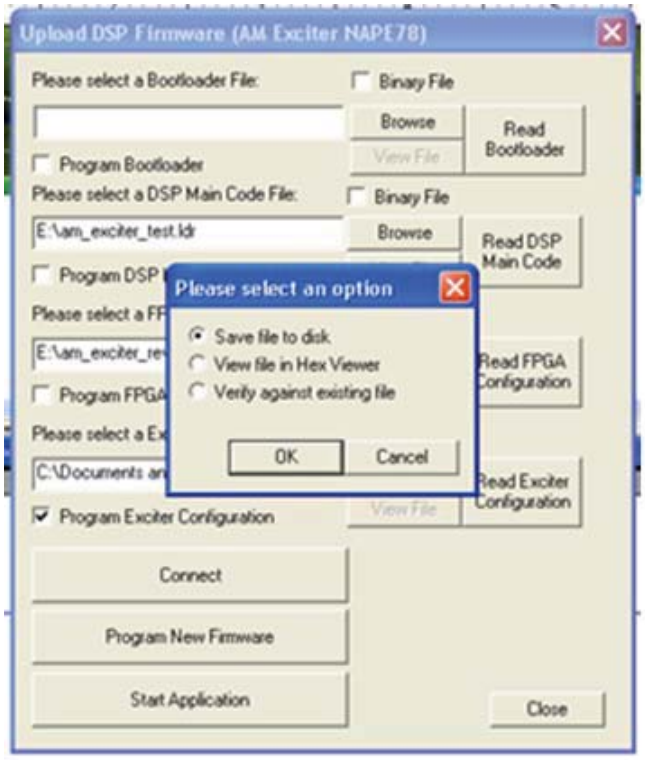


5. Click the **Upload DSP Firmware** button (see Figure 1.8 on page 1-56). The menu shown in Figure 1.9 should appear, along with the **Connected to DSP successfully!** prompt. Click **OK**.

6. Once connected, click the **Read Exciter Configuration** button. Select **Save file to disk** and click **OK** (see Figure 1.10 on page 1-58) to save the current calibration data. Browse to a desired location to save the file.

7. If the defective exciter does not allow the previous steps to be performed, try using the operational exciter to save the required calibration data. In this case, repeat Step 2 through Step 6 for the operational exciter's digital AM exciter PWB. If there is no operational exciter, contact Nautel for the required calibration data.

Figure 1.10: Upload DSP Firmware Menu - Select an Option



8. Remove and retain four sets of mounting hardware from the digital AM exciter PWB being replaced (A11A2 or A11A3).

9. Pull the digital AM exciter PWB away from the control/interface PWB (A11A1). It may be helpful to gently pry the connector loose with a screwdriver.

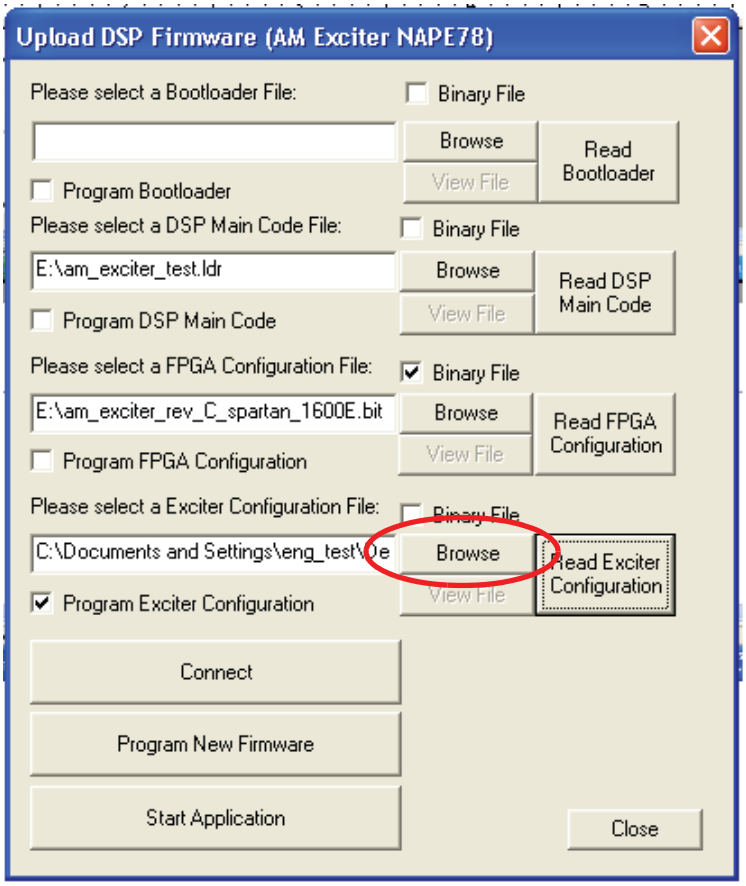
10. Install the new digital AM exciter PWB by reversing Step 8 and Step 9.

11. Connect a cable between the replacement digital AM exciter PWB's RS-232 connector (9-pin D-sub J3, see Figure 1.7 on page 1-55) and a PC.

12. On the digital AM exciter PWB's **MODE** program header E1 (see Figure 1.7), install the shorting jumper in the **PROGRAM** position (shorting pins 1 and 2). Press **RESET** switch S1, located directly above E1.

13. Once connected, use the PC to browse to the configuration file saved in Step 6 by clicking the **Browse** button next to the *"Please Select a Exciter Configuration file:"* field (see Figure 1.11 on page 1-59).

Figure 1.11: Upload DSP Firmware Menu - Browse for configuration file



14. Click the **Program Exciter Configuration** checkbox (see Figure 1.11 on page 1-59) so that the box contains a checkmark and then click the **Program New Firmware** button.

15. On the digital AM exciter PWB's **MODE** program header E1 (see Figure 1.7), return the shorting jumper to the **NORMAL** position (shorting pins 2 and 3). Press **RESET** switch S1, located directly above E1.

16. On the front panel AUI, reset any active alarms.

17. Upgrade the subsystem software using the AUI's **Upgrade Software** page under the **System Settings** menu. See the *NX25/NX15 Operations and Maintenance Manual* for detailed instructions.

18. Set the transmitter to its **RF On** state.

Control/interface PWB replacement

1. Record the following information (as a minimum) from the front panel AUI:

   - **Presets** page: record settings for all desired presets
   - **Scheduler** page: record **Rules** and **Daily Events** information
   - **Factory Settings** page: record information in the **RF Symmetry** and **Transmitter Type** menus
   - **System Settings** page: record all information in the **Exciter Clock Calibration** and **Power Lockout** menus
   - **User Settings** page: record all information in the **Network Setup** menu
   - **Remote I/O** page: record all information for the user-defined remote **Inputs** and **Outputs**, including **Channel** and **Control** settings
   - **Changeover** page: record all information

2. Use a digital multimeter to measure the VSWR threshold voltage on the control/interface PWB at R73-LHS. Record this voltage.

3. Set the transmitter to its **RF Off** state. Turn off (disable or lock out) the ac power at the source. Open the front door to gain access to the exciter panel (see Figure 1.6 on page 1-54).

4. Disconnect all cables attached to the control/interface PWB (A4), taking note of the connector labels on the cables and the PWB.

5. Remove and retain the two screws securing the connector bracket in the upper, left portion of the control/interface PWB.

6. Remove either the remote interface PWB (A11A4) or both digital AM exciter PWBs (A11A2 and A11A3), whichever is easier. It may be helpful to gently pry the connectors loose with a screwdriver.

7. Remove and retain 13 sets of mounting hardware from the control/interface PWB (A11A1).

8. Obtain a replacement control/interface PWB (Nautel Part # NAPC160B/01).

9. Set the **COMB CONT INTLK** (E1) and **REMOTE SUPPLY** (E3) jumpers on the replacement PWB to the same positions as the defective PWB.

10. Install the new control/interface PWB by reversing Step 4 through Step 7. For connector mating assistance, refer to the connector mating tables in Section 4, "Wiring/connector lists" on page 4-1.

11. Re-enter all the AUI information recorded in Step 1.

12. Set the time using the front panel AUI's **Factory Settings - Time Setup** page.

13. Measure the VSWR threshold voltage on the control/interface PWB at R73-LHS. Adjust **VSWR THRESHOLD** potentiometer R78 until the multimeter reading is the same as the voltage recorded in Step 2.

14. Upgrade the subsystem software using the AUI's **Upgrade Software** page under the **System Settings** menu. See the *NX25/NX15 Operations and Maintenance Manual* for detailed instructions.

GPS Sync PWB replacement

1. Remove and retain four sets of mounting hardware from the GPS sync PWB being replaced (A11A5).

2. Set the jumpers on the replacement PWB to the same positions as the defective PWB.

3. Install the new GPS sync PWB by reversing Step 1 and Step 2.

> *NOTE:*
> *Remove the jack screws from 9-pin D-sub connector J1 on the new GPS sync PWB before installing it.*

Exgine PWB replacement

1. Remove and retain four sets of mounting hardware from the exgine PWB (A11A7).

2. Set the jumpers on the replacement PWB to the same positions as the defective PWB.

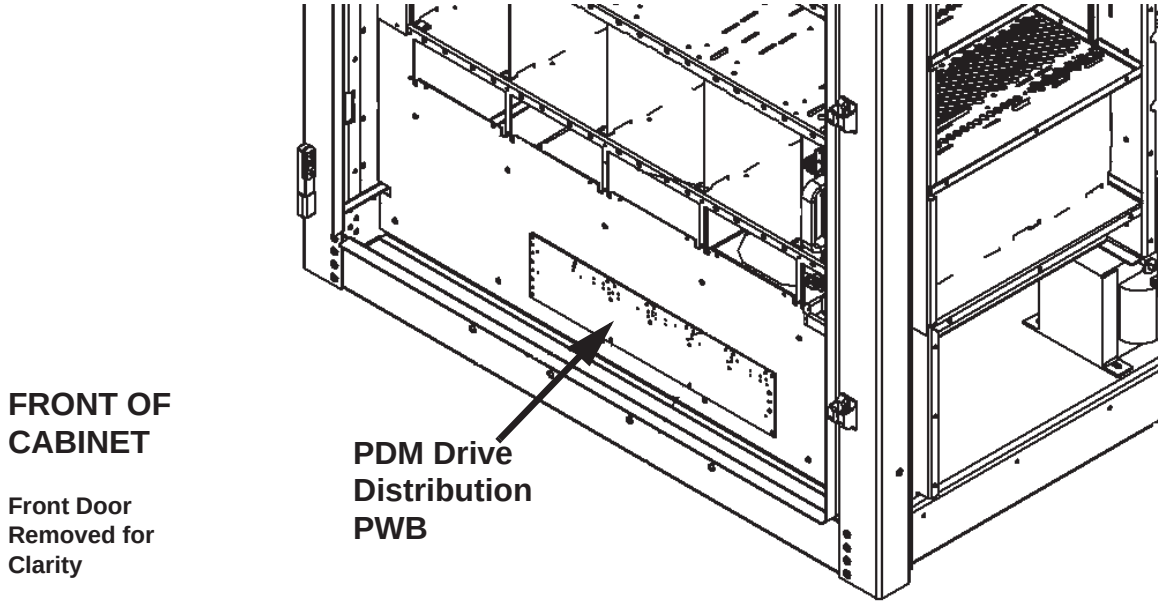
3. Install the new exgine PWB by reversing Step 1 and Step 2.

PDM Drive Distribution PWB replacement

WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and verify the 10 bright green LEDs on the power module interface PWBs - in the back of each cabinet - are off before removing any connections or PWBs.

See Figure 1.12.

Figure 1.12: Location of PDM Drive Distribution PWB



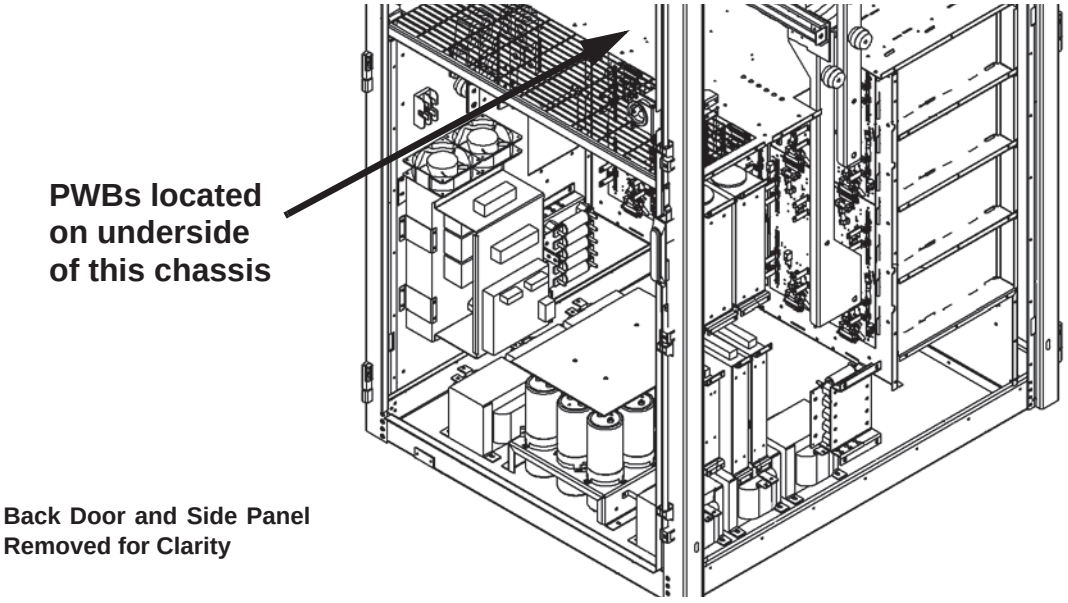
1. Open the front door.
2. Disconnect all cables attached to the PDM drive distribution PWB, taking note of the connector labels on the cables and the PWB.
3. Remove and save six sets of mounting hardware.
4. Remove the defective PWB from the transmitter.
5. Reverse Step 1 through Step 4 to install the new PWB.

RF drive distribution PWB replacement

WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the 10 bright green LEDs on the power module interface PWBs - in the back of each cabinet - are off before removing any connections or PWBs.

See Figure 1.13.

Figure 1.13: Location of RF Drive Distribution and Rack Interface PWBs



1. Turn off the ac power at the source. Open the back door and verify the green LEDs on the power module interface PWBs are off, indicating the capacitors are discharged. For additional safety, measure the dc voltage across the + and - terminals of any of the large, electrolytic capacitors on the floor of the cabinet. There should be little or no voltage.

2. Disconnect all cables attached to the RF drive distribution PWB, taking note of the connector labels on the cables and the PWB.

3. Carefully remove and save seven sets of mounting hardware.

4. Remove the PWB from the transmitter.

5. Reverse Step 1 through Step 4 to reinstall the PWB.

Rack Interface PWB replacement

WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the 10 bright green LEDs on the power module interface PWBs - in the back of each cabinet - are off before removing any connections or PWBs.

See Figure 1.13 on page 1-63.

1. Turn off the ac power at the source. Open the back door and verify the green LEDs on the power module interface PWBs are off, indicating the capacitors are discharged. For additional safety, measure the dc voltage across the + and - terminals of any of the large, electrolytic capacitors on the floor of the cabinet. There should be little or no voltage.

2. Remove the interconnecting RF drive distribution PWB (see"RF drive distribution PWB replacement" on page 1-63). Gently pry the connectors loose with a screwdriver.

3. Disconnect all cables attached to the rack interface PWB, taking note of the connector labels on the cables and the PWB.

4. Carefully remove and retain six sets of mounting hardware.

5. Remove the rack interface PWB from the transmitter.

6. Obtain a replacement rack interface PWB (Nautel Part # NAPI152A) and set DIP switch S1 as follows.

S1 Position	A6 Setting
8	OPEN
7	OPEN
6	OPEN
5	CLOSED
4	CLOSED
3	CLOSED
2	OPEN
1	OPEN

7. Reverse Step 1 through Step 5 to reinstall the PWB.

8. If you are replacing the Controller's rack interface PWB, disengage all RF power modules in the transmitter before turning on the ac power (see "Removing and reinstalling RF power modules" on page 1-45).

9. One at a time, reinstall each RF power module. The LED sequence on the front panel of each module should change to solid red. Reconnect each RF power module's PDM cable; the LED sequence should change to flashing amber.

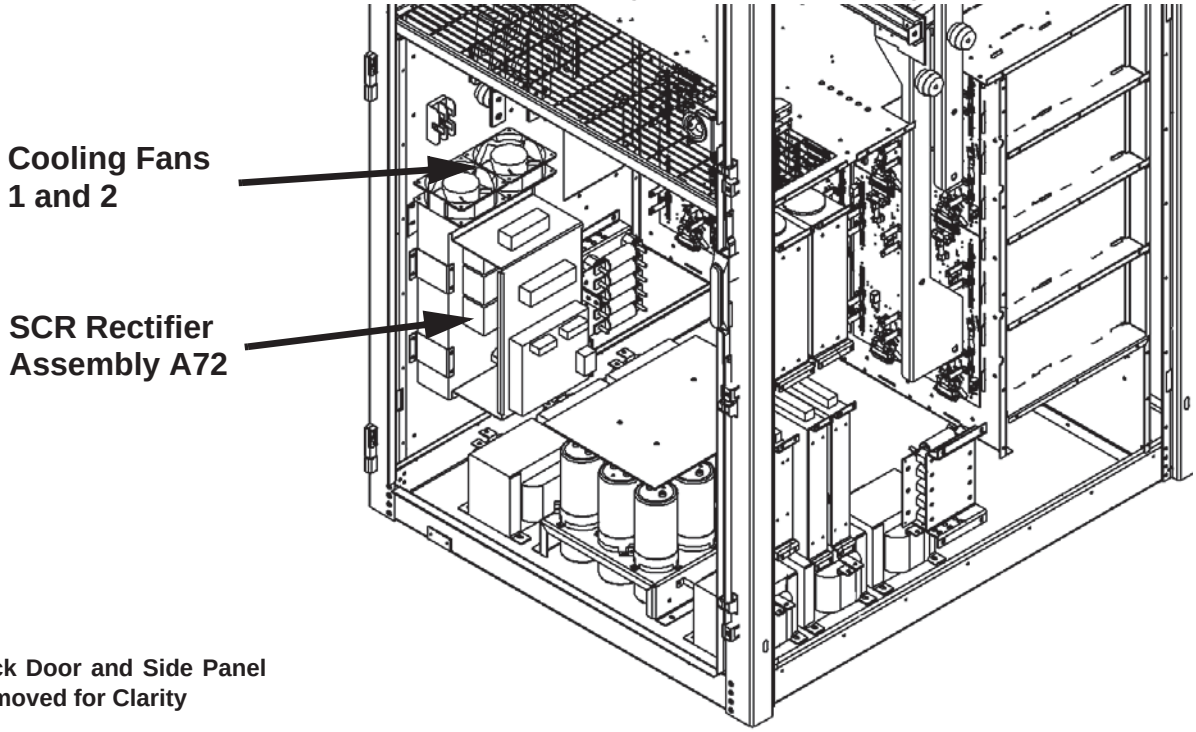
10. Upgrade the subsystem software using the AUI's **Upgrade Software** page under the **System Settings** menu. See the *NX25/NX15 Operations and Maintenance Manual* for detailed instructions.

SCR Rectifier Inspection/Replacement

> WARNING:
> Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the 10 bright green LEDs on the power module interface PWBs - in the back of each cabinet - are off before removing any connections or assemblies.

See Figure 1.14.

Figure 1.14: Location of SCR Rectifier Assembly U1 and its Cooling Fans



1. Turn off the ac power at the source. Open the back door and verify the green LEDs on the power module interface PWBs are off, indicating the capacitors are discharged. For additional safety, measure the dc voltage across the + and - terminals of any of the large, electrolytic capacitors on the floor of the cabinet. There should be little or no voltage.

2. If you are responding to a **Rectifier Fan 1 (or 2) Fail** alarm (if not, proceed to Step 3), inspect the SCR rectifier assembly's cooling fans (see Figure 1.14 on page 1-66) for debris that might restrict proper movement of the fan blades. If there is no noticeable debris, remove the suspect fan (1 or 2, as specified by the alarm) by disconnecting its wiring and then removing the four Philips screws securing it to the top of A72. Replace the fan with a suitable replacement (48 V muffin fan, EBM Part # W1G110-AG07-05). Secure the replacement fan to the SCR rectifier assembly and connect the fan's wiring as it was previously installed. Return the transmitter to service.

3. Disconnect all wiring attached to the SCR rectifier assembly, taking note of the wiring labels.

4. While supporting the weight of the SCR rectifier assembly, remove and save 12 sets of mounting hardware.

5. Remove the SCR rectifier assembly from the transmitter.

6. Reverse Step 1 through Step 4 to reinstall the new or repaired SCR rectifier assembly. Ensure all connections are tight, noting some connections have special torque requirements (e.g., torque the 2 AWG wires connecting to LINE 1, LINE 2 and LINE 3 to 12 N-m (106 in-lbs). For wiring termination assistance with connections to the SCR rectifier assembly (A72), check the wiring list in Section 4, "Wiring/connector lists" on page 4-1.

Low Voltage Power Supply Replacement

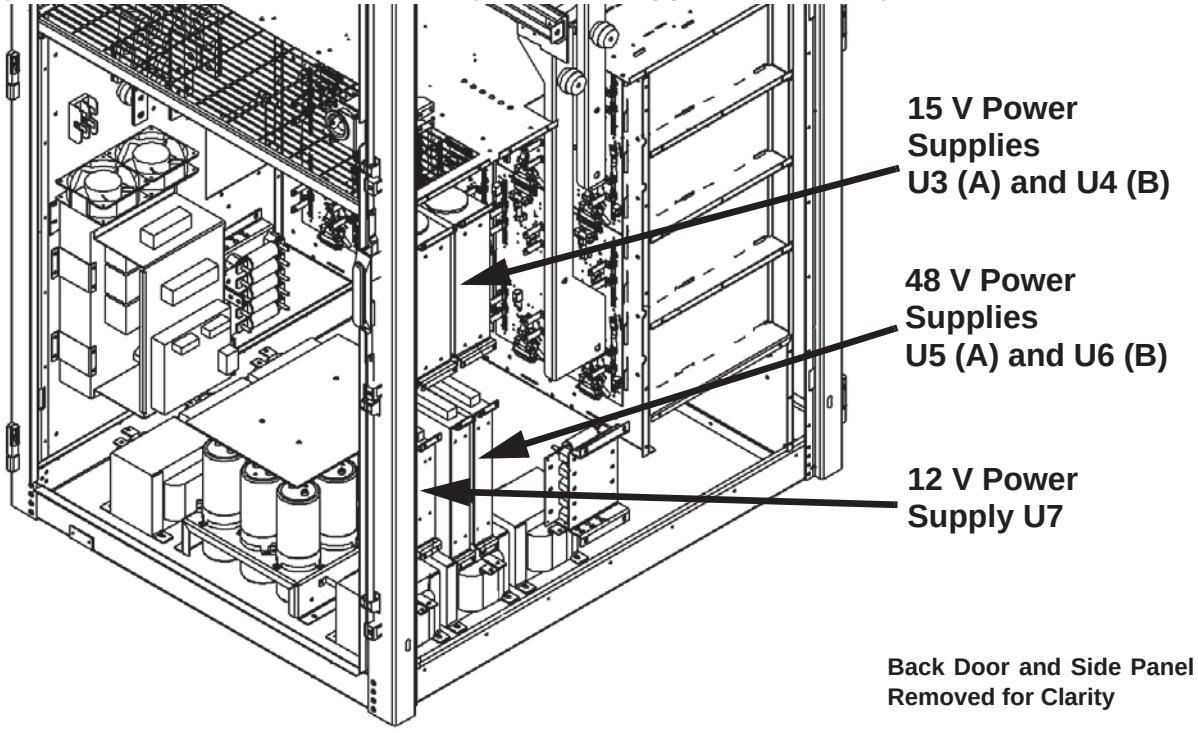
WARNING:
Lethal voltages exist inside the transmitter when the power is turned on. Turn off the power at the source and wait until the 10 bright green LEDs on the power module interface PWBs - in the back of each cabinet - are off before removing any connections or assemblies.

See Figure 1.15 on page 1-68.

1. Turn off the ac power at the source. Open the back door and verify the green LEDs on the power module interface PWBs are off, indicating the capacitors are discharged. For additional safety, measure the dc voltage across the + and - terminals of any of the large, electrolytic capacitors on the floor of the cabinet. There should be little or no voltage.

2. Disconnect all wiring attached to the affected power supply module (U3 through U7), taking note of the connector labels on the cables.

Figure 1.15: Location of Low Voltage Power Supplies U3 through U7



3. Remove and save four sets of mounting hardware.

4. Remove the power supply module from the transmitter, noting its reference designation (U3 through U7) should be marked on the side panel near the module.

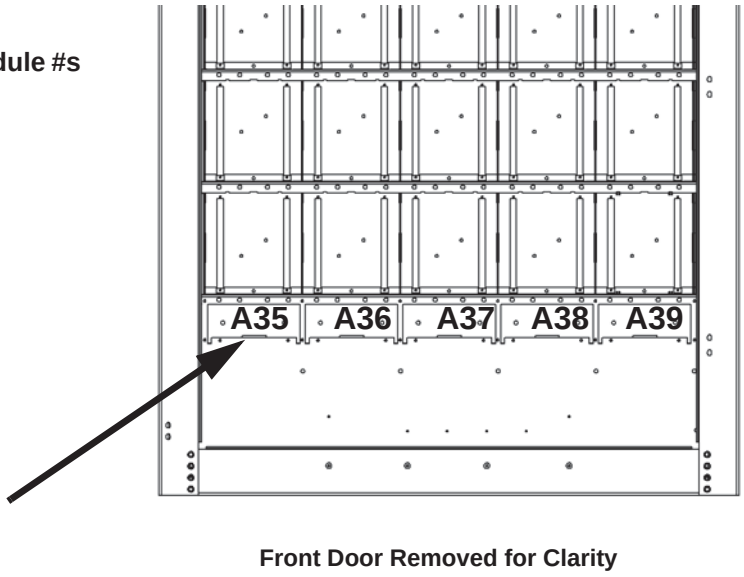
5. Reverse Step 1 through Step 4 to reinstall the new power supply module. Reconnect all wiring.

RF Power Module Fan Tray replacement

See Figure 1.16.

Figure 1.16: Location of Fan Tray Assemblies

Fan Tray	Associated RF Power Module #s (A15-A24)
A35	A15 and A16
A36	A17 and A18
A37	A19 and A20
A38	A21 and A22
A39	A23 and A24



1. Open the front door.

2. Determine the suspect fan tray assembly (through) associated with the offending RF power module # alarm(s).

3. Remove and save two sets of mounting hardware. Pull the fan tray assembly out of the transmitter.

4. Reverse Step 1 through Step 3 to install the new fan tray assembly.