

NV5/NV3.5 TRANSMITTER

OPERATIONS AND MAINTENANCE MANUAL

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

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RELEASE CONTROL RECORD

| Issue | Date | Reason |
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ABOUT THIS MANUAL

This manual provides technical information needed when operating, maintaining and troubleshooting an NV5/NV3.5 transmitter. This manual is intended for use by transmitter operators and field technicians.

USING THIS MANUAL

If you are responsible for configuring or operating a transmitter, see [Section 2, "Operating the transmitter" on page 2-1](#) and [Section 3, "Using the event log" on page 3-1](#).

If you are performing scheduled maintenance, or planning your maintenance schedule, see [Section 4, "Routine maintenance" on page 4-1](#).

If you are performing a test or adjustment, as instructed during a troubleshooting task, see [Section 5, "Test and adjustment" on page 5-1](#).

PERFORMING PROCEDURES

When using procedures in this manual, perform each step in sequence.

- If you are asked to **see** another section of this manual, or another document, refer to that section or document for additional information, then continue the procedure.
- If you are asked to **go** to another step within the procedure, jump directly to that step without performing the intervening steps.
- If you are asked to **go** to another section or document, stop the procedure and perform the tasks described in the other section or document.
- If you are asked to **check a voltage**, use a digital voltmeter and test the voltage relative to ground (unless otherwise instructed).
- If you are asked to **check a signal**, use an oscilloscope and test the signal relative to ground (unless otherwise instructed).



CAUTION: FAILURE TO COMPLY WITH RECOMMENDATIONS MAY VOID YOUR MANUFACTURER'S WARRANTY. FOR MORE INFORMATION, REVIEW YOUR WARRANTY DOCUMENTS.

Tip: When you have completed a task or a step, put a checkmark beside the step number.

TECHNICAL SUPPORT

Nautel offers technical support to customers over the Internet and by telephone. Nautel's customer support team will answer your questions and work with you to identify and resolve problems.

For 24-hour technical support, call toll free at 1.877.628.8353 (in USA and Canada only) or call 1.902.823.5100 (international) or find us on the Internet at <http://www.nautel.com>.

For parts and tools information, see "[Parts and tools](#)" on page 9-1 of the *NV5/NV3.5 Pre-Installation Manual*.

For extended warranty information, see "[Pre-installation assistance](#)" on page 10-1 of the *NV5/NV3.5 Pre-Installation Manual*.

NV5/NV3.5 TRANSMITTER MANUALS

The NV5/NV3.5 documentation suite includes the following documents:

NV5/NV3.5 PRE-INSTALLATION MANUAL, NV5/NV3.5-PREINST. Provides instructions and reference information needed when planning and preparing for the installation of an NV5/NV3.5 transmitter.

NAUTEL SITE PROTECTION MANUAL. Provides detailed information about protecting your site from lightning-related hazards.

NV5/NV3.5 INSTALLATION MANUAL, NV5/NV3.5-INST. Provides instructions and reference information needed when installing an NV5/NV3.5 transmitter.

NV5/NV3.5 OPERATING AND MAINTENANCE MANUAL, NV5/NV3.5-OPS-MAINT. Provides instructions for operating, maintaining and troubleshooting an NV5/NV3.5 transmitter. It also provides reference information needed when performing diagnostic procedures.

NV5/NV3.5 TROUBLESHOOTING MANUAL, NV5/NV3.5-TROUBLE. Provides detailed technical information about the NV5/NV3.5 transmitter, including electrical schematics and mechanical drawings.

NAUTEL WEBSITE / ONLINE RESOURCES

The Nautel website provides useful resources to keep you up to date on your NV5/NV3.5.

NAUTEL USER GROUP (NUG)

The website includes a special section that customers can log into in order to access the Nautel customer newsletter, product manuals, frequently asked questions (FAQ), information sheets, and information about field upgrades.

DOCUMENTATION: ONLINE AND PRINTED

The website's NUG section provides online access to all the documentation for your NV5/NV3.5. Documentation is provided in Acrobat (PDF) format. You can use the documentation online or print the sections that you need.

When using online documents:

- Click on blue text (hyperlinks) to jump to a related section, or to get additional information (e.g., view a term's definition).
- To search a document to find keywords, use Find in Acrobat Reader's Edit menu.
- To quickly find a specific section, click the section in the PDF file's Bookmarks list.

When using printed documents:

- To find keywords, go to the *Index* section at the end of the manual.
- To find a specific term, go to the *List of Terms* section near the end of the manual.

ABOUT SAFETY

All Nautel transmitters are designed to meet the requirements of *EN60215, Safety Requirements for Radio Transmitters*.

The philosophy of *EN60215* is that the removal of any cover or panel that can only be opened using a tool is a maintenance activity, and that any person performing a maintenance activity is expected to be trained for that activity. Under *EN60215*, it is assumed that trained personnel will be knowledgeable and will take precautions such as removing all power to the transmitter before accessing its components.

ELECTRICAL HAZARDS

To remove power from the transmitter, switch off and lock out the ac power. There are three amber LEDs at the bottom rear of the cabinet that glow to remind anyone who has not turned off the power that the system is live and serious danger is present.



DANGER - HIGH VOLTAGE

Indicates dangerous voltage (in excess of 72 volts), capable of causing a fatal electrical shock, are present on or near parts bearing this label.



WARNING: IT IS NOT ENOUGH TO SWITCH OFF RF POWER. THE POWER LINE IS STILL CONNECTED. DISCONNECT AND LOCK OUT THE UPSTREAM SUPPLY BEFORE SERVICING.

Mount the transmitter ac power disconnect switch/breaker close to the transmitter so that it can be reached quickly in an emergency. Clearly label the disconnect switch/breaker (e.g., **EMERGENCY SWITCH**).

After turning off the power, always perform a measurement to confirm that the power is off before touching anything within the transmitter. If the wrong breaker was opened, the equipment will be live.



WARNING: DO NOT USE AN ORDINARY MULTIMETER TO CHECK FOR VOLTAGE, SINCE IT MAY HAVE BEEN LEFT INADVERTENTLY ON THE AMP (A) RANGE, TRIGGERING A SHORT AND AN ARC BLAST THAT COULD RESULT IN SEVERE BURNS AND EVEN DEATH.

Use only a non-contact voltage probe or a safety voltmeter (available from vendors such as Fluke, Ideal, and Teagam).

Use a proper lockout procedure to ensure that another worker cannot accidentally reapply power while you are performing maintenance on any part of the transmitter or site.

LIGHTNING HAZARDS

Before opening the transmitter and touching internal parts, remove and solidly ground the antenna connection.



WARNING: IT IS NOT ENOUGH TO GROUND THE ANTENNA TERMINAL WITH THE ANTENNA STILL CONNECTED. EVEN A SMALL IMPEDANCE IN THE GROUND STRAP WILL RESULT IN LETHAL VOLTAGES DURING A LIGHTNING STRIKE.

RF HAZARDS

A serious RF hazard and very high voltages exist in the vicinity of the antenna and its networks during normal operations.

TOXIC HAZARDS

There are devices used in this equipment containing beryllium oxide ceramic, which is non-hazardous during normal device operation and under normal device failure conditions. These devices are specifically identified with "(BeO)" in the *Description* column of the *Troubleshooting Manual's* parts list(s).

Do not cut, crush or grind devices because the resulting dust may be hazardous if inhaled. Unserviceable devices should be disposed of as harmful waste.

PHYSICAL HAZARDS



DANGER - MOVING BLADES

Fan blades can cause injury. Lock out power before removing safety features.

OTHER HAZARDS

Ensure that appropriate fire alarms and fire extinguishers are available. Extinguishers must be suitable for use on electrical fires.

Many other site safety risks exist. It is beyond the scope of this manual to identify all the risks and procedures.

SAFETY PRECAUTIONS

This section provides very important information about protecting the safety of personnel and equipment:

- Personal safety - see [page xv](#)
- Site safety - see [page xvi](#)
- Equipment safety - see [page xviii](#)

PERSONAL SAFETY

TRAINING

The training of any personnel who will have physical access to the site or the transmitter is very important. Personnel must be familiar with the transmitter, so that they can avoid physical danger, and be aware of hazards to themselves and the equipment.

Nautel offers a number of training courses covering the basic fundamentals of RF systems and transmitters, and the operation and maintenance of the transmitter. For more information about available courses and schedules, go to the Nautel website at <http://www.nautel.com/Training.aspx>, or ask your Nautel sales representative.

SITE ORIENTATION

When you give personnel access to the transmitter site (e.g., hiring new personnel, or giving access keys to personnel), perform a site orientation to ensure that they are familiar with the site, on-site procedures, and on-site hazards. Cover the following topics:

- Securing the site (locking doors and fences) to prevent unauthorized access

- How and when to call for technical support or emergency assistance
- Areas of the site and pieces of equipment that are *off limits*

VOLTAGE AWARENESS

Ensure that all personnel that are able to access areas with high voltage circuits or high field strengths are aware of the hazards associated with high voltage. Cover the following topics:

- High voltage or high field strength areas where caution is required
- Physical risks of electric shock
- Risks for personnel with pacemakers or other medical implants
- Induced voltages in high field strength areas
- On-site risks during thunderstorms and lightning strikes
- Operation of safety interlocks (if installed)

FIRST AID

Nautel does not offer first aid training, since the hazards associated with high voltage and RF energy are not specific to the transmitter. However, the customer should provide first aid training to all personnel who have access to the transmitter site. First aid training should include CPR, care of burns, artificial respiration, and defibrillation if specific equipment is available on-site.

SITE SAFETY

CONTROLLING ACCESS

Transmitters and antennas generate and carry dangerous voltages that can be harmful or fatal. It is very important that you control access to the site and its equipment. To secure your transmitter site, use:

- Locking steel or security doors to prevent casual access
- A perimeter fence to keep trespassers away from the antenna system and feedline
- “No Trespassing” signs
- An alarm system

MARKING HAZARDS

Place warning signs close to any hazardous areas or systems (e.g., the feedline or the antenna system). Make the signs large enough that they cannot be missed. Provide signage in all languages used in the region. These signs are intended not only for authorized personnel, but also for emergency responders or accidental trespassers.

QUALIFYING SITE PERSONNEL

Make sure that personnel who have access to the site are qualified to work around electronics and high voltage systems.

AC POWER PROTECTION

You should take steps to protect equipment from surges (over-voltage spikes) on the ac power lines. Surges may occur during thunderstorms, or because of malfunctions in the electrical distribution grid. Surge suppressors and ac power conditioners can prevent serious damage to your on-site equipment, including the transmitter.

RF PROTECTION

Transmitters and their antenna systems create intense radio frequency fields at the transmitter site, particularly near the feedline, antenna and tower. At some sites, these fields may cause biological effects, including the heating of body tissues. Intense fields can also create dangerous high voltages on ungrounded, conductive surfaces and objects. At certain points where high voltage conductors come close to grounded conductors (e.g., at feedline junctions or on the tower), dangerous electrical arcing or flashovers can occur. It is very important that you take the following steps to prevent damage to equipment or personnel due to RF fields:

- Use safety interlocks to de-energize transmitters if personnel open doors or panels accessing high field areas
- Place warning signs in any locations where high fields can occur
- Train personnel about the short-term and long-term hazards of RF radiation
- Physically block access to the area around the antenna system, feedline and tower
- Ground all exposed conductive surfaces or objects in high field areas

The RF connection to the transmitter output can be a serious safety hazard. Connect a 50 Ω test load during installation and commissioning. It is recommended that a switch be used to automatically connect the transmitter to the antenna system without human contact with the transmitting conductors.

SAFETY INTERLOCKS

The transmitter contains an electrical interlock, which is an external circuit that turns off the RF output if any of its switches are opened.

AC DISCONNECT SWITCH

Safe operation of the transmitter requires an ac disconnect switch. Lock the ac disconnect switch in the disconnected (open) position during the installation process.

EQUIPMENT SAFETY

ELECTROSTATIC PROTECTION

The transmitter's systems are very rugged and resistant to damage. However, it is possible for damage to occur because of high voltage electrostatic discharges during servicing. Train all service personnel to ground themselves to bleed off any static charge before opening the transmitter or touching any exposed components. Provide a grounding wand or known ground (e.g., a grounded metal table) that personnel can use to discharge themselves.

SURGE PROTECTION

Surge protection is recommended for your entire site. However, even if you do not use a surge protector on the service entrance to the site, you should install a surge protector in the transmitter's ac power feed to prevent over-voltage from entering the transmitter.

LIGHTNING PROTECTION

The transmitter is designed to resist lightning strike damage. However, intense or repeated strikes could damage the transmitter. We recommend that you install lightning suppression on the antenna, tower and feedline to reduce the effect of lightning strikes on the transmitter itself (and to protect the rest of your site equipment and your personnel). For detailed information about lightning protection, see the *Nautel Site Preparation Manual*, available from your Nautel sales agent, or online from the Nautel website.

PHYSICAL PROTECTION

Consider physical hazards to equipment at your site, including the transmitter. Ensure that equipment is protected from weather (e.g., rain or flooding), even during extreme weather events. Place equipment so that it is not in the path of swinging doors or high-traffic areas. Do not allow wheeled items like office chairs or tables with wheels in the transmitter room, as these may damage equipment if accidentally pushed or knocked over. Do not place the transmitter under water pipes, drains, or sprinklers. Keep any equipment that generates heat, like the transmitter, away from flammable materials like ceiling panels, cubicle dividers, and curtains.

EARTHQUAKE PROTECTION

If the transmitter site is in a region that experiences any noticeable earthquake activity, take steps to prevent the transmitter from shifting or rocking during an earthquake. Even during minor earthquakes, rocking or movement of the transmitter is likely to damage the feedline connection, and could even cause a catastrophic failure of the ac power feed into the transmitter. During larger earthquakes, the weight of the transmitter chassis could be hazardous to nearby equipment or personnel.

SECTION 1: DESCRIPTION

Refer to the functional block diagram: [NV Series Transmitter Block Diagram](#) - see page 1-9.

This section provides a high-level description of the transmitter's key sections. The transmitter circuitry is subdivided into four basic stages:

- [Ac-dc power stage](#)
- [Control/monitor stage](#) - see page 1-3
- [RF drive stage](#) - see page 1-4
- [RF power stage](#) - see page 1-6

NV5/NV3.5 ELECTRICAL SCHEMATICS

Some descriptions in this section refer to electrical schematics (SD-#s) . These are located in Section 5 of the *NV5/NV3.5 Troubleshooting Manual*.

REDUNDANCY

The NV5/NV3.5 features redundancy in all key systems:

- RF power modules
- Exciters
- Cooling fans
- Cooling fan power supplies
- Low voltage power supplies
- SBC/AUI power supplies

AC-DC POWER STAGE

See electrical schematics SD-1 (A, B or C), SD-2 and SD-3.

The ac-dc power stage converts the ac power source to a positive dc voltage (PA volts) for the transmitter's intermediate (IPA) and RF power amplifiers. The transmitter accepts a wide range of ac input voltage options:

- 3-phase, 180 - 264 V ac (208 V ac nominal)
- 3-phase, 312 - 457 V ac (380 V ac nominal)
- 1-phase, 180 - 264 V ac (240 V ac nominal)

The ac-dc power stage provides power to operate cooling fans in the power supply modules, RF power modules and reject load modules. It also provides power to the low voltage power supplies, which generate the low level dc voltages (± 15 V and +5 V) used throughout the transmitter, and to the +12 V dc power supplies for the SBC (single-board computer) and AUI (advanced user interface).

The ac-dc power stage comprises ac input terminal blocks TB1, TB2 and TB3, an ac distribution assembly (A6), a power supply distribution PWB (A7), SBC/AUI power supplies A (U1) and B (U2), LVPS modules A (U3) and B (U4), fan power supply modules A (U7) and B (U8), IPA power supply modules A (U9) B (U10), and dual PA power supply modules (U12 through U15) for each of the two RF power modules. There is also a PS interface PWB associated with each power supply module (fan, IPA and PA).

POWER SUPPLY MODULES

See Figure SD-2. Power supply modules U9 through U15 convert the ac input voltage to a regulated dc supply (IPA volts and PA volts) for all both RF power modules (module contains both IPA and PA). Each switching power supply module provides 2000 W output, at typical levels of 50 V and 40 A. The modules regulate the output voltage based on a *PA (or IPA) Volts Control* input from the control/monitor stage. Test points on the associated PS interface PWB allow monitoring of module presence and ac input status. Each module has a built-in cooling fan and each senses out-of-regulation and excessive temperature conditions and applies PS Fail and PS Temp alarm signals to the associated RF power module. Both conditions cause the power supply to shut itself down, thus reducing the transmitter's RF output.

The same modules are used for fan power supply modules U7 and U8. Their *PS Fail* and *PS Temp* alarm signals, as well as the *PS Module Present* status signal, are applied to the control/monitor stage.

LVPS MODULES

See Figure SD-1 (A, B or C). LVPS modules A (U3) and B (U4) convert the ac input voltage to the regulated low voltage dc supplies. The +5 V, +15 V and -15 V regulated outputs of the supplies are ORed together at the control/interface PWB (A1) and applied throughout the transmitter.

+12 V POWER SUPPLY MODULES

See Figure SD-1 (A, B or C). +12 V power supply modules A (U1) and B (U2) convert the ac input voltage to the regulated +12 V dc supplies. The +12 V outputs are ORed together on the power supply distribution PWB (A7) and a common +12 V supply is applied to the control/monitor stage.

POWER SUPPLY DISTRIBUTION PWB

See Figures SD-1 (A, B or C) and SD-3. The power supply distribution PWB (A7) interfaces between fan power supply modules U7 and U8 and the cooling fans for RF power modules 1 and 2 and the reject load. The fan voltage (+48 V) is applied via power rectifiers CR1 and CR2 to the transmitter's cooling fans. A nominal 47 V is applied as *Fan V Sample A* and *B* to the control/monitor stage for metering and fan PS fault detection.

The power supply distribution PWB also interfaces between SBC/AUI power supplies U1 and U2 and the control/monitor stage. +12 V is applied via power rectifiers CR3 and CR4 to the control/monitor stage. A nominal +12 V is applied as *+12V Sample A* and *B* to the control/monitor stage for metering and supply fault detection.

CONTROL/MONITOR STAGE

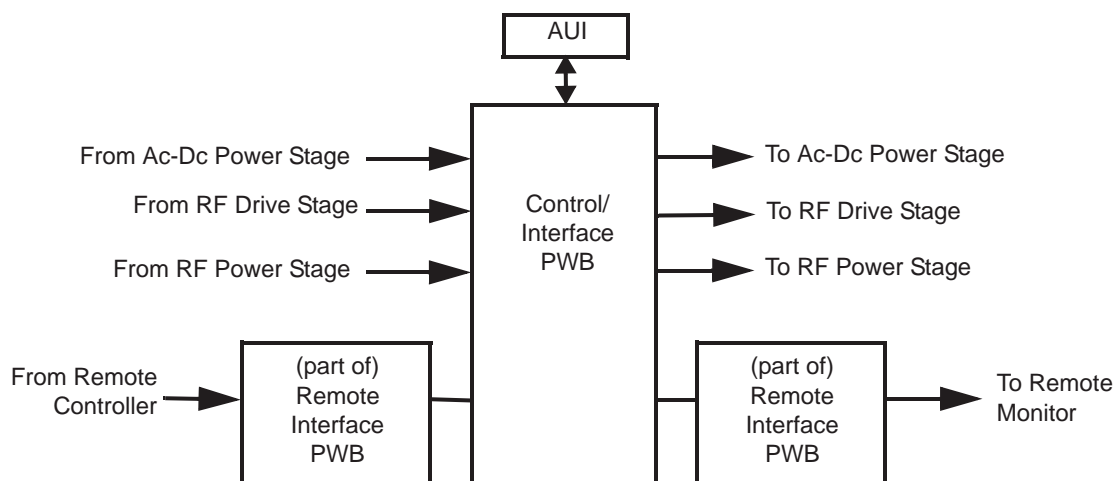
See electrical schematics SD-4 and SD-5 and [Figure 1.1 on page 1-4](#). The control/monitor stage monitors critical samples and status/alarm signals from the ac-dc power stage, RF drive stage and RF power stage. For example, RF power monitoring and RF power stage status information is applied to the control/monitor stage. Based on the value and status of each input, the control/monitor stage produces the appropriate control signals for the RF power stage to ensure the proper operation and protection of the transmitter. The control/monitor stage also provides the remote control/monitor interface for the transmitter.

The control/monitor stage comprises a control/interface PWB (A1), a remote interface PWB (A2), an LCD touch monitor (U5) and a single-board computer (U6).

U5 is a 17-inch, colour LCD screen that is mounted on the front of the transmitter. It provides an advanced user interface (AUI) for the transmitter. The AUI can be controlled by touch screen and is also available as a flash graphic on any web-interfaced PC or handheld device via the internal NV web server. See ["Advanced user interface" on page 2-2](#) for detailed information on AUI functionality.

The control/interface PWB contains push-button switches that provide backup control for the RF on/off, local/remote, power increase/decrease and reset functions. It also contains LEDs that serve as an alternate means to monitor status (local/remote and RF on/off), forward power level (percentage indicators from 10% to 100% of maximum RF output power) and various alarms.

Figure 1.1: Control/Monitor Stage



RF DRIVE STAGE

See Figure SD-6. The RF drive stage converts the exciter's RF output to the intermediate RF level needed to drive the RF power modules. It consists of exciter A (A3), exciter B (A4, optional) and RF drive splitter/changeover assembly (A5).

EXCITER(S)

Refer to the functional block diagram: [NVE300 Exciter Block Diagram](#) - see page 1-10.

Exciters A (A3) and B (A4) are the RF drive sources for the transmitter. They accept the external audio program and/or IBOC information (see the *NV5/NV3.5 Installation Manual* for details on various program input types). The exciters' main/standby operation is controlled locally using the AUI, or remotely. The exciter outputs are applied to the RF drive splitter/changeover assembly (A5). The exciter provides an RF drive signal of 11 W (in analog mode).

RF DRIVE SPLITTER/CHANGEOVER ASSEMBLY

The RF drive splitter/changeover assembly (A5) controls the routing of the main and standby exciters and provides the RF drive signals for the two RF power modules. The assembly is comprised of the splitter/changeover PWB (A5A1) and the 4-way RF drive splitter/attenuator PWB (A5A2).

EXCITER RELAY CONTROL

The RF drive outputs from exciters A and B are applied to the splitter/changeover PWB (A5A1) at A5A1J1 and A5A1J2 respectively. The *Exciter Relay Control* input (A5A1J3-4) is a signal applied from the control/monitor stage that controls relay A5A1K1.

- When exciter A is selected as the main RF drive source, the *Exciter Relay Control* input is open circuit and relay A5A1K1 will be de-energized. Exciter A's output will be applied to 3 dB hybrid coupler A5A1U1.
- When exciter B is selected as the main RF drive source, the *Exciter Relay Control* input is near ground potential (0 V) and relay A5A1K1 will be energized. Exciter B's output will be applied to 3 dB hybrid coupler A5A1U1.

EXCITER DRIVE SPLITTER

The splitter/changeover PWB's 3 dB hybrid coupler (A5A1U1) is connected as a splitter. The RF drive source (A or B) selected by relay A5A1K1 is applied to A5A1U1's input. The signal is split into two equal amplitude signals that are 90° out-of-phase. These split signals are applied to 4-way RF drive splitter PWB A5A2.

4-WAY RF DRIVE SPLITTER/ATTENUATOR

The 4-way RF drive splitter/attenuator PWB (A5A2) accepts the outputs from the splitter/changeover PWB's 3 dB hybrid coupler and splits it into four equal amplitude signals, using two 3 dB couplers identical to A5A1U1. The outputs of the 3 dB couplers are applied to attenuators for application to the two RF power modules. Attenuation values are set in order to balance the RF drive output levels.

RF POWER STAGE

See Figures SD-7, SD-8 and SD-9. The RF power stage accepts the intermediate RF drive inputs from the RF drive stage and generates the final RF output. It consists of two RF power modules, a module backplane PWB (A17), a combiner/filter (A16), an output power probe (A13), a 2-input reject load assembly (A14) and a reject load interface PWB (A15).

RF POWER MODULE

See Figure SD-7 (see the *NV5/NV3.5 Troubleshooting Manual* for a detailed RF power module description) and ["RF Power Module Block Diagram" on page 1-11](#).

Each of the two RF power modules provides up to 2750 W (for NV5) or 2062.5 W (for NV3.5) of RF output power and is comprised of an IPA power amplifier PWB, eight power amplifier PWBs, power module interface PWB, combiner PWB, splitter PWB and six cooling fans. The intermediate RF drive outputs from the RF drive stage are applied to the RF power modules via module backplane PWB 1-4 (A17). Within each RF power module, the intermediate RF drive signal is sampled and then drives the IPA amplifier. The IPA output is sampled then split to drive the module's eight PAs. The *IPA Volts* and *PA Volts* inputs from the associated switching power supply modules control the RF output of the IPA and eight PAs, respectively. The RF power module receives alarm and status signals (*PS Temp*, *PS Fail*, *PS AC Fail*, and *PS Module Present*) from the ac-dc power stage. The RF power module also provides a *Pwr Supply Inhibit* signal (one for each of the power module's dual supplies) to the ac-dc power stage, which, when active, inhibits the associated switching power supply. A *PA V Sample* and *IPA V sample* from each RF power module is applied to the control/monitor stage. The control/monitor stage supplies a *PA Volts Inhibit* signal, which controls the PA outputs of the RF power module.

MODULE BACKPLANE PWB

See Figure SD-7. The two RF power modules have an associated module backplane PWB which interfaces with all module inputs and outputs, except for the RF output. It also provides the fan volts connections for the module's cooling fans. The setting of dipswitches S1 through S4 assign a four-bit address for each specific module based on module position. Jumper E1 is set to TERM on RF power module 2 (the last module) to terminate the RS-485 serial communication cable.

COMBINER/FILTER

See Figure SD-8.

The 10 kW combiner/filter (A16) accepts the RF outputs from two RF power modules and provides a single RF output. The 10 kW combiner/filter uses a 3 dB hybrid coupler, which accepts the outputs of two RF power modules. The equal amplitude, 90° out-of-phase (quadrature) RF signals are combined at the 3 dB hybrid coupler outputs. The combined output is applied to a 10 kW low pass filter before being applied to the output power probe.

Any amplitude or phase imbalances between 3 dB hybrid coupler inputs cause a proportional signal to be applied to the reject load assembly. The amplitude of the *5 kW Rej Ld Pwr* signal (via J5) represents imbalance between the combined outputs.

OUTPUT POWER PROBE

See Figure SD-8. The output power probe (A13) monitors the transmitter's forward and reflected power and generates the *Fwd Pwr Sample* (A1J1) and *Refld Pwr Sample* (A2J1) signals applied to the control/monitor stage for protection and monitoring. RF monitor PWB A3 provides a nominal 1.6 V (NV5) or 1.3 V (NV3.5) rms [at 5 kW (NV5) or 3.75 kW (NV3.5)] signal at A3J1 for use with a modulation monitor or spectrum analyzer. RF sample PWBs A4 and A5 provide similar samples at A4J1 and A5J1. These samples are applied to exciters A and B (if used) for use by the exciters' adaptive pre-correction circuitry [for all-digital (HD) or hybrid (FM+HD) modes of operation] and also by the AUI's spectrum analyzer display.

REJECT LOAD ASSEMBLY

See Figure SD-9. The reject load assembly (A14) provides a means to dissipate reject power from the outputs of the combiner/filter's 3 dB hybrid coupler. The reject load assembly contains power resistors to dissipate reject power and cooling fans to regulate temperature.

Reject power generated by the 5 kW combining stage of the 10 kW combiner/filter assembly is dissipated by resistors in the 2-input reject load assembly (A14). Micro-strip transmission lines (on 2-input reject load PWB A14A1) in close proximity to the reject load signals induce two true RF sample voltages of the associated reject power. These samples are peak detected and applied to the control/monitor stage via the reject load interface PWB (A15). The reject load interface PWB provides an interface between the ac-dc power stage's *Fan Volts* supply and the reject load assembly's cooling fans. It also acts as the interface between the cooling fans' *Rej Fan Tach* signals and the control/monitor stage.

Figure 1.2: NV Series Transmitter Block Diagram

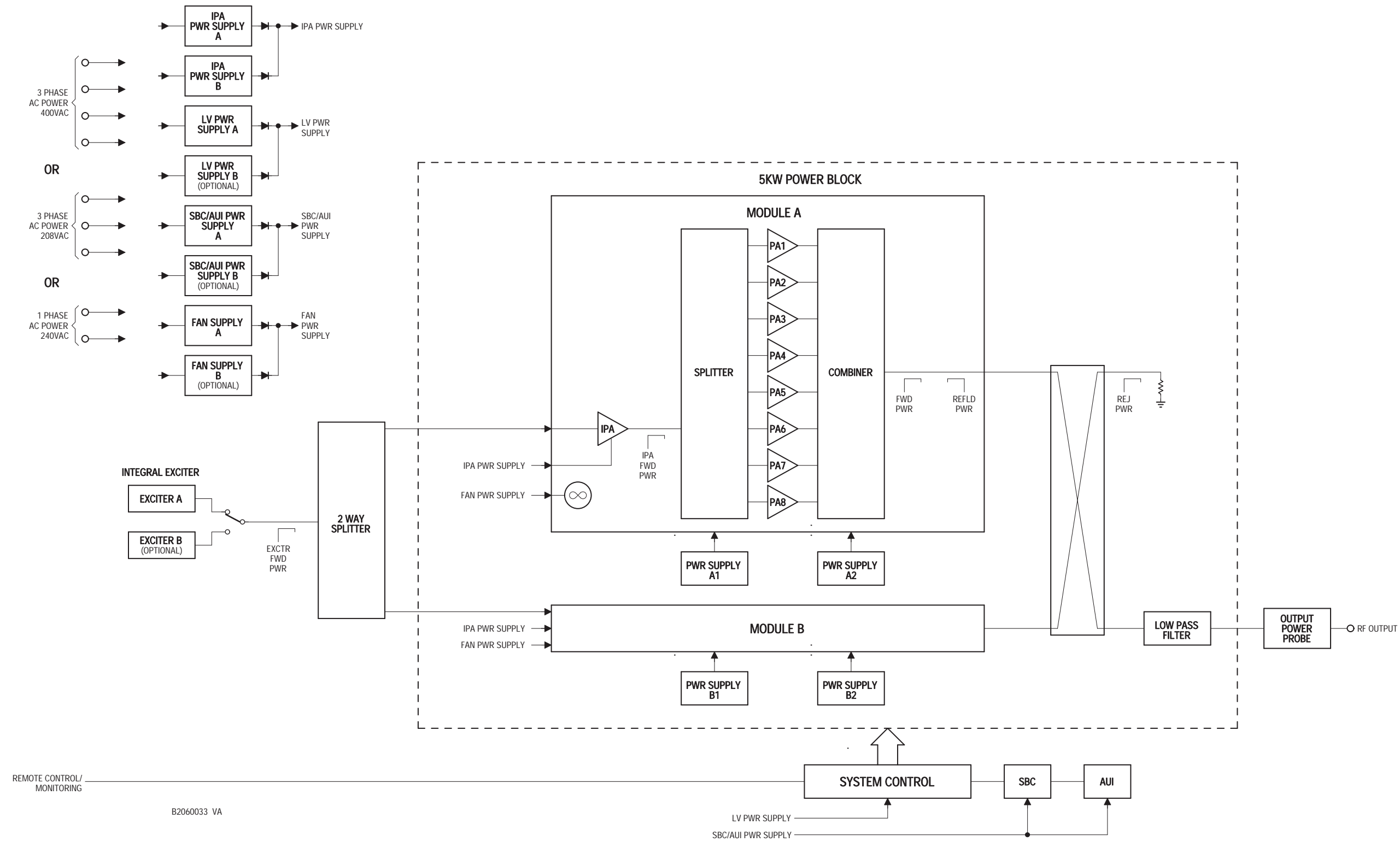


Figure 1.3: NVE50 Exciter Block Diagram

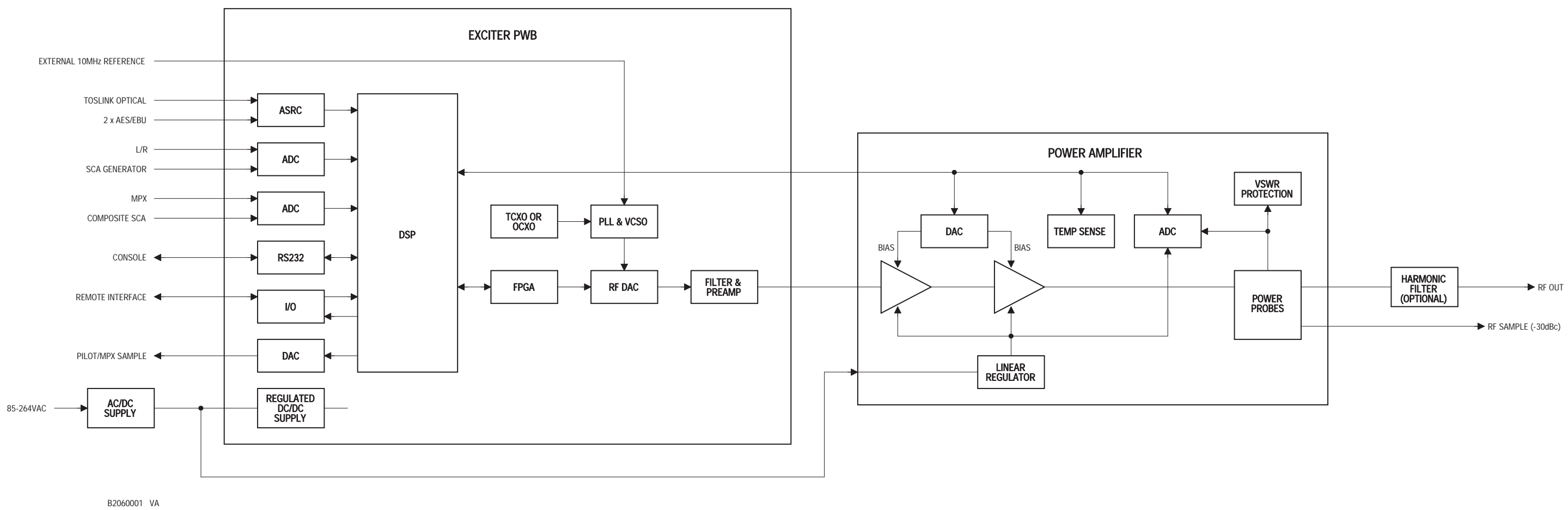
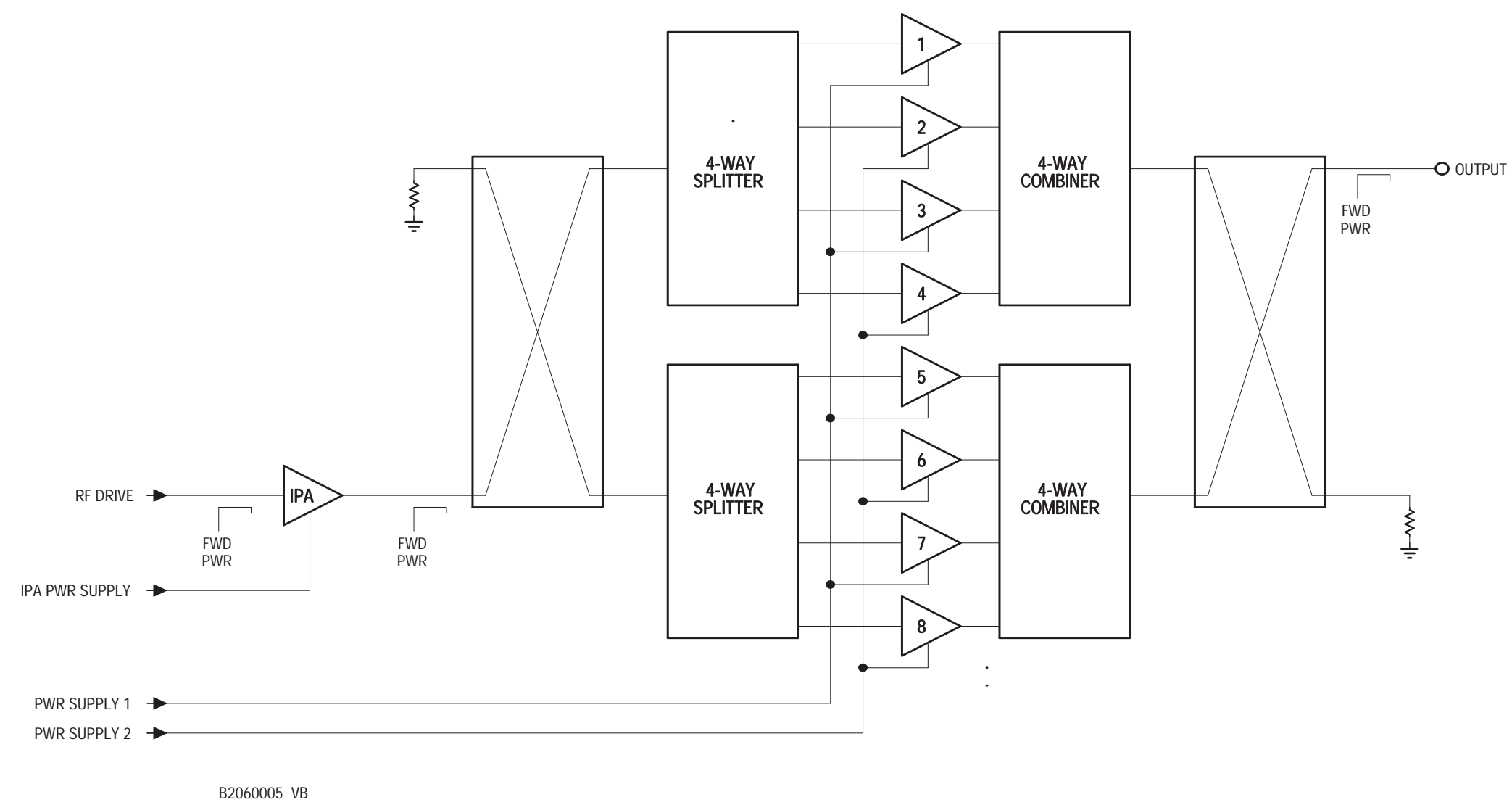


Figure 1.4: RF Power Module Block Diagram



SECTION 2: OPERATING THE TRANSMITTER

This section provides information about operating the NV5/NV3.5 transmitter:

- [Advanced user interface - see page 2-2](#)
 - [Accessing the AUI - see page 2-5](#)
 - [AUI pages - see page 2-6](#)
 - [AUI layout - see page 2-7](#)
 - [Navigating from page to page - see page 2-9](#)
 - [Menu page - see page 2-10](#)
- [Viewing transmitter log - see page 2-12](#)
- [Viewing tool menu panels - see page 2-14](#)
- [Viewing real-time meters - see page 2-26](#)
- [Setting the time and date - see page 2-28](#)
- [Operating presets - see page 2-29](#)
- [Viewing transmitter status - see page 2-36](#)
- [Setting user accounts - see page 2-37](#)
 - [Setting user permission level - see page 2-37](#)
 - [Editing account information - see page 2-38](#)
- [Changing exciter transfer settings - see page 2-39](#)
- [Software configuration - see page 2-40](#)
 - [Network setup - see page 2-41](#)
 - [Upgrading software - see page 2-43](#)
 - [Watchdog setup - see page 2-44](#)
 - [Email configuration - see page 2-45](#)
 - [Notifications - see page 2-46](#)
- [Changing hardware settings - see page 2-48](#)
- [Configuring remote inputs and outputs - see page 2-60](#)
 - [Digital inputs - see page 2-61](#)
 - [Digital outputs - see page 2-63](#)
 - [Analog outputs - see page 2-64](#)

ADVANCED USER INTERFACE

The NV5/NV3.5's advanced user interface (AUI) is a 17-inch, colour LCD screen mounted on the front of the transmitter (see [Figure 2.1](#)). The AUI can be controlled by touch screen and is also available using a PC and a web browser. It has a wide range of displays, including:

- Tool menu panels (spectrum analyzer, signal constellation, Lissajous plot, etc.)
- Real-time meters
- Detailed transmitter status or events log
- Presets
- Hardware configuration
- Software configuration
- Remote input/output configuration
- Exciter changeover configuration
- Login administration

See the complete AUI Flow Diagram illustrated in [Figure 2.2](#).

Figure 2.1: NV5/NV3.5 AUI



Information is displayed in a series of screens that serve specific functions.

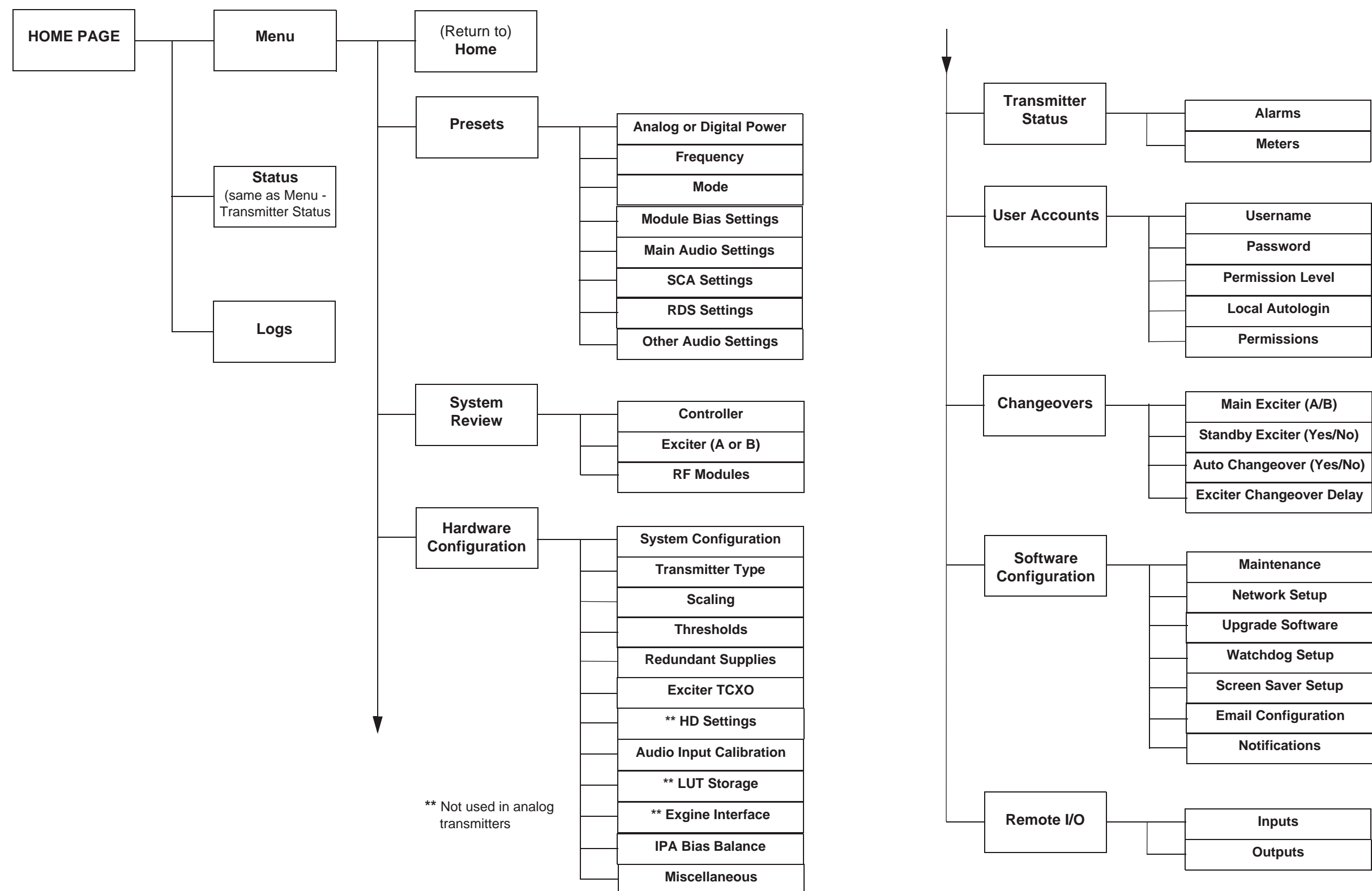


Figure 2-2: NV Transmitter AUI Flow Diagram

ACCESSING THE AUI

The transmitter's AUI provides a means to restrict local and remote access to transmitter control functions to authorized users only. For local users, there are user accounts that can be pre-defined to set access restriction from read-only (no control) and full-administrative control.

To access the AUI using a web browser, you must configure your network settings (see [“Network setup” on page 2-41](#)), open ports 3501, 843 and 80 on your router or firewall software, and then log in to the AUI application via the login menu (see [Figure 2.3](#)). The login will remain active until the browser is closed. Once you have opened the appropriate ports and configured network settings, you can gain remote access to the transmitter by entering the IP Address specified in the **Network Setup** page into the address field of a web browser.

Figure 2.3: AUI Login Menu



The transmitter's front panel touch screen allows viewing of the AUI pages, regardless of the login status, but you must log in and have the proper permission level to access functions that can alter transmitter control settings. If properly configured (using the **Local Autologin** feature of the **User Accounts**), the login menu will appear on the touch screen when you first turn on or after any attempt to perform a change to a transmitter setting (e.g., power trim, mode change, etc.).

You can access the login menu by pressing the **Change User** button at the bottom, right-hand corner of the AUI (see [Figure 2.4 on page 2-7](#)).

A keyboard menu appears on the display when you touch the **User** or **Password** field. Enter your **User** name and **Password**, then press **Submit**. If you do not have a user account, it must be set up by an existing user with proper permissions (see [“Setting user accounts” on page 2-37](#)).

AUI PAGES

Table 2.1 defines the available AUI pages.

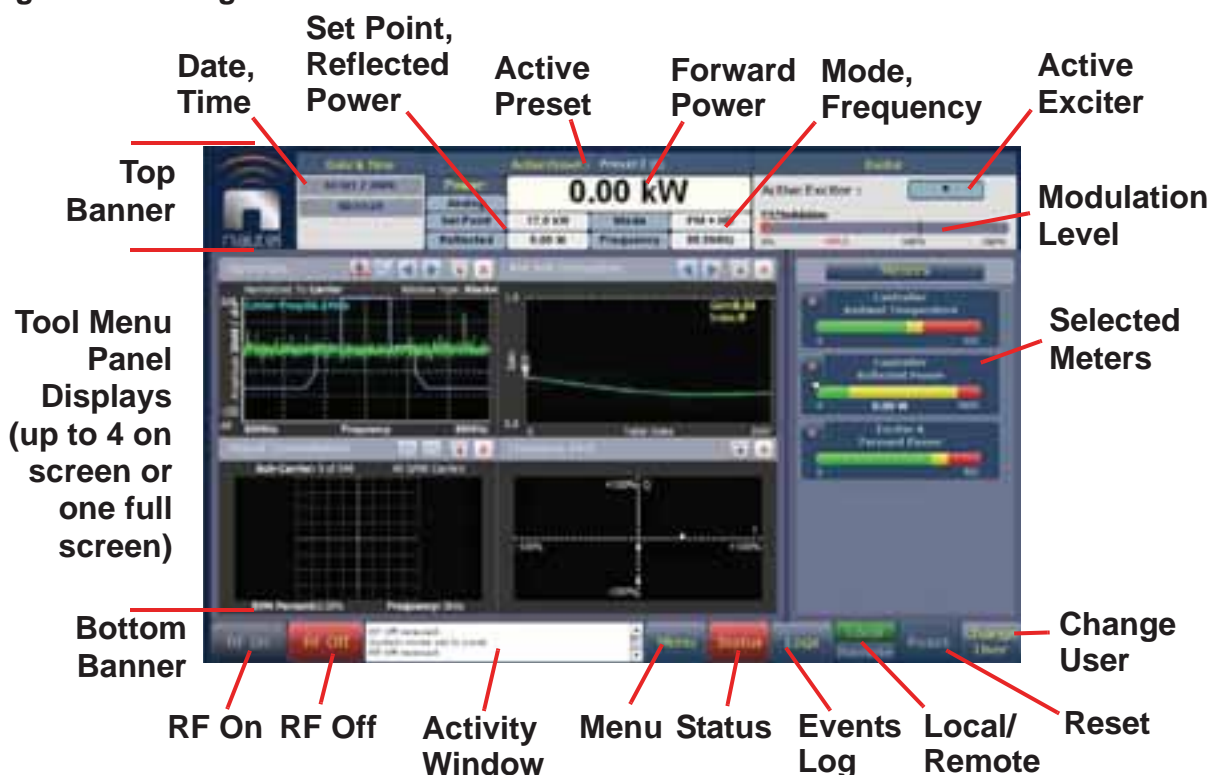
Table 2.1: AUI Pages

| AUI Page | Function | See Page |
|------------------------|---|---------------------------|
| Home | View meters, tool menu panels, choose options and navigate to other pages. | page 2-9 |
| Menu | Choose options and navigate to other pages. | page 2-10 |
| Transmitter Log | View transmitter event history. | page 2-12 |
| Tool Menu | Choose tool menu panel options. | page 2-14 |
| System Review | Choose meters for display. | page 2-26 |
| Set Time & Date | Set precise time and date. | page 2-28 |
| Presets | Activate and edit user-defined presets. | page 2-29 |
| Transmitter Status | View transmitter's current active faults and operational status. | page 2-36 |
| User Accounts | Set user permission rights and define user account information. | page 2-37 |
| Changeovers | Set main exciter and auto exciter changeover function. | page 2-39 |
| Software Configuration | Calibrate and refresh the AUI screen, restart the server, set network information, perform software upgrades and configure email and alarm notification parameters. | page 2-40 |
| Hardware Configuration | Define system configuration, transmitter type, set/calibrate transmitter parameters and thresholds, set IBOC parameters, store LUT data to active exciter, configure Engine interface information and perform an IPA balance (to optimize reject load power). | page 2-48 |
| Remote I/O | Define remote digital inputs and outputs. | page 2-60 |

AUI LAYOUT

Each AUI page provides information about a specific transmitter function. All navigation through the AUI pages begins on the main screen shown in [Figure 2.4](#).

Figure 2.4: Using the AUI



The top banner is permanent on all AUI pages and includes:

- **Logo:** From any AUI page, press the displayed logo to return to the Home page.
- **Date & Time:** Displays the date (including day of the week, month, day and year) and current time. Press on the date or time to shortcut to the Set Time and Date window (see [Setting the time and date on page 2-28](#)).
- **Active Preset:** Displays the name of the active preset, current forward power (and power set point based on the active preset) and reflected power levels as well as the operating mode (FM, FM+HD, HD, etc.) and carrier frequency. Press on the forward power meter field to shortcut to the Presets page (see [Operating presets on page 2-29](#)).
- **Exciter:** Displays the active exciter and the peak (red) FM modulation value. Press in the Active Exciter field to shortcut to the Changeovers page (see [Changing exciter transfer settings on page 2-39](#)).

The bottom banner is also permanent on all AUI pages and includes:

- **RF On:** Press to enable the transmitter's RF power stage. When the button is highlighted green, RF is enabled (on). When the button is highlighted amber, a fault condition exists that is preventing the RF power stage from turning on.
- **RF Off:** Press to disable the transmitter's RF power stage.
- **Activity Window:** Displays various messages to reflect specific user interface commands, such as RF on/off, local/remote control, or reset.
- **Menu:** Press to open the **Menu** page, which allows navigation to various other pages (see [Menu page on page 2-10](#)).
- **Status:** Press to open the **Transmitter Status** page (see [Viewing transmitter status on page 2-36](#)), which provides current alarm and status details for the transmitter. When the **Status** button is red, one or more alarms of severity level 10 is currently being reported and the transmitter is in an 'off-air' state. When the **Status** button is orange, one or more alarms of severity level 5 (but none of severity level 10) is currently being reported, but the transmitter is still 'on-air', possibly at reduced power. When the **Status** button is green, the transmitter is operating normally. In this case there are no alarms are being reported or there is one or more alarms of severity level 1 (but none of severity level 5 or 10). This page is also available through the **Menu** page.
- **Logs:** Press to shortcut to the **Transmitter Log** page, which displays historical alarm and status records for the transmitter (see [Viewing transmitter log on page 2-12](#)).
- **Local/Remote:** Displays the operational control status of the transmitter. From the touch screen, press the desired button. If **Local** is highlighted, remote users cannot change the setting. If **Remote** is highlighted, local users can still change the transmitter status.
- **Reset:** Press to reset protection circuits and restore any RF power modules (and associated power supplies) that were inhibited, but are now alarm-free.
- **Change User:** Press to display a login menu. A keyboard menu appears on the display when you press the Username or Password field. Enter your Username and Password, then press **Done**. If you do not have a user account, see ["Setting user accounts" on page 2-37](#).

The displays between the top and bottom menus, contains user selected pages. These pages provide access to a variety of AUI functions such as transmitter status and hardware settings. The following paragraphs describes how to use these pages.

NAVIGATING FROM PAGE TO PAGE

You can easily navigate through the AUI from its home page (see [Figure 2.5](#)) or Menu page (see [Figure 2.6 on page 2-10](#)). It is possible to navigate to the same pages from either the home page or the Menu page.

Figure 2.5: Home Page



Press the Menu button to view the various sub-menu options (see [Figure 2.6 on page 2-10](#)).

MENU PAGE

From the home page, press the Menu button to view the Menu page (see [Figure 2.6](#)). From this page, you can select one of the following sub-menus:

Figure 2.6: Menu Page



Select Home to return to the home page (see [Figure 2.5 on page 2-9](#)).

Select Presets to load, edit, or save presets (see [“Operating presets” on page 2-29](#)).

Select System Review to view the metering status of various parameters relating to the transmitter (controller), exciters or individual RF power modules (see [“Viewing real-time meters” on page 2-26](#)).

Select Hardware Configuration to access pages that allow system configuration, setting/calibrating transmitter parameters and thresholds, setting IBOC parameters and storing LUT data to the active exciter (see [“Changing hardware settings” on page 2-48](#)).

Select Transmitter Status to access a page that displays the transmitter's operational status (see [“Viewing transmitter status” on page 2-36](#)).

Select **User Accounts** to access a page that displays a list of users with access to the AUI and, depending on permission level, allows editing of user accounts (see [“Setting user accounts” on page 2-37](#)).

Select **Exciter Changeover** to access a page that allows setting of the main (active) exciter and setup of automatic exciter changeover (see [“Changing exciter transfer settings” on page 2-39](#)).

Select **Software Configuration** to access a page that provides help with performing touch screen maintenance, network configuration, software upgrades, email configuration and alarm notifications (see [“Software configuration” on page 2-40](#)).

Select **Remote I/O** to access a page that allows assignation of remote digital inputs and digital outputs (see [“Configuring remote inputs and outputs” on page 2-60](#)).

VIEWING TRANSMITTER LOG

You can view the NV5/NV3.5's events log using the [Log page](#) - see [Figure 2.7](#). This page shows a log of all transmitter events. To view this page, press Logs from the bottom banner of any AUI screen.

Figure 2.7: Log page



This page has the following selection options:

- **Device Type:** Press the drop-down arrow and select the desired device type to filter events based on the type selected:
 - All - displays all transmitter events
 - Controller - displays controller events only
 - Exciters - displays exciter events only
 - RF Modules - displays RF power module events only
- **Get Logs:** Press to get or update the entire logs list.
- **Copy Logs** (button appears for remote AUI access only): Press to create a copy of all the logs in the selected list (copied to the remote user's computer clipboard). You can paste the tab-delimited text copy of the logs into a text editing program (e.g., Word, Excel, Notepad).

- **Clear Logs:** Press to clear all logged events.
- **Legend:** Press to display a window (see below) that describes the meaning of all the symbols that can appear in the Alarm State and Severity columns. Press **Ok** to clear this window.



- **Logs list:** For viewing purposes only. Columns indicate detailed information about the alarm:
 - **Device** indicates the origin device of the alarm [Controller (transmitter), Exciter or RF Module].
 - **Alarm** indicates the alarm name.
 - **Alarm State** indicates whether the alarm is active (red bell) or cleared (green checkmark) and in some cases, indicates whether the RF was turned on (green antenna) or off (red antenna).
 - **Severity** indicates how the alarm affects transmitter operation [a single orange ! indicates low severity (level 1, RF output not affected); a single red ! indicates medium severity (level 5, RF output is reduced); three red ! indicates high severity (level 10, RF output is inhibited)].
 - **Time of Event** indicates the time and date that the event occurred.

VIEWING TOOL MENU PANELS

The NV5/NV3.5 provides nine tool menu panel parameters that you can choose to display on the home page. Up to four tool menu panels can be displayed at one time, including a spectrum analyzer. To view all the tool menu panel options (see [Figure 2.8](#)), close one of the existing tool menu panels by pressing X in the top, right corner of the tool menu panel, and then press or click anywhere in the blank space.

Press or click on the desired tool menu panel to display it. See [Table 2.2 on page 2-15](#) for a description of each tool menu panel.

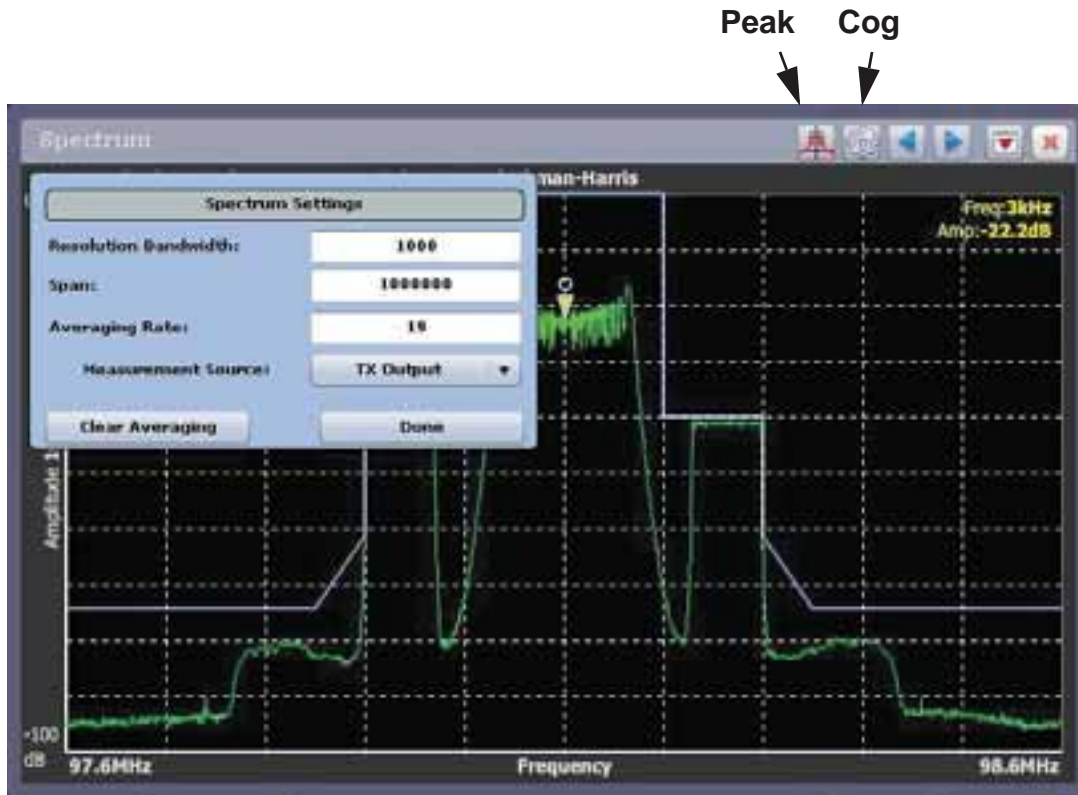
Figure 2.8: Tool Menu Panel Options



Table 2.2: Tool Menu Panels

| Tool | Description | Reference |
|-----------------------|---|-------------------------------|
| Spectrum | Displays a spectrum analyzer, capable of monitoring the transmitter's RF output spectrum and various RF sections of the exciter. An audio spectrum analyzer is also available to allow viewing of the composite baseband. | See page 2-16 |
| EQ Frequency Response | Displays the frequency response of the modulator's EQ filter. | See page 2-18 |
| EQ Impulse Response | Displays the impulse response of the modulator's EQ filter. | See page 2-19 |
| EQ Filter Delay | Displays the delay of the modulator's EQ filter across its bandwidth. | See page 2-20 |
| AM-AM Correction | Displays the amplitude compensation being applied to the magnitude signal. | See page 2-21 |
| AM-PM Correction | Displays the phase compensation being applied to the phase signal. | See page 2-22 |
| Signal Constellation | Displays the phase and amplitude of the symbols being modulated within an OFDM sub-carrier as dots on a cartesian graph. Also displays timing and data carrier information. | See page 2-23 |
| Lissajous Plot | Displays a Lissajous figure that represents the resultant vector (magnitude and phase) for the applicable channels (either L and R or I and Q). | See page 2-24 |
| Power Distribution | Displays a CCDF plot that indicates the probability of exceeding a given power level, based on the average power level. Aids in determining peak power capability. | See page 2-25 |

Figure 2.9: Spectrum Analyzer



SPECTRUM ANALYZER. See Figure 2.9. The carrier level is normalized to its unmodulated carrier level at 0 dB. The graph center is always at the carrier frequency, as defined by the active preset's Frequency value.



Note:

Any spurious emissions that are displayed are a product of the spectrum analyzer and are not actually present on the transmitter output.

Touch on the panel to display a cursor in the approximate area. The cursor position (frequency and amplitude) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons to make fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

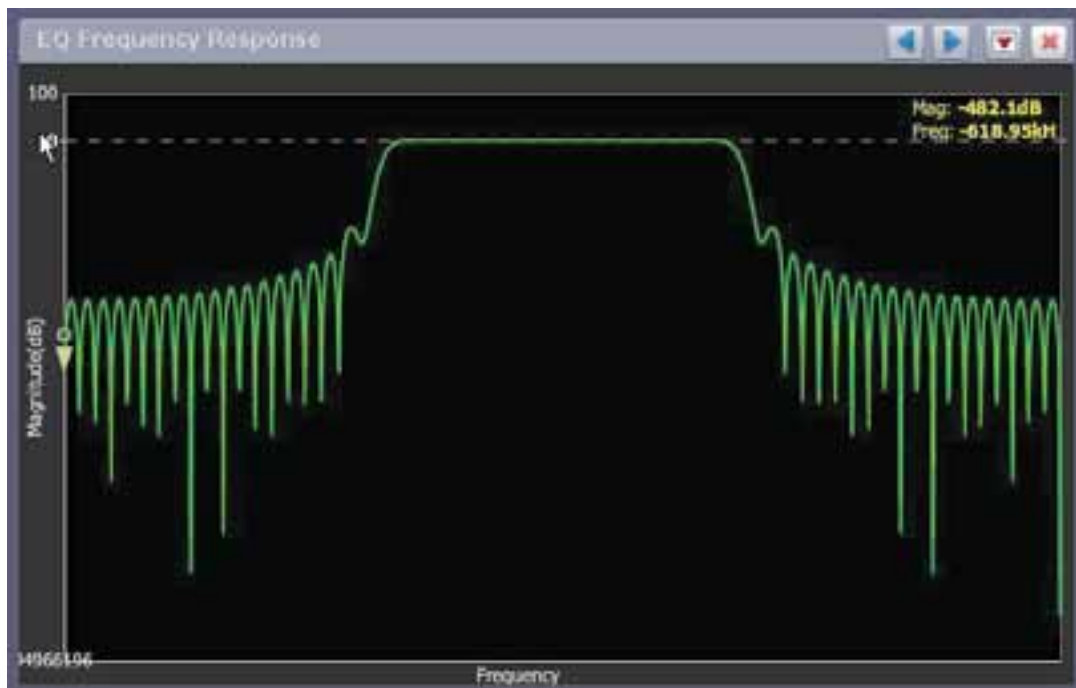
Use the “peak” button to place the cursor on the next successive peak (moving left to right) in the spectrum.

Use the “cog” button to gain access to spectrum settings (see [Figure 2.9 on page 2-16](#)) such as:

- **Resolution Bandwidth:** determines the FFT bin size or the smallest frequency that can be resolved. Default is 1000 Hz.
- **Span:** determines the start and stop frequencies of the analyzer with the carrier frequency always at the center. Default is 1 MHz. Maximum is 1.2 MHz.
- **Averaging Rate:** determines the number of averages that the analyzer performs per sweep. Press the **Clear Averaging** button to reset this value to 0.
- **Measurement Source:** determines the source of the spectrum plot (transmitter output, audio analyzer, etc.) that is being displayed. Selecting **TX Output** uses the exciter's RF sample feedback signal to display the RF output spectrum. Selecting **Audio Analyzer** displays the composite baseband signal.

EQUALIZER SCREENS. The NV5/NV3.5's exciter includes a fixed equalizer to optimize audio performance. There are three menus available in the tool menu panels - EQ Frequency (see [Figure 2.10](#)), EQ Impulse Response (see [Figure 2.11 on page 2-19](#)) and EQ Filter Delay (see [Figure 2.12 on page 2-20](#)). Coefficients are selected based on your channel frequency. All frequencies shown are relative to the channel frequency.

Figure 2.10: EQ Frequency Response



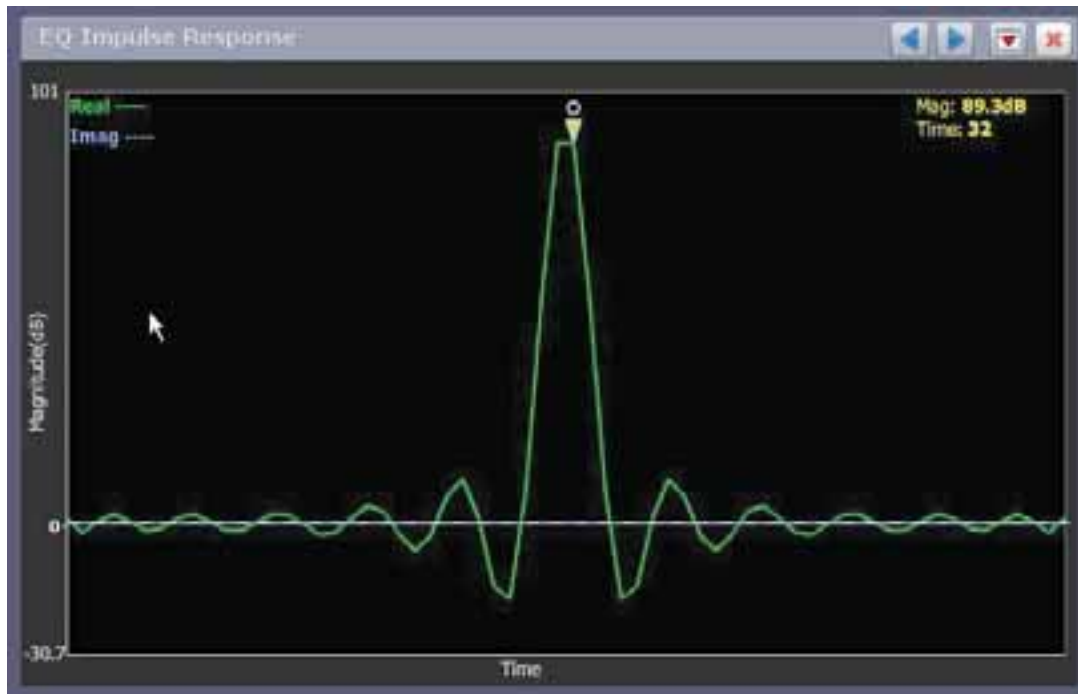
EQ FREQUENCY RESPONSE

See [Figure 2.10](#). This panel displays the frequency response of the modulator's EQ filter.

Touch on the panel to display a cursor in the approximate area. The cursor position (magnitude and amplitude) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

Figure 2.11: EQ Impulse Response

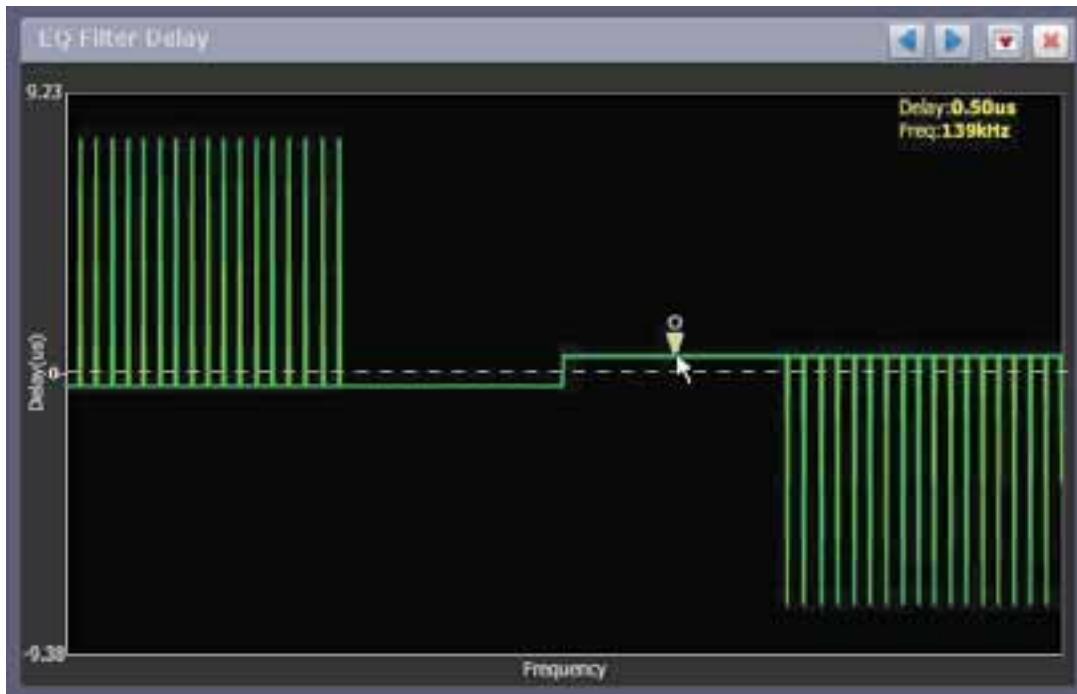
EQ IMPULSE RESPONSE

See [Figure 2.11](#). This panel displays the impulse response of the modulator's EQ filter.

Touch on the panel to display a cursor in the approximate area. The cursor position (magnitude and time) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

Figure 2.12: EQ Filter Delay

EQ FILTER DELAY. See [Figure 2.12](#). This panel displays the delay of the modulator's EQ filter across its bandwidth.

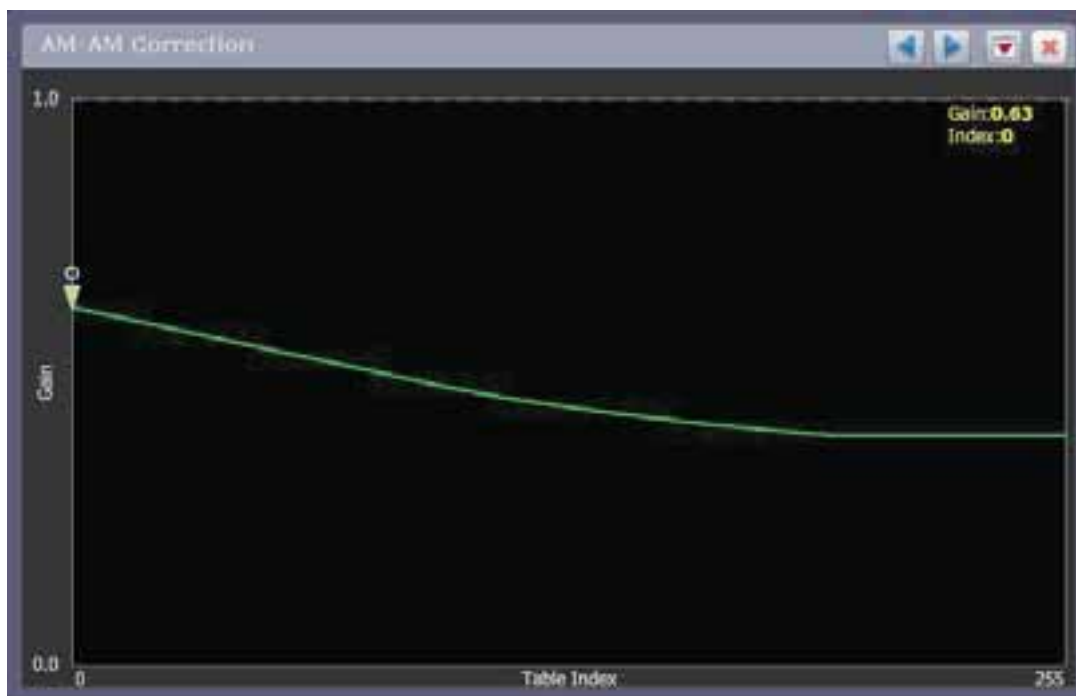
Touch on the panel to display a cursor in the approximate area. The cursor position (delay and frequency) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

AM-AM AND AM-PM CORRECTION SCREENS. When the transmitter is operating with digital carriers, the exciter linearizes the transmitter's RF drive signal by performing adaptive pre-correction. There are two correction parameters - AM-AM Correction (see [Figure 2.13](#)) and AM-PM Correction (see [Figure 2.14 on page 2-22](#)), which can be viewed as tool menu panels.

Figure 2.13: AM-AM Correction

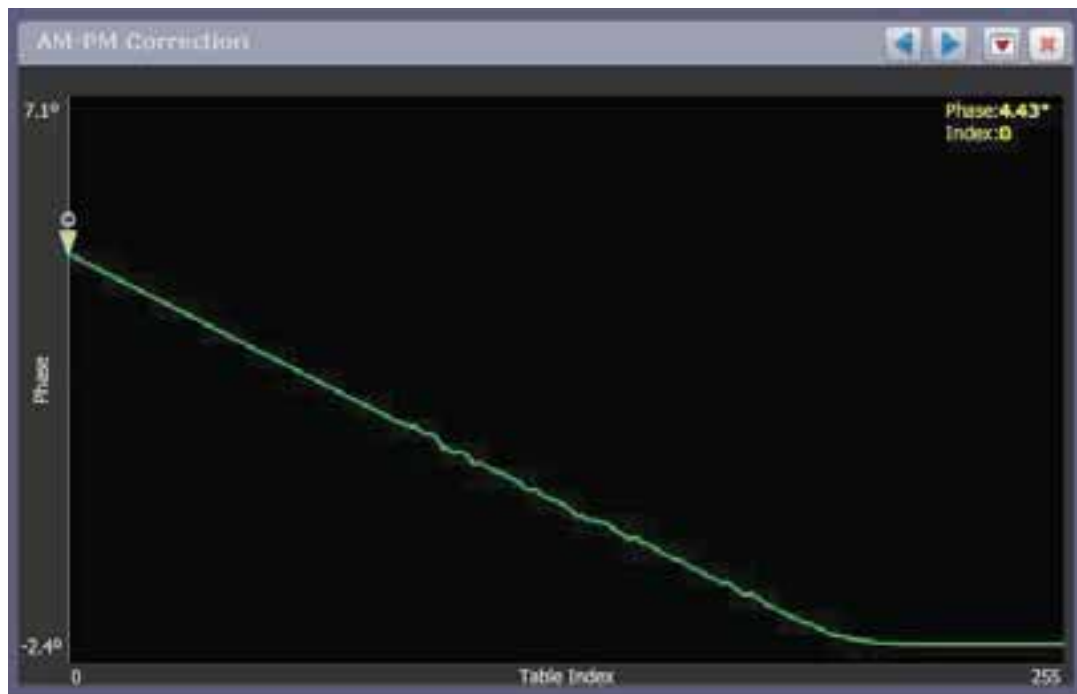


AM-AM CORRECTION. This panel displays the amplitude correction being applied to the magnitude signal. The x-axis represents the signal amplitude and the y-axis represents the gain correction applied for a given amplitude value.

Touch on the panel to display a cursor in the approximate area. The cursor position (gain and LUT index) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

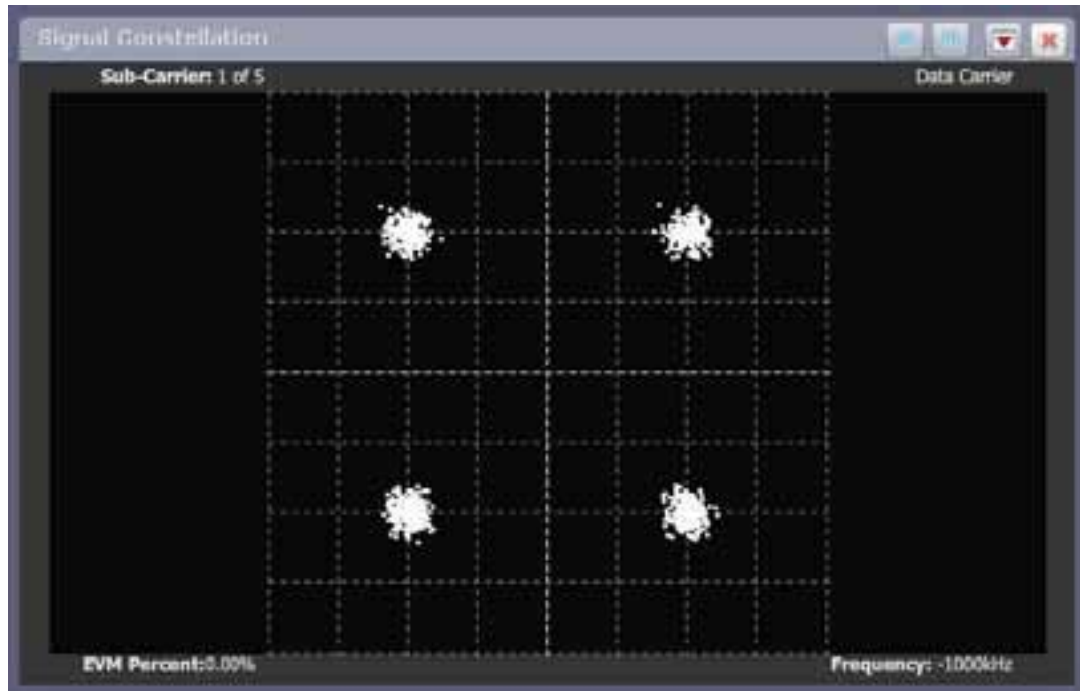
Figure 2.14: AM-PM Correction

AM-PM CORRECTION. This panel displays the phase correction being applied to the RF drive signal. The x-axis represents the signal amplitude and the y-axis represents the phase shift correction applied for a given amplitude value.

Touch on the panel to display a cursor in the approximate area. The cursor position (phase and LUT index) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

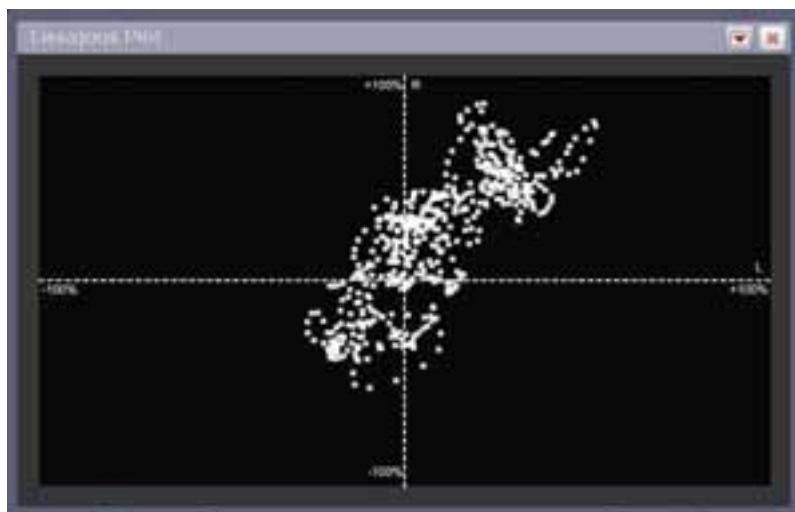
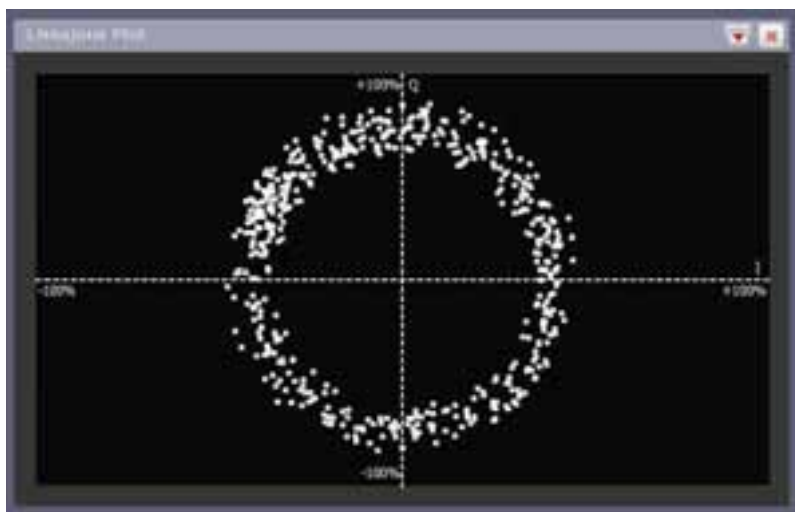
Figure 2.15: Signal Constellation

SIGNAL CONSTELLATION. See [Figure 2.15](#). The exciter constantly measures the transmitter signal and performs basic demodulation of the digital carriers. The **Signal Constellation** panel displays the phase and amplitude of the symbols being modulated within an OFDM sub-carrier as dots on a cartesian graph. There are separate screens for each sub-carrier. Typically, the dots will be grouped together around the ideal data points. When the transmitter is on, the signal constellation display is representative of the transmitter output. When the transmitter is off, the display is representative of the forward path that will be transmitted.

The EVM Percent value in the lower, left corner represents the 'error vector magnitude'. This value (percentage) indicates the error percentage on the carrier vector (e.g., if the carrier vector is synchronized, the EVM percentage should be less than 15%; if out of synchronization, the EVM percentage may exceed 60%).

Use the + and - buttons to select a higher or lower sub-carrier for viewing. Some sub-carriers are for timing and synchronization. Others are modulated with data/content.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

Figure 2.16: Lissajous Plot (I and Q mode)**L and R mode****I and Q mode**

LISSAJOUS PLOT. See [Figure 2.16](#). This panel displays a Lissajous figure that represents either L (left) and R (right) audio content or a representation of the FM modulated signal [I (in-phase) and Q (quadrature)]. I and Q will be automatically selected unless you are operating in stereo mode or not operating HD. Left and right audio content is displayed for all other audio sources.

The plot consists of a group of sequential samples to allow signal analysis. In L and R mode, the L+R portion of the signal tends to dominate the plot, resulting in the majority of samples appearing in the lower, left and upper, right quadrants. In I and Q mode, signals that are of equal frequency and 90 degrees out-of-phase result in a circular display.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

Figure 2.17: Power Distribution Graph

POWER DISTRIBUTION GRAPH. See [Figure 2.17](#). The exciter measures the relative power levels of the signal and determines the probability of exceeding a given power level, relative to the average power. The data is plotted in the Power Distribution Graph as a CCDF (complementary cumulative distribution function). The x-axis displays the relative power level in dB, with the reference representing the average power. The y-axis displays the probability of exceeding that power level. This graph can be used to assess the distribution of a given signal, and provides an indication of the amount of peak power capability required.

Touch on the panel to display a cursor in the approximate area. The cursor position (power gain and probability index) is noted in the upper, right-hand corner of the panel. Touch in other areas of the tool menu panel to provide a coarse adjustment of the cursor position.

Use the left and right buttons as fine adjustments.

Use the up or down button to maximize (if it was minimized) or minimize (if it was maximized) the panel size.

VIEWING REAL-TIME METERS

The NV5/NV3.5 can display many metered parameters on the right hand side of the home page. To view all the meter options, press the **Meters** button on the right-hand side of the AUI. This opens the System Review page (see [Figure 2.18](#)).

Figure 2.18: System Review page (Meter Options)



Press the appropriate transmitter sub-system from the Transmitter Layout list to view the Relevant Meters for that sub-system. The Transmitter Layout list contains Controller, Exciter (A or B) and RF Modules sub-systems. Additionally, the RF Modules folder includes a list of RF Module 1 through Module 2 sub-systems, representing all the RF power modules in the transmitter. Each module can be selected to show its meters.

Press on the check-box next to the desired parameter in the Relevant Meters list to select it for display in the Meters section of the AUI page. If necessary, use the scroll bar on the right side of the page to find the desired meter.

Each meter is a colour-coded bar with minimum and maximum values. The meter's current value is indicated by an arrow on the colour-coded bar, as well as a displayed value below the meter. A parameter value in the green section of a meter bar indicates the parameter is within the range for normal operation. A parameter value in the yellow section (as applicable) of a meter bar indicates the parameter is still within an operational range, but is approaching design limitations. A parameter value in the red section of a meter bar indicates the parameter is outside normal operating conditions.

To delete a meter from the home page, press the X in the left side of the meter's box in the Meters section or de-select the check-box in the System Review page.

To view detailed info on a specific transmitter sub-system (e.g., Controller), select the desired sub-system and then press on the **i** (information) button to the right of the sub-system name (see Figure 2.19).

Figure 2.19: Detailed Sub-System Information (Controller shown)



SETTING THE TIME AND DATE

The NV5/NV3.5's internal clock has a backup battery, and maintains accurate time and date even during power outages. However, you need to reset the time and date when the transmitter is first installed, or if the backup battery has failed.

You can set the NV5/NV3.5's time and date from the [Set Time and Date page](#) - see [Figure 2.20](#). To view the [Set Time and Date page](#), press on the time or date in the upper, left corner of any AUI page.

Figure 2.20: Set Time and Date page



The [Set Time and Date page](#) contains editable fields for the date (month, day and year) and time (hours, minutes, seconds and tenths of seconds). The clock operates in 24-hour format.

Use the up and down buttons to increase or decrease the desired value in the specific field. Press OK to accept changes or Cancel to undo changes.

OPERATING PRESETS

Presets contain operational data (power level, frequency, mode, program input characteristics) for the transmitter. You can create and control preset settings as follows:

The Presets page (see [Figure 2.21](#)) lets you create up to 63 new operating presets or edit existing presets. To view the Presets page, select Presets from the Menu options.

Figure 2.21: Presets page



LOADING PRESETS. When you first enter the Presets page, the current “active” preset is displayed. If the current preset is not the preset you want to work with, use the Load button on the left side of the AUI to call up a window containing a list of available presets.

Select the desired preset and press the Load button to view or enable editing of the preset. Press the Delete button to delete the selected preset. You cannot delete the current “active” (operational) preset. Press Cancel to return to the Presets page.

ACTIVATING PRESETS. Press the Save & Activate button to enable the preset as the transmitter’s active preset. This will also save any fields that have been updated in the current preset.

RELOADING PRESETS. Press the Reload button to revert the preset values to their original values, assuming Activate or Save has not been pressed. For example, if you updated several fields, but had not yet pressed Activate or Save (see the save options below), then pressing Reload will revert all fields to their original values.

EDITING AND SAVING PRESETS. To change the settings for a selected preset, change the value in the desired field(s) by entering new values or selecting from the drop-down menus, as appropriate. When you edit a field, an asterisk appears at the beginning of the preset name (e.g., *Presets: Preset 1). When changes are complete, press the Save button and then press the Save Preset window's Save or Save New button. Pressing Save will overwrite the existing preset. Pressing Save New will save a new preset and name. Press Cancel to abort the save. Parameters that can be edited are:



Note:

If you change an FM+HD or HD preset, particularly its power level or frequency, it is possible to optimize the transmitter's performance by adjusting the HD PA Volts value in the Mode section of the Presets screen. See "Improving transmitter performance for IBOC presets" on page 4-12 of this manual.

- For Analog Power (FM or FM+HD mode), enter the transmitter's "analog TPO" value and power unit (W or kW); for Digital Power (HD mode), enter the digital or total RMS power value and power unit (W or kW). Maximum power settings for each mode (including the IBOC injection level for IBOC modes) and carrier frequency (as applicable) are shown in [Table 2.3](#).

Table 2.3: Maximum power level settings**

| Mode and IBOC Injection Level (as applicable for IBOC modes) | Maximum Power Set Point Limit (W) (linearly interpolate between frequencies) | | |
|---|---|------------------------|------------------------|
| | 88.0 MHz | 93.0 MHz | 98.0 MHz to 108.0 MHz |
| FM+HD, -20 dB | 4.9 (NV5), 3.3 (NV3.5) | 5.2 (NV5), 3.3 (NV3.5) | 5.5 (NV5), 4.1 (NV3.5) |
| FM+HD, -19 dB | 4.8 (NV5), 3.2 (NV3.5) | 5.1 (NV5), 3.3 (NV3.5) | 5.4 (NV5), 4.0 (NV3.5) |
| FM+HD, -18 dB | 4.6 (NV5), 3.0 (NV3.5) | 5.0 (NV5), 3.3 (NV3.5) | 5.2 (NV5), 3.9 (NV3.5) |
| FM+HD, -17 dB | 4.4 (NV5), 2.9 (NV3.5) | 4.9 (NV5), 3.3 (NV3.5) | 5.1 (NV5), 3.8 (NV3.5) |
| FM+HD, -16 dB | 4.2 (NV5), 2.7 (NV3.5) | 4.8 (NV5), 3.3 (NV3.5) | 5.0 (NV5), 3.8 (NV3.5) |
| FM+HD, -15 dB | 4.0 (NV5), 2.6 (NV3.5) | 4.6 (NV5), 3.3 (NV3.5) | 4.9 (NV5), 3.7 (NV3.5) |
| FM+HD, -14 dB | 3.8 (NV5), 2.5 (NV3.5) | 4.4 (NV5), 3.3 (NV3.5) | 4.8 (NV5), 3.6 (NV3.5) |
| FM+HD, -13 dB | 3.5 (NV5), 2.3 (NV3.5) | 4.1 (NV5), 3.1 (NV3.5) | 4.4 (NV5), 3.3 (NV3.5) |

Table 2.3: Maximum power level settings**

| Mode and IBOC Injection Level (as applicable for IBOC modes) | Maximum Power Set Point Limit (W) (linearly interpolate between frequencies) | | |
|---|---|------------------------|------------------------|
| | 88.0 MHz | 93.0 MHz | 98.0 MHz to 108.0 MHz |
| FM+HD, -12 dB | 3.2 (NV5), 2.2 (NV3.5) | 3.8 (NV5), 2.8 (NV3.5) | 4.0 (NV5), 3.0 (NV3.5) |
| FM+HD, -11 dB | 2.8 (NV5), 2.0 (NV3.5) | 3.4 (NV5), 2.5 (NV3.5) | 3.7 (NV5), 2.6 (NV3.5) |
| FM+HD, -10 dB | 2.5 (NV5), 1.9 (NV3.5) | 3.1 (NV5), 2.3 (NV3.5) | 3.4 (NV5), 2.3 (NV3.5) |
| FM | 5.5 (NV5), 4.1 (NV3.5) (all frequencies) | | |
| HD | 3.0 (NV5), 2.2 (NV3.5) (all frequencies, all injection levels) | | |

** Maximum power set point limits can vary from the indicated value for various reasons. Nautel does not guarantee performance at the indicated values.

- Frequency: enter value. Valid frequencies are between 87.00 and 108.00 MHz.
- Mode: select FM (analog) HD (all-digital) or FM+HD (hybrid)
 - IBOC Injection: for FM+HD and HD modes, enter value, in dB, between -20 and -10 dB. This value determines the relationship between the digital carriers power and the analog carrier power. Example: -20 dB indicates that the total RMS power of the digital carriers will be 1/100 of the total RMS power of the analog carrier. -10 dB indicates that the total RMS power of the digital carriers will be 1/10 of the total RMS power of the analog carrier. As this value changes, the spectrum analyzer instrument panel's mask also changes, as required.
 - LUT Index: For FM+HD and HD modes only, select 1 through 12 or Flat (Flat is default). Based on the selection, the LUT (if stored) in the LUT storage menu (in the exciter) will be used. Each exciter stores its own LUT. Selecting Flat sets the LUT gain (AM-AM Correction) to flat over the full Table Index (0-255). The LUT storage menu contains LUT names that correlate to mode/power level/frequency/injection level.
 - HD PA Volts: for FM+HD and HD modes, enter value, in volts, between 25.0 V and 53.0 V. This value sets the drain voltage applied to the PAs in the RF power modules, from their associated power supplies, for hybrid (FM+HD) and all-digital (HD) modes. This value affects IBOC performance. Larger values result in an improved spectrum, but decreased efficiency. Conversely, smaller values result in improved efficiency, but degrade the spectrum. Typical values are between 35 V and 50 V, and depend on many variables such as power level, frequency and injection level.
 - HD IPA Volts: for FM+HD hybrid mode only, enter value, in volts, between 25.0 V and 53.0 V. This value sets the drain voltage applied to the IPA in the RF power modules, from their associated power supplies, for hybrid (FM+HD) and all-digital (HD) modes. This value affects IBOC performance. Larger values result in an improved spectrum, but decreased efficiency. Conversely, smaller values result in improved efficiency, but degrade the spectrum. The default value is 50 V and typically does not change.

- Exciter Power: for FM mode only, enter value, in watts. Valid limits are determined by the RF drive high and low thresholds. Typical/factory set value is 11 W.
- IPA Output Power: enter value, in watts. Valid limits are determined by frequency and the IPA output power high and low thresholds. Typical/factory set value is 100 W (between 87 and 94.3 MHz), 110 W (between 94.4 and 101.3 MHz) or 120 W (between 101.4 and 108 MHz).
- FM IPA ALC: for FM mode only, select Enabled or Disabled. When enabled, the transmitter maintains the analog power setpoint to compensate for fluctuating variables such as VSWR (affecting IPA performance), IPA power (due to increasing/decreasing RF drive), PA voltage (due to ac mains) , etc. When disabled, the transmitter's output will fluctuate as a function of these variables.
- FM PA ALC: for FM mode only, select Enabled or Disabled. When enabled, the transmitter maintains the analog power setpoint to compensate for fluctuating variables such as VSWR (affecting PA performance), IPA power (due to increasing/decreasing RF drive), PA voltage (due to ac mains) , etc. When disabled, the transmitter's output will fluctuate as a function of these variables.
- Module Bias Settings: open folder
 - IPA Bias: sets the IPA module PA bias current; select Off (0 mA, $V_{gs} = 0V$), 1 (25 mA), 2 (50 mA), 3 (100 mA), 4 (250 mA) or 5 (500 mA); automatically determined based on operating mode (see [Table 2.4](#)); V_{gs} values to achieve IPA bias index 1 through 5 are factory determined.
 - PA Bias: sets the RF power module PA bias current; select Off (0 mA, $V_{gs} = 0V$), 1 (25 mA), 2 (50 mA), 3 (100 mA), 4 (250 mA) or 5 (500 mA); automatically determined based on operating mode (see [Table 2.4](#)); V_{gs} values to achieve IPA bias index 1 through 5 are factory determined.
 - Module 1 through 16 IPA Bias: for each applicable module, enter value between 0 and 255; modules set to 255 use the default bias index value (stored within the module); modules set to any other value use that value. "Default" appears in fields that have been entered as 255.

Table 2.4: IPA and PA Bias Values

| Parameter | Mode | | |
|-----------|------|-------|----|
| | FM | FM+HD | HD |
| IPA Bias | 1 | 3** | 5 |
| PA Bias | Off | 1** | 5 |

** - values are as shown regardless of IBOC injection level

- Main Audio Settings: open folder
 - Audio Source: Connects the appropriate exciter input for use. Select Left/Right/Mono (on Analog Audio In D-sub connector A1J5) or Composite (balanced composite on BAL/UNBAL MPX IN BNC A1J6, Primary Digital and Secondary Digital [the source of each depends on the Hardware Configuration/

Miscellaneous screen setting: AES/EBU # 1 on AES/EBU IN XLR connector A1J4 or AES/EBU # 2 on Analog Audio In D-sub connector A1J5.

- Digital Level: applies to Primary Digital or Secondary Digital source only; enter value between -16 and 0 dBFS, with a typical setting of -4 dBFS (100% modulation value).
- Analog Level: applies to Left/Right Mono source only; enter value between -12 and +12 dBu, which represents the input voltage level that yields 100% modulation (typically 4.7 dBu).
- Audio Mode: select Mono L, Mono R or Stereo (applies to any source; selecting Stereo applies a 19 kHz pilot; selecting Mono L or Mono R applies no pilot).
- 15kHz Lowpass Filter: applies to Mono audio modes; select Enabled (applies 15 kHz low-pass filter to audio input) or Disabled.
- Preemphasis: select 0 us, 25 us, 50 us or 75 us.
- Composite Level: applies to Composite source only; enter value between 0 and 4.5 V p-p (typically 3.55 V p-p), which represents the input voltage level that yields 100% modulation.

Note:

Refer to FCC guidelines for allowable modulation depth with SCAs or RDS enabled.

- SCA Settings: open folder
 - Composite SCA: connects the appropriate MPX SCA connector (J7:A for SCA1, J7:B for SCA2) for use with an externally generated SCA; select Enabled or Disabled. When enabled, all the selections listed below are active.
 - Composite SCA Input Level: signal level that represents 10% modulation. Enter a value between 1 and 5 V p-p (typically 2.83 V p-p).
 - SCA Reduction: attenuation applied to the SCA input; enter value between 0 and 20 % (typically 0%).
 - Internal SCA1 or SCA2 Enable: Enable or disable the appropriate internal SCA (SCA1 or SCA2). When enabled, the settings listed below are active for the associated SCA signal (1 or 2).
 - SCA1 or SCA2 Injection Level: enter value between 0 and 20% (typically 10%); this level is added to the composite baseband.
 - SCA1 or SCA2 Frequency: enter value between 20 and 100 kHz (typically set to 67 kHz or 92 kHz).
 - SCA1 or SCA 2 Input Level: enter value between -12 and +12 dBu, which represents the input voltage level that yields 10% modulation (typically 4.7 dBu).

- SCA1 or SCA2 7.5kHz Lowpass Filter: select Enabled (applies 7.5 kHz low-pass filter to audio input) or Disabled.
- SCA1 or SCA2 Preemphasis: select 0 us, 50 us, 75 us or 150 us.
- SCA1 or SCA2 Mode: select FM (frequency modulated sub-carrier, typical) or DSB-SC (double side band suppressed carrier).
- RDS Settings: open folder
 - RDS: select Enabled or Disabled. When enabled, all the selections listed below are active.
 - RDS Local Echo: select Enabled or Disabled. When enabled, the exciter RDS port transceiver will echo all inputs and controls received back to the terminal.
 - Data Source: select Ext. UECP, Internal RBDS, Internal RDS or Ext. ASCII.
 - Injection Level: enter percentage.
 - Phase: enter value in degrees.
 - Baud Rate: select 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 or 57600 bps.
 - PI Code (hex): enter value.
 - PS Code: enter value.
 - PTY: for Internal and External RDS Data Sources only; select from various program choices.
 - PTYN: enter value.
 - Music/Speech: select Music or Speech.
 - Traffic Info: select None, TA, TP or TA+TP.
 - Artificial Head Flag: select Enabled or Disabled.
 - Compression Flag: select Enabled or Disabled.
 - Dynamic Flag: select Enabled or Disabled.
 - Stereo Flag: select Enabled or Disabled.
 - Alternate Frequencies: select None or 1 through 6.
 - Alt. Freq. 1 through 6: enter frequency in MHz.

- Other Audio Settings: open folder
 - Pilot Level: enter value between 6 and 12 % (typically 9 %).
 - Pilot 1 PPS Sync: select Enabled or Disabled.
 - Pilot Sync Phase: if Pilot 1 PPS Sync is enabled, enter value between 0 and 360 degrees (typically 0 degrees).
 - Sample Output: Determines which sample signal will be present on exciter's rear panel **PILOT/MPX SAMPLE OUT** BNC connector. Select Pilot (default setting, pilot sample present) or MPX (Composite) (composite baseband signal present).
 - Audio Delay: select Enabled or Disabled, then enter value in ms.
 - Audio Loss Timeout: select Enabled or Disabled, then select Action [None (default), Inhibit or Change Preset, if applicable], then select Audio Loss Preset (from pre-configured presets), then enter Timeout Minutes, Timeout Seconds and Threshold (in percentage). Selecting None causes no action to be taken when audio loss timeout is enabled. Selecting Inhibit causes the transmitter to inhibit RF output during the timeout period. The inhibit condition will be removed and the transmitter RF output will be enabled upon the modulation level exceeding the Audio Loss Timeout Threshold. Selecting Change Preset will cause the transmitter to activate the preset specified as the Audio Loss Preset (typically set to a backup audio input). The transmitter will not automatically re-activate the original preset when its audio is restored. Nautek recommends you set the backup preset's Audio Loss Preset to the original preset to allow restoration of the primary audio source upon the failure of the backup source. When the total modulation is below the the Threshold setting for a period of time that exceeds the Timeout Minutes plus the Timeout Seconds, the audio loss timeout Action will take place, if enabled.
 - Hard Limiter: select Enabled or Disabled, then enter the Hard Limit threshold percentage. If enabled, the modulation level will be limited (audio signal clipped or distorted) if it exceeds the Hard Limit threshold.
 - AGC Limiter: select Enabled or Disabled, then enter AGC Limit percentage and Time Constant in us. If enabled, when the modulation level exceeds the AGC Limit, the gain of the audio input will instantly decrease in order to reduce the modulation level below the AGC limit threshold. Recovery from this audio gain reduction is dependent on the Time Constant delay (fast attack, slow recovery). The input signal is briefly distorted by the audio gain reduction when the threshold is exceeded.
 - Two Slope Limiter: select Enabled or Disabled, then enter Threshold and Gain in percentage. If enabled, when the modulation level exceeds the Threshold, the gain of the audio input will instantly change according to the Gain percentage setting (percentage of the initial gain, that which is below the threshold). The input signal is distorted by the audio gain change. When the modulation levels drops below the threshold, the original gain is used.

VIEWING TRANSMITTER STATUS

You can view the NV5/NV3.5's operational status using the [Transmitter Status page](#) - see [Figure 2.22](#). This page shows current active alarms and status to aid in fault diagnosis. To view the [Transmitter Status page](#), select Transmitter Status from the Menu options.

Figure 2.22: Transmitter Status page



The left-hand section of the **Transmitter Status** displays tabs that list all transmitter alarms. Alarms are listed by their host device (e.g., Controller, Exciter A, etc.), alarm name and severity level [1 = low (RF output not affected), 5 = medium (RF output is reduced), 10 = high (RF output is inhibited)].

Touch an item in the **Alarms** list to display its details on the right-hand section. Details include a description of the alarm and help text, which may include troubleshooting tips.

Press the **Reset** button at the bottom of any AUI screen to attempt to clear any latching alarms that are holding the transmitter in an "off-air" state. If the offending alarm has cleared, the transmitter should resume operation.

SETTING USER ACCOUNTS

Depending on user permission rights, you can set up accounts to allow certain users to access and control features of the AUI using the [User Accounts page](#) - see [Figure 2.23](#). To view the User Accounts page, select User Accounts from the Menu options.



Note:

Depending on the permission level assigned to a given user, some features shown in [Figure 2.23](#) may not be displayed or available.

Figure 2.23: User Accounts page



SETTING USER PERMISSION LEVEL

There are three levels of permission that can be assigned to users, each with their own specific function. All users have permission to change their own username and password, but are otherwise limited to the following functions:

- Read Only: Can monitor equipment data only. No administrative or control functions.

- **Read/Write:** Can monitor and control equipment. No administrative functions.
- **Super User:** Can perform all functions. Super User is the only permission level that allows addition, removal or modification of users.

EDITING ACCOUNT INFORMATION

If you have Super User permission level, you can edit any user account.

EDITING AN EXISTING ACCOUNT. To edit an existing user account, press on the desired user in the List of Users on the left side of the AUI. The Settings for that user will be displayed on the right-hand side of the AUI. You can edit the Username, Password, Permission Level (see [Setting user permission level](#)), Local Autologin status and Permissions.

CHANGING THE PASSWORD. To change your password, press the **Change Password** button. A menu appears that prompts you to enter the old password, new password and confirmation of the new password. Press **OK** or **Cancel** to exit this menu.

SETTING LOCAL AUTOLOGIN STATUS. When set to **Yes** the selected user account will be automatically logged in on the local transmitter with all the rights and privileges assigned to that user. There may only be one autologin user at any given time; when it is set to **Yes** on one user it is automatically cleared on all other users. When set to **No**, the transmitter will not login automatically and will instead prompt for username and password when it boots up.

CHANGING PERMISSIONS. To change permissions to specific functions, press the **Change Permissions** button. A menu appears that contains six selectable items - Presets, Hardware Configuration, Changeovers, Software Configuration, Remote I/O and Clear Log. Check the items for which you are allowing edit permission. Press **OK** or **Cancel** to exit this menu.

ADDING AN ACCOUNT. To add a new user account, press on the **Add New User** button. Enter the username and then set the account information in the Settings section.

REMOVING AN ACCOUNT. To remove a user account, select the desired user from the List of Users and press on the **Remove User** button. A verification prompt will appear. Press **OK**.



Note:

Do not delete the SNMP_User account from the list of users.

To save your changes, press the **Apply Changes** button. Press the **Undo Changes** button to restore to the previous settings.

CHANGING EXCITER TRANSFER SETTINGS

You can control the auto exciter transfer function using the [Exciter Changeover](#) page - see [Figure 2.24](#). To view the Exciter Changeover page, select Exciter Changeover from the Menu options.

Figure 2.24: Exciter Changeover page



The active exciter is displayed in the top, left corner.

For Main Exciter , select A or B. This will default to A if No is selected for Standby Exciter.

For Standby Exciter, select Yes if standby operation is available or desired or No if standby operation is not available or not desired. This is factory set and does not typically require adjustment.

For Auto Exciter Changeover, select Yes if automatic changeover is desired or No if user selected changeover is desired. You cannot change the Auto setting if the selected Standby Exciter button is No.

In the Exciter Changeover Delay field, enter the desired delay (in seconds) and press Set.

SOFTWARE CONFIGURATION

You can perform software upgrades to the AUI or transmitter or perform various restarts or resets using the [Software Configuration page](#) - see [Figure 2.25](#). To view the [Software Configuration page](#), select Software Configuration from the Menu options. The following options are available:

Figure 2.25: Software Configuration page



- **Maintenance:** Folder that contains maintenance command buttons to perform Touchscreen Calibration, Reboot AUI, Reboot Active Exciter or Reboot Standby Exciter (appears for dual exciter transmitters).

Note:

Using the Restart AUI or Reboot AUI function does not interrupt the transmitter's RF performance.

- **Network Setup:** Allows setting of network parameters (see [“Network setup”](#) on page 2-41)
- **Upgrade Software:** Allows for uploading software upgrade files for various transmitter sub-systems (e.g., Controller, Exciter, etc.) (see [“Upgrading software”](#) on page 2-43).

- **Watchdog Setup:** Allows configuration of a reset for the single-board computer (SBC) if communication is lost between the SBC and the Controller (see [“Watchdog setup” on page 2-28](#)).
- **Screen Saver Setup:** Allows setting or disabling of the screen saver timeout period.
- **Email Configuration:** Allows configuration of email parameters (e.g., server name, port number, etc.) (see [“Email configuration” on page 2-45](#)).
- **Notifications:** Allows configuration of email notifications to be sent for user-selected alarm occurrences (see [“Notifications” on page 2-46](#)).

NETWORK SETUP

See [Figure 2.26](#).

Figure 2.26: Network Setup page



To configure the AUI network, perform the following steps:

1. Select either DHCP (if DHCP is available on the network) or Static IP.

2. If Static IP was selected, enter the IP Address, Subnet Mask and Default Gateway. Consult your network administrator for assistance in determining these settings.
3. When complete press the **Apply** button to activate the changes or press the **Undo All** button to restore the previous settings.

UPGRADING SOFTWARE

See Figure 2.27.

Figure 2.27: Upgrade Software page



To upgrade a transmitter subsystem's software, see "Upgrading software" in Section 4, "Non-standard maintenance" on page 4-1 of this manual.

WATCHDOG SETUP

See Figure 2.28.

Figure 2.28: Watchdog Setup page



To configure the watchdog reset feature, perform the following steps:

1. Under the Watchdog Setup options, select how you want the watchdog reset to respond in the event of a communication error between the Controller and the single-board computer.
 - Reset Immediately: A watchdog reset will occur immediately after a communications error.
 - Disable Reset: No watchdog reset will occur.
 - Custom Delay (default setting): A watchdog reset will occur after a communications error, but after a user-defined delay. If selected, enter the delay, in minutes (factory set to 2 minutes).
2. When complete press the **Apply** button or press the **Undo** button to restore the previous setting. If Reset Immediately was selected prior to pressing the **Apply** button, the SBC will reboot.

EMAIL CONFIGURATION

See Figure 2.29.

Figure 2.29: Email Configuration page

The screenshot shows the 'Email Configuration' page within a software interface. At the top, there's a status bar with 'Date & Time' (Sun Jan 27 2008, 21:17:12), 'Power' (0.00 kW), 'Active Preset' (Preset 3 (3)), and 'Exciter' (Active Exciter:). Below this, a table shows 'Set Point' (4.00 kW), 'Mode' (FM + HD), 'Reflected' (0.00 W), and 'Frequency' (92.3MHz). A 'Modulation' bar is also present. The main area is titled 'Software Configuration' and has a sidebar with options: Maintenance, Network Setup, Upgrade Software, Watchdog Setup, Screen Saver Setup, Email Configuration (selected), and Notifications. The 'Email Configuration' section contains four input fields: 'Server Name', 'Port Number' (set to 25), 'Client Name', and 'Sender Name'. Below these fields are 'Apply', 'Undo', and 'Test' buttons. At the bottom, there's a 'Status' bar with 'Rx On', 'Rx Off', and a note 'Exciter mode set to Remote. RF Off required. No email configuration yet.' On the right side of the status bar are buttons for 'Menu', 'Status', 'Logs', 'Local Remote', 'Reset', and 'Change User'.

The transmitter's email service expects to be connected to an unsecure email server. For this reason, the transmitter needs to be on the same secure network as the email server you intend to use. To configure the email feature, perform the following steps:

1. Enter the four fields, noting the following:
 - **Server Name:** This is the IP or host name of your email server.
 - **Port Number:** Standard default email port is 25. Unless your email server uses a different number, no change is necessary.
 - **Client Name:** Must be set to the transmitter/station identification (e.g., NV40WXYZ@xxxxx.yyy). This address appears in the 'subject' field and also in the body of the email.
 - **Sender Name:** Enter as a standard email address (e.g., xxxxxxxx@yyyyy.zzz). This address appears in the 'from' field when you receive an email.
2. When complete press the **Apply** button or press the **Undo** button to restore the previous settings. Use the **Test** button to enter an email address to test your settings. You will receive a test email. Press **OK** to run the test or **Cancel** to return to the Email Configuration page.

NOTIFICATIONS

See Figure 2.30.

Figure 2.30: Notifications page



To configure the notifications feature, perform the following steps:

1. Pre-existing notifications are displayed in the Notifications list. Press the **Add** button to create a new item for the notification, press **Update** (after highlighting an existing item) to edit an existing item or press **Delete** to erase an item.
2. When you press **Add** or **Update**, the screen in Figure 2.31 will appear. This screen allows you to add or edit a **Notification Name**, **Recipient Email**, and select the desired alarm(s) that trigger the email notification. Select alarms by moving them (using the >> and << arrow buttons) from the Available Alarms list to the Selected Alarms list.



Note:

When entering the **Notification Name**, do not use a space to separate names; an underscore () character is acceptable (e.g., 15V-A or 15_V_A is OK; 15 V A is not).

When entering multiple email addresses in the **Recipient Email** field, use a semi-colon (with no spaces) to separate email addresses.

Figure 2.31: Notifications adding/updating page



3. When complete press the OK button or press the Cancel button to return to the Notifications page.

CHANGING HARDWARE SETTINGS

You can establish values for critical parameters using the [Hardware Configuration Page - System Configuration](#) shown - see [Figure 2.32](#). To view the Hardware Configuration page, select Hardware Configuration from the Menu options. The various options available are:

Figure 2.32: Hardware Configuration Page - System Configuration shown



WARNING: DEVICE SETTINGS ARE ESTABLISHED AT THE FACTORY AND SHOULD NOT REQUIRE ANY ADJUSTMENT. THESE SETTINGS AFFECT CRITICAL SYSTEM PROTECTION CIRCUITS. MAKING CHANGES TO THESE SETTINGS MAY VOID YOUR WARRANTY. CONTACT NAUTEL BEFORE MAKING CHANGES.

- **System Configuration:** See [Figure 2.32 on page 2-48](#). Allows for setting the transmitter combination mode (Standalone, SC1 combined, Master or Slave), ALC limit (in %) and the cooling fan supply voltage.

- Transmitter Type: See [Figure 2.33](#). Allows setting of the transmitter type (e.g., NV40, NV20, etc.).

Figure 2.33: Transmitter Type page



- **Scaling:** See [Figure 2.34](#). Allows for calibrating various metered parameters. Select the desired parameter from the drop-down list or by using the left and right arrows. The Meter Value of the parameter will be displayed. Enter the Scale Factor and press Apply to save changes.

Figure 2.34: Scaling page



- **Thresholds:** See [Figure 2.35](#). Allows for setting of alarm thresholds for critical parameters. Select the desired threshold from the drop-down list or by using the left and right arrows. Some thresholds have various fields associated with them; touch the applicable field to enable editing. The current threshold is displayed. Enter the new threshold and press **Apply** to save changes.

Figure 2.35: Thresholds page



- Redundant Supplies: See [Figure 2.36](#). Allows for configuring redundant fan, IPA, LVPS and 12 V power supplies. Select Yes if the supply has a backup. Select No if the supply is standalone.

Figure 2.36: Redundant Supplies page



- Exciter TCXO: See [Figure 2.37](#). Allows for calibrating the internal clock reference to an external 10 MHz clock by entering (using Set) the precise frequency of the external 10 MHz source and pressing the Start button. A value change is not typically required. Changes apply to the active exciter (A or B) only. To calibrate the other exciter, switch to the other exciter and repeat the change.

Figure 2.37: Exciter TCXO page



- IBOC Settings: See [Figure 2.38](#). Allows for setting of Forward Tap Delay, FM+HD Low Inj Gain, FM+HD High Inj Gain and HD Only System Gain. Also allows for an IBOC power calibration. Changes apply to the active exciter (A or B) only. To calibrate the other exciter, switch to the other exciter and repeat the change.

Figure 2.38: IBOC Settings page



- **Audio Input Calibration:** See [Figure 2.39](#). Allows for calibrating the analog left, analog right, SCA1, SCA2, MPX or MPX SCA levels. The peak meter value of the parameter will be displayed. Enter the calibration value and press Set to save changes. Nautel sets this value at the factory. Changes apply to the active exciter (A or B) only. To calibrate the other exciter, switch to the other exciter and repeat the change.

Figure 2.39: Audio Input Calibration page

The screenshot displays the Nautel transmitter's control interface. At the top, a status bar shows the date and time (Fri May 20 2006 00:19:05), power levels (0.00 kW), and frequency (92.3MHz). Below this, a 'Hardware Configuration' menu is visible on the left, with 'Audio Input Calibration' selected. The main area is titled 'Audio Input Calibration' and contains several rows of input fields and 'Set' buttons for calibrating different audio signals. The bottom of the screen has a row of buttons: RF On, RF Off, Menu, Status, Logs, Local/Remote, Reset, and Change User.

| Parameter | Value | Set |
|--------------------|-------|-----|
| Analog Left Peak | | Set |
| Analog Right Peak | | Set |
| Internal SCA1 Peak | | Set |
| Internal SCA2 Peak | | Set |
| Composite Peak | | Set |
| Composite SCA Peak | | Set |

- **LUT Storage:** See [Figure 2.40](#). Allows for calibrating HD settings for the exciter. Nautek sets LUT values at the factory. They should not require adjustment. Changes apply to the active exciter (A or B) only. To calibrate the other exciter, switch to the other exciter and repeat any changes.

Figure 2.40: LUT Storage page



- **Exgine Interface:** See [Figure 2.41](#). You can enable (turn on) or disable (turn off) digital carriers and configure IP information for the Exgine interface. You can also select the protocol (UDP or TCP) and set network information such as Exgine IP, Exporter IP, Netmask, Gateway, Exgine Port and MAC Address. Press Set to save changes.

Figure 2.41: Exgine Interface page



- IPA Bias Balance: See [Figure 2.42](#). Allows for optimal balancing of RF power module outputs to minimize reject load power. You should typically perform this procedure after an RF power module has been replaced or repaired. Press the Start button to initiate the process. Wait until the progress bar indicates completion and then press Save. Note that this balancing process affects only the active preset and updates the Module Bias Settings for each module as required (see “[Editing and saving presets](#)” on page 2-30).

Figure 2.42: IPA Bias Balance page

Hardware Configuration

- System Configuration
- Transmitter Type
- Scaling
- Thresholds
- Redundant Supplies
- Exciter TCXO
- HD Settings
- Audio Input Calibration
- LUT Storage
- Engine Interface
- IPA Bias Balance**
- Miscellaneous

IPA Bias Balance

IPA Bias Balance: Ready

Start

Cancel

Reject Powers

| | | | | | |
|--------------------------|-------|--------------------------|-------|--------------------------|-------|
| Reject Power 15-16 (50W) | 0.00W | Reject Power 3-4 (50W B) | 0.00W | Reject Power 1-16 (400W) | 0.00W |
| Reject Power 13-14 (50W) | 0.00W | Reject Power 1-2 (50W A) | 0.00W | Reject Power 9-16 (200W) | 0.00W |
| Reject Power 11-12 (50W) | 0.00W | Reject Power 13-16 | 0.00W | Reject Power 1-8 (200W) | 0.00W |
| Reject Power 9-10 (50W) | 0.00W | Reject Power 9-12 (100W) | 0.00W | Total Reject Power | 3.00W |
| Reject Power 7-8 (50W D) | 0.00W | Reject Power 5-8 (100W) | 0.00W | | |
| Reject Power 5-6 (50W C) | 0.00W | Reject Power 1-4 (100W) | 0.00W | | |

IPA Biases

| | | | | | | | |
|----------------|------|----------------|------|-----------------|------|-----------------|------|
| IPA Bias DAC 1 | 0.00 | IPA Bias DAC 5 | 0.00 | IPA Bias DAC 9 | 0.00 | IPA Bias DAC 13 | 0.00 |
| IPA Bias DAC 2 | 0.00 | IPA Bias DAC 6 | 0.00 | IPA Bias DAC 10 | 0.00 | IPA Bias DAC 14 | 0.00 |
| IPA Bias DAC 3 | 0.00 | IPA Bias DAC 7 | 0.00 | IPA Bias DAC 11 | 0.00 | IPA Bias DAC 15 | 0.00 |
| IPA Bias DAC 4 | 0.00 | IPA Bias DAC 8 | 0.00 | IPA Bias DAC 12 | 0.00 | IPA Bias DAC 16 | 0.00 |

RF On RF Off Invalid recipient email Invalid recipient email

Menu Status Logs Local Remote Reset Change User

- Miscellaneous: See [Figure 2.43](#). The Miscellaneous page allows for the following options:
 - External 10 MHz: Allows configuration for an external 10 MHz synchronization source. Select **Yes** if the an external 10 MHz source is being used. Select **No** if an external 10 MHz source is not being used.
 - Primary/Secondary Audio Input: Allows selection of the input (AES/EBU #1 or AES/EBU #2) that is mapped to the primary and secondary digital inputs.

Figure 2.43: Miscellaneous page



CONFIGURING REMOTE INPUTS AND OUTPUTS

You can define and configure your remote input/output interface for the transmitter using the [Remote I/O Page \(Inputs tab selected\)](#) - see [Figure 2.44](#). To view the Remote I/O page, select Remote I/O from the Menu options.

Refer also to the *NV5/NV3.5 Installation Manual* for information on remote inputs and outputs and their factory default settings.

Figure 2.44: Remote I/O Page (Inputs tab selected)



Press the Inputs (see [Figure 2.44](#)) or Outputs (see [Digital outputs on page 2-63](#)) tab to view or edit detail on the digital inputs or outputs.

DIGITAL INPUTS

Using the Inputs tab (see [Figure 2.44 on page 2-60](#)), you can configure up to 24 digital inputs that allow you to remotely control various operational characteristics of the transmitter. Unless otherwise noted these inputs are only accepted by the transmitter if the remote/local status is set to remote. That setting can only be made by a local user using the front panel AUI.

Nautel presets the digital inputs prior to shipping. See the *NV5/NV3.5 Installation Manual* for details.

Select the desired digital input (1 through 24) from the list. The **Channel** and **Logic** settings for the selected input, as well as the current logic level (1 or 0), are displayed on the right-hand side of the page. You can define the **Channel** and **Logic** settings as follows:

SELECT CHANNEL

You can configure digital inputs 1 through 24 for one of a variety of control inputs. Press the existing **Channel** bar to display the **Select a remote** window. From this window select one of the following options by pressing **Load**:

- **Not Assigned.** No effect on transmitter operation, regardless of logic level.
- **RF On/Off.** Same as pressing the **RF On** (telling the system to provide RF power, if possible) or the **Rf Off** button on the AUI.
- **Controller Reset.** Causes a system reset.
- **Inc/Dec RF Power.** Same as pressing the **Increase** or **Decrease** button on the AUI.
- **Main Exciter.** Selects the main exciter to operate the transmitter.
- **Auto Exciter Changeover.** Sets the exciter changeover function to operate automatically.
- **Preset: NAME.** Selects the associated preset (from a list of all pre-defined presets) as active.

CONFIGURE LOGIC

You can configure the active/inactive logic for each of the 24 digital inputs. Press the existing Logic bar to display the applicable drop-down menu options, which may include:

- **Falling Edge Turn On/Reset/Set To B.** Logic '0' (low or trailing edge) activates the input (or causes a reset or selects B, as appropriate).
- **Rising Edge Turn On/Reset/Set To B.** Logic '1' (high or rising edge) activates the input (or causes a reset or selects B, as appropriate).
- **Falling Edge Turn Off/Set To A.** Logic '0' (low or trailing edge) de-activates the input (or selects A, as appropriate).
- **Rising Edge Turn Off/Set To A.** Logic '1' (high or rising edge) de-activates the input (or selects A, as appropriate).
- **Falling Edge Toggle.** Logic '0' (low or trailing edge) de-activates the input; next logic '0' (low or trailing edge) activates the input.
- **Rising Edge Toggle.** Logic '1' (high or rising edge) activates the input; next logic '1' (high or rising edge) de-activates the input.
- **Rising Edge, Turn On/Set To B. Falling Edge Turn Off/Set To A.** Logic '1' (high or rising edge) activates the input (or selects B, as appropriate); logic '0' (low or trailing edge) de-activates the input (or selects A, as appropriate).
- **Falling Edge, Turn On/Set To B. Rising Edge Turn Off/Set To A.** Logic '0' (low or trailing edge) activates the input (or selects B, as appropriate); logic '1' (high or rising edge) de-activates the input (or selects A, as appropriate).
- **Active High, Increase.** Logic '1' (high) causes a power increase.
- **Active Low, Increase.** Logic '0' (low) causes a power increase.
- **Active High, Decrease.** Logic '1' (high) causes a power decrease.
- **Active Low, Decrease.** Logic '0' (low) causes a power decrease.

Press **Apply** to activate changes. Press **Undo** to cancel changes.

DIGITAL OUTPUTS

Using the [Digital Outputs Page](#) - see [Figure 2.45](#), you can configure up to 24 digital outputs that indicate either the presence of various alarms or the status of operator controlled circuits.

Nautel presets the digital outputs prior to shipping. See the *NV5/NV3.5 Installation Manual* for details.

Figure 2.45: Digital Outputs Page



Select the desired digital output (1 through 24) from the list. The **Channel** and **Logic** settings for the selected output, as well as the current logic level (1 or 0), are displayed on the right-hand side of the page. You can define the **Channel** and **Logic** settings as follows:

SELECT CHANNEL

You can configure digital outputs 1 through 24 to monitor a variety of alarm and status outputs. Press the existing **Channel** bar to display the **Select a remote** window. From this window select one of the channels, then press **Load** to accept:

- **Not Assigned.** No alarm or status parameter is monitored.

- **Local/Remote.** The active logic level indicates the transmitter is in local control. The inactive logic level indicates the transmitter is in remote control.
- **RF On/Off.** The active logic level indicates the transmitter's RF power stage is on (enabled). The inactive logic level indicates the transmitter's RF power stage is off.
- **Active Exciter.** The active logic level indicates that exciter A is active. The inactive logic level indicates that exciter B is active.
- **Auto Exciter Changeover.** The active logic level indicates that the automatic exciter changeover function is enabled.
- **Main Exciter.** The active logic level indicates that exciter A is selected as the main exciter. The inactive logic level indicates that exciter B is selected as the main exciter.
- **Preset Status (1-4 default).** The active preset's output will be indicated by a logic low. The remaining, non-active preset outputs will be open collector.
- **Various Alarms.** The active logic level indicates that the selected alarm is occurring. Any transmitter alarm can be selected as a digital output. Refer to the *NV5/NV3.5 Troubleshooting Manual* for a description of each alarm.

CONFIGURE LOGIC

You can configure the active/inactive logic for each of the 24 digital outputs. Press the existing **Logic** bar to display the applicable drop-down menu options. For example, if the selected channel is **RF On/Off**, the drop-down options are:

- **Output Low When Off.** Logic '0' (low) indicates the output is true (RF is off); Logic '1' (high) indicates the output is false (RF is on).
- **Output Low When On.** Logic '0' (low) indicates the output is true (RF is on); Logic '1' (high) indicates the output is false (RF is off).

Press **Apply** to activate changes. Press **Undo** to cancel changes.

ANALOG OUTPUTS

There are eight analog outputs that can be remotely monitored. These outputs are factory defined during testing and are not user configurable. Refer to the *NV5/NV3.5 Installation Manual* for a list of these analog outputs.

SECTION 3: ROUTINE MAINTENANCE

This section provides instructions for performing routine maintenance on the NV5/NV3.5 transmitter. This section includes the following topics:

- [Scheduled maintenance](#)
 - Cleaning
 - Checking hardware - see page 3-2
 - Battery replacement - see page 3-2
- [Replacing an air filter - see page 3-3](#)
- [Performing on-air checks - see page 3-5](#)
- [Replacing the control/interface PWB battery - see page 3-6](#)
- [Replacing the NVE exciter PWB battery - see page 3-7](#)
- [Inspecting lightning protection systems - see page 3-8](#)

SCHEDULED MAINTENANCE

Scheduled maintenance consists of performing a visual inspection of the NV5/NV3.5 at scheduled intervals. The recommended minimum time between scheduled maintenance visits is three months. Local operating and environmental conditions may dictate more frequent visits, while in remote sites less frequent visits may be acceptable. Experience and system reliability will determine the most practical schedule for a specific installation.

CLEANING

At a minimum, follow the cleaning procedures listed below.



Note:

A site located in a dirty area using open-air cooling requires more extensive cleaning than a site located in a clean area using closed-air cooling.

1. Check the air filters, noting there are three in the back of the transmitter and one in the front door of the transmitter. Remove the air filters, inspect them, then re-install the air filters if they are clean. If an air filter is dirty or damaged, replace it as soon as possible. See [“Replacing an air filter” on page 3-3](#).

2. Clean the NV5/NV3.5 using a vacuum cleaner and a soft-bristle brush to remove loose dirt. Clean, damp rags should be used to remove dirt that cannot be removed with a vacuum cleaner. Never use compressed air to clean the NV5/NV3.5.
3. Clean the 17-inch LCD monitor on the front door as follows:
 - Open the transmitter's front door and gain access to the rear of the LCD monitor.
 - Remove the cover that protects the connectors at the bottom of the LCD monitor, noting it is secured using seven M4 nuts, split washers and flat washers. Retain hardware.
 - Disconnect the round, black DC INPUT plug from the bottom, left of the monitor. This removes power from the monitor, which makes it easier to see dirty or oily areas on the screen and also prevents any inadvertent touch-screen operation.
 - Use a dry, soft microfiber cloth and very gently wipe the screen. Do not press hard in an attempt to scrub off dirt or oil. If necessary, dampen the cloth with distilled water
 - When complete, reconnect the DC INPUT plug to the monitor and re-install the cover.

CHECKING HARDWARE

All hardware must be checked at least once a year. Thermal cycling from turning the NV5/NV3.5 on and off will require more frequent checks.

- To prevent damaging the hardware, ensure that the proper sized tools are used. In most cases, hardware is metric.
- A mounting surface or terminal that has changed colour indicates a loose hardware connection.
- Ac input cables installed on terminal block TB1 must be checked and, if necessary, retorqued. See Section 4, Connecting Ac Power of the *NV5/NV3.5 Installation Manual* to determine specific torque values.

BATTERY REPLACEMENT

The NV5/NV3.5's control/interface PWB contains a battery backup circuit that provides a memory of transmitter alarm occurrences during ac power failure. See ["Replacing the control/interface PWB battery" on page 3-6](#).

Each exciter's (A or B) NVE exciter PWB contains a battery backup circuit that provides a memory of exciter alarm occurrences during ac power failure. See ["Replacing the NVE exciter PWB battery" on page 3-7](#).

REPLACING AN AIR FILTER

The transmitter contains several cotton air filters, contained in the front door and the upper and lower rear panels. If an air filter becomes damaged, replace it as follows:

INTERVAL

As required.

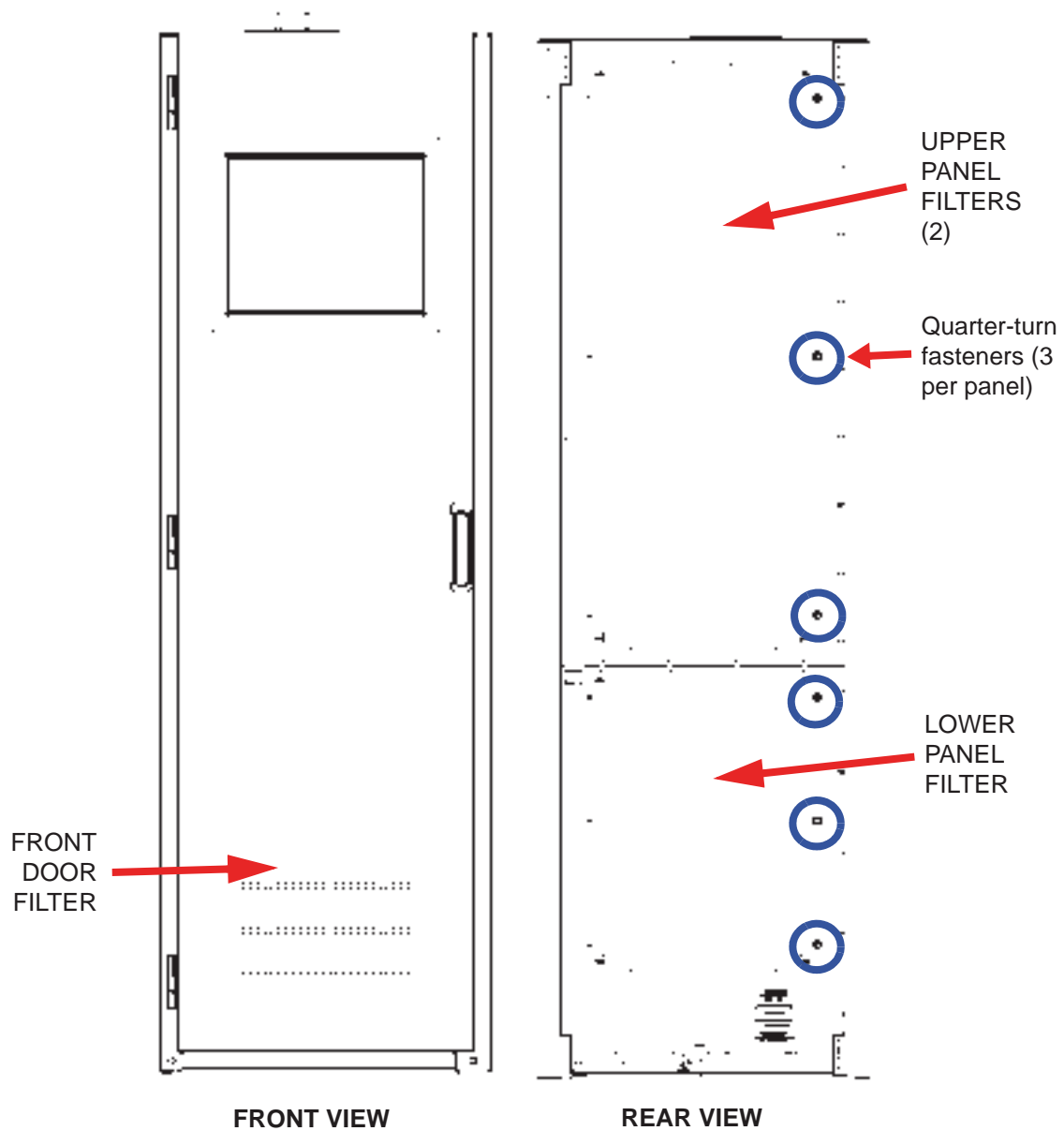
PARTS AND TOOLS

- Replacement air filter
- Phillips screwdriver

PROCEDURE

Take the following steps to replace an NV5/NV3.5 air filter:

1. Order a new filter or filters, as necessary. You can order a standard sized filter from Nautel (Nautel Part # HR128) or from the manufacturer (15" x 20" x 2", American Air Filter PerfectPleat HC M8 MERV 8 or equivalent) or obtain one from any local supplier of HVAC supplies.
2. Unpack the new filter and inspect it for damage.
3. Remove the old or damaged filter (see [Figure 3.1 on page 3-4](#)) as follows:
 - For a front door air filter, open the front door and remove the protective metal cover (two M4 screws) just above the fan filter. Remove the screws and slide up the cover to allow access to the fan filter bracket's securing screws. Remove the filter bracket's four M4 securing screws. Remove the air filter from the bracket.
 - For rear panel filters, loosen the three quarter-turn fasteners at the right-hand side of the appropriate filter panel. Remove the angle bracket from the right-hand side of the filter panel and remove (slide out) the air filter.
4. Insert the new air filter into the bracket. As required, reinstall the filter bracket and protective metal cover for the front door filter, or reinstall the angle bracket on the right-hand side of the rear panel(s).
5. Dispose of the damaged air filter.

Figure 3.1: Replacing Air Filters

PERFORMING ON-AIR CHECKS

You should check the on-air quality of the transmitter's signal periodically. This check can be done locally at the transmitter site, or remotely from another location in the transmitter's coverage area.

INTERVAL

Every 12 months, or as required by law.

PARTS AND TOOLS

- High-quality receiver compatible with the modulation scheme used on the transmitter.

PROCEDURE

1. Monitor the transmitter signal to identify any problems:
 - Use a high quality receiver to monitor audio quality.
 - Check the spectral output of the transmitter using the front panel AUI's spectrum analyzer.
 - Take a portable receiver to different locations in your coverage areas to identify any problems with the antenna pattern or areas of localized interference.
2. Obtain the *Critical Parameters* sheet that was completed during factory testing and provided with the transmitter. Use the transmitter's AUI to compare current transmitter settings with those on the *Critical Parameters* sheet.



Note:

Nautel completes the Critical Parameters sheet with the transmitter terminated into a precision 50 ohm load. Measurements made on site into a dummy load or station antenna may not yield the same readings. Slight variances are acceptable. The data is provided as a troubleshooting aid.

REPLACING THE CONTROL/INTERFACE PWB BATTERY

Replace the battery on the control/interface PWB (A1) once a year, or whenever the **Controller - Low Battery** alarm appears (on the AUI or via remote digital output). Chemical leakage from an old battery can cause damage. Also, the control/interface PWB's microcontroller may not retain its settings if ac power is turned off while the backup battery power is low. The battery should be replaced while ac power is applied to the transmitter.

INTERVAL

Every 12 months.

PARTS AND TOOLS

Replacement battery: 3 V lithium coin cell, 20 mm (Nautel Part # BBLT01, Panasonic # CR2032).

PROCEDURE

Perform the following steps to replace the battery:

1. Ensure ac power is being applied to the transmitter.
2. Gain access to the control/interface PWB (A1) by opening the front door of the transmitter.
3. Replace the battery in XBT1 on the control/interface PWB. See Figures MD-1 and MD-3 in the mechanical drawings section at the end of the *NV5/NV3.5 Troubleshooting Manual* to locate the control/interface PWB (A1) and its battery.
4. Close the front door.
5. Check for any alarms on the AUI. Battery related alarms should clear. (See [“Viewing transmitter status” on page 2-37.](#))

REPLACING THE NVE EXCITER PWB BATTERY

Replace the battery on the applicable exciter's NVE exciter PWB (A3A1 or A4A1) once a year, or whenever the Exciter A/B- Low Backup Battery alarm appears (on the AUI or via remote digital output). Chemical leakage from an old battery can cause damage. Also, the NVE exciter PWB's microcontroller may not retain its settings if ac power is turned off while the backup battery power is low. The battery should be replaced while ac power is applied to the transmitter.

INTERVAL

Every 12 months.

PARTS AND TOOLS

Replacement battery: 3 V lithium coin cell, 20 mm (Nautel Part # BBLT01, Panasonic # CR2032).

PROCEDURE

Perform the following steps to replace the battery:

1. Ensure ac power is being applied to the transmitter.
2. Open the front door and - without disconnecting any interconnecting cables - slide the associated exciter forward enough to remove the exciter's cover. See Figures MD-1 in the mechanical drawings section at the end of the *NV5/NV3.5 Troubleshooting Manual* to locate the exciters. See Figure MD-5 to locate the NVE exciter PWB (A1).
3. Gain access to the appropriate exciter's NVE exciter PWB (A3A1 or A4A1) by removing the cover.
4. Replace the battery in XBT1 on the NVE exciter PWB.
5. Close the front door.
6. Check for any alarms on the AUI. Battery related alarms should clear. (See ["Viewing transmitter status" on page 2-37.](#))

INSPECTING LIGHTNING PROTECTION SYSTEMS

You should inspect the lightning protection systems that are connected to your NV5/NV3.5 transmitter, ac power, RF feedline, antenna and tower periodically to ensure that your site, equipment and personnel are fully protected.

INTERVAL

Every 6 months.

PARTS AND TOOLS

Depends on your site, but may include a digital multimeter, ladder, binoculars, and continuity tester.

PROCEDURE

Perform the following steps to test the lightning protection systems:

1. Test the continuity between ground available at your lightning arrestor and ground available on various pieces of equipment connected to the transmitter. Ensure that there is no resistance (near 0 ohms, accounting for multimeter test lead resistance).
2. Physically inspect the lightning arrestor to ensure that all connections are tight. Also look for any sign of scoring or burning (indications of possible damage from earlier lightning strikes).
3. Using binoculars, visually inspect the hardware on the tower. Look for charred, broken or frayed connections and corrosion.

SECTION 4: NON-STANDARD MAINTENANCE

This section provides instructions for performing non-standard maintenance on the NV5/NV3.5 transmitter. This section includes the following topics:

- [Upgrading software](#)
- [Improving transmitter performance for IBOC presets - see page 4-12](#)
- [Changing the RF output connector - see page 4-14](#)
- [Bypassing the UPS interface option - see page 4-18](#)

UPGRADING SOFTWARE

Periodically, enhancements or improvements to the operating system are identified and made available. Perform a software upgrade, as required, as follows:

PARTS AND TOOLS

- Laptop (i.e., local computer for direct connection) or network computer with Windows and Internet Explorer Web browser
- CAT5 Ethernet cable
- Upgrade software (*.tgz file), provided via email, web download or flash card

PRELIMINARY CHECKS

1. Determine the current software revision installed. Via the advanced user interface (AUI) screen, go to **Menu/Software Configuration/Upgrade Software**. Select the *.tgz file from the Select a Boot Image list (should highlight in blue) and press **About**. Note the current software revision for AUI, Server, Controller, Exciter and RF Modules.
2. Contact Nautel for the most recent software revision and receive a new compact flash card (which contains upgrade *.tgz file) or download *.tgz file to a laptop or network location.
3. If you received a new compact flash card, continue to [“Compact flash card swap” on page 4-2](#). If not, proceed to [“Transferring upgrade file” on page 4-2](#).

COMPACT FLASH CARD SWAP

If you received a new compact flash card with the upgrade *.tgz file, swap the current card with the new card as follows:

1. From the transmitter AUI, go to **Menu/Software Configuration/Network Setup**, and record your current network settings (IP Address, Subnet Mask, Default Gateway). Contact Nautel for the most recent software revision and receive a new compact flash card (which contains upgrade *.tgz file) or download *.tgz file to a laptop or network location.
2. Unplug the single board computer's (SBC) power connector P8 - located behind a cover on the rear of the door (use 7 mm nut-driver - M4 hardware).
3. Remove the current compact flash card - bottom edge of SBC. Note the orientation of the card.
4. Install the new card, noting orientation, and plug in SBC power connector P8.
5. The AUI should boot up and the transmitter login screen should appear (or the main screen - depending if Auto Login was enabled for the active user).
6. Proceed to ["Flashing transmitter with upgrade software" on page 4-4](#).

TRANSFERRING UPGRADE FILE

The following steps assume either the laptop will be used to connect directly to the transmitter **OR** the transmitter and network computer are currently connected to the same network.

TRANSMITTER IP CONFIGURATION

1. From the transmitter AUI, go to **Menu/Software Configuration/Network Setup**.
2. Record your current network settings (IP Address, Subnet Mask, Default Gateway).
3. If connecting to the transmitter directly with a laptop, select **Static IP** and set as follows:
 - IP Address: 10.10.10.2
 - Subnet Mask: 255.255.255.0
 - Default Gateway: 192.168.1.2

Press **Apply**.

4. Set the transmitter for Remote control.

LAPTOP IP SETUP

The following steps assume the operating system is Windows XP. Adapt as required for computers with different operating systems.

1. On the laptop go to Start Menu/Control Panel/Network Connections/Local Area Network.
2. In the Local Area Network Status, open the General tab and choose Properties. Scroll down and highlight Internet Protocol (TCP/IP). Choose Properties.
3. In the *Internet Protocol (TCP/IP) Properties* window, select Use the following IP address.
4. Enter the following settings:
 - IP Address: 10.10.10.1
 - Subnet Mask: 255.255.255.0
 - Default Gateway: 192.168.1.2
5. In the *Internet Protocol (TCP/IP) Properties* window, select OK.
6. In the *Local Area Connection Properties* window, select OK.
7. In the *Local Area Connection Status* window, select Close.
8. Close the *Network Connections* window.

TRANSFER SOFTWARE UPGRADE FILE TO TRANSMITTER

1. If using a laptop, connect the laptop network interface card to the transmitter LAN port (A1J21 on the control/interface PWB) using a CAT5 Ethernet cable. Open Internet Explorer and search for 10.10.10.2. The transmitter login screen should appear.
2. If using a network computer, open Internet Explorer and search for the IP address recorded in [Step 2 of "Transmitter IP configuration" on page 4-2](#). The transmitter login screen should appear.
3. In the *Internet Protocol (TCP/IP) Properties* window, select Use the following IP address.
4. At the transmitter login screen enter:
 - User: "Nautel" or "****", where **** is the user assigned user name
 - Password: none (default) or "****", where **** is the user assigned password

5. Navigate through the AUI to Menu/Software Configuration/Upgrade Software and press Browse. Locate the software update *.tgz file and press Upload to load the file into the transmitter boot image list.
6. Proceed to ["Flashing transmitter with upgrade software"](#).

FLASHING TRANSMITTER WITH UPGRADE SOFTWARE

1. Set the transmitter to RF Off and for Local control. Perform the following steps locally (in front of the transmitter AUI).
2. Go to the AUI Menu/Software Configuration/Upgrade Software screen and select the update *.tgz file from the boot image list (should highlight in blue) and press Begin Flash.

**CAUTION:**

Note the red warning text at the top of the AUI screen - do not leave this page until the flash process is complete.

3. After a successful load (boot status indicates 100% complete and notes that modules should be reset) press Reset and go to the Maintenance screen in Menu/Software Configuration and select Reboot AUI.
4. This completes the software upgrade. Restore the former network settings on the transmitter and laptop as required (see [Step 2 of "Transmitter IP configuration" on page 4-2](#)).
5. From the transmitter AUI, go to Menu/Software Configuration/Network Setup, and set the network settings (IP Address, Subnet Mask, Default Gateway) recorded in [Step 1 of "Compact flash card swap" on page 4-2](#).
6. Login and repeat [Step 1 of "Preliminary checks" on page 4-1](#) to determine if the current version is the same as the upgrade version - this confirms the upgrade was successful.
7. If the upgrade was not successful, repeat [Step 1](#) through [Step 6](#), except in [Step 3](#), cycle the ac power (switch off, then on) instead of selecting Reboot AUI. If still unsuccessful, contact Nautel.

CONFIGURATION CHANGE

Perform the referenced procedures on NV series transmitters that upgrade to software version 2.7 or greater.

For transmitters that were received equipped with software version NV SW 2.3 or previous, perform the following procedures:

- [RF Drive Sample Calibration](#)
- [Exciter HD Calibration](#) - see page 4-7
- [LUT Re-Saving](#) - see page 4-8

For transmitters that were received equipped with software version NV SW 2.6, perform only:

- [RF Drive Sample Calibration](#)



Note:

Operate the transmitter in FM mode at the assigned power level for at least 15-20 minutes prior to making measurements or adjustments. This will allow the transmitter to warm up, when adjustments should be made.

RF DRIVE SAMPLE CALIBRATION

1. With RF off, go to the AUI Menu/Hardware Configuration/Scaling screen. Select "RF Drive Power" from the pull-down menu, and change the scale factor to 1.000. Press the **Apply** button.
2. Operate the transmitter (RF On) in an FM mode preset at the licensed analog power level (or rated power), with exciter A as active.



Note:

*If any RF drive related alarms occur (cycles between high and low), temporarily reduce the active FM Preset's Exciter Power setting - in the AUI's Menu / Preset screen - to half its current value (record the original value). Press the **Activate** button. Continue reducing this setting if these symptoms continue.*

3. Go to the AUI Menu/System Review screen. Press the **i** button in the Controller line. Record the RF Drive Power.

4. From the same AUI screen, press the **i** button in the Exciter A line. Record the exciter's Forward Power.
5. If exciter B is installed, manually change over to exciter B (using the AUI Menu/Changeover screen), then go to the AUI Menu/System Review screen. Press the **i** button in the Exciter B line. Record the exciter's Forward Power.
6. Calculate the average exciter forward power level between exciters A and B using the power levels recorded in [Step 4](#) and [Step 5](#). The transmitter's RF Drive Power reading will be re-calibrated to the average exciter forward power.
7. Go to the AUI Menu/Hardware Configuration/Scaling screen. Select "RF Drive Power" from the pull-down menu. Change the scale factor until the Meter Value matches the average exciter forward power calculated in [Step 6](#). Press the **Apply** button.
8. If the preset's Exciter Power setting was adjusted, set it back to the original value recorded in the note after [Step 2](#). Press the **Activate** button. Repeat [Step 2](#) through [Step 7](#) until the "RF Drive Power" meter value matches the average exciter forward power calculated when the preset's Exciter Power setting is equal to its original value (if necessary, only reduce the setting by a smaller amount each subsequent time). Record the new Scale Factor.
9. If necessary, proceed to Exciter HD Calibration; if not, select the desired preset or operating mode. Note that for any FM+HD mode, the power level displayed in the AUI's Presets page is the desired analog power setting (TPO). The power reading at the top of the home page is also the analog portion of the FM+HD output.
10. The procedure is complete. Nautel recommends that you retain at the site the new RF Drive Power Scale Factor from [Step 8](#). Also, email the data to Nautel (support@nautel.com).
11. For future reference, if the NAPC156 Control Interface PWB requires replacement, you will need to manually re-enter the new RF Drive Power Scale Factor after the original factory EEPROM is loaded into the replacement PWB.

EXCITER HD CALIBRATION

*Note:**This procedure addresses all IBOC modes of operation (FM+HD and HD).*

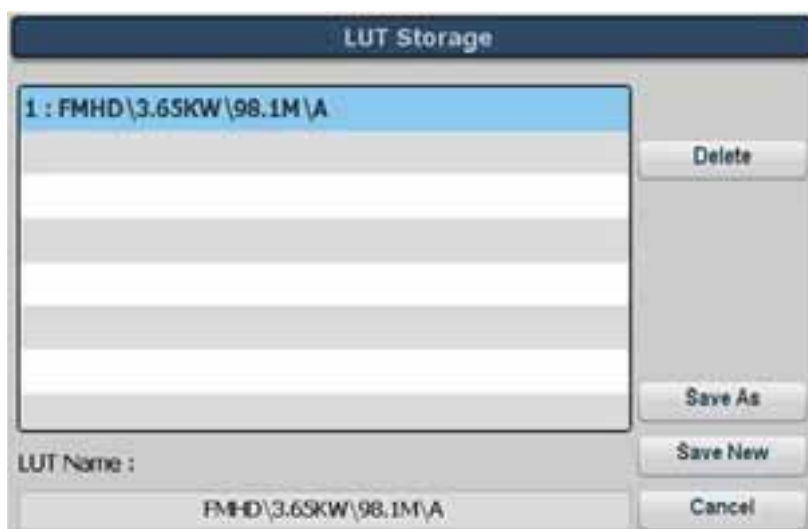
1. Operate the transmitter (RF On) in an FM mode preset at the licensed analog power level (or rated power), with exciter A as active.
2. Go to the AUI Menu/Hardware Configuration/HD Settings screen.
3. Press the **Calibrate** button next to Exciter HD Power Calibration.
4. Almost immediately the Calibration Value shall change from a nominal 1.000 to a value typically near or between 0.900 and 1.100. Record the calibration value.
5. If exciter B is installed, manually change over to exciter B (using the AUI Menu/Changeover screen) and repeat [Step 2](#) through [Step 4](#). When complete, change over to exciter A (making it active again).
6. Proceed to [“LUT Re-Saving” on page 4-8](#).

LUT RE-SAVING

*Note:**This procedure applies to IBOC transmitters only (FM+HD and HD).*

1. With RF Off and exciter A active, go to the AUI Menu/Hardware Configuration/HD Settings screen and record the "Default LUT Height" value. Exciter A and B have independent "Default LUT Height" values; the value displayed on the AUI represents that value stored in the active exciter.
2. Go to the AUI Menu/Hardware Configuration/LUT Storage screen and record the stored Index details vs. the Index # in the table.

For example, [Figure 4.1](#) shows index 1 having a mode of FM+HD, a power of 3.65 kW, a frequency of 98.1 MHz and it is exciter A. The associated Preset will also have this LUT Index # selected under the Other Audio Settings sub-menu. In this example, index 1 is the only index to have a LUT stored. If others were stored in exciter A, they would appear under index 2, 3, etc., and may have different modes (FM+HD or HD), power levels, frequencies and even injection levels (default is -20 dB if not shown). The table shows the stored indexes for the active exciter; exciter B indexes will have \B at the end in place of \A and there should exist an equivalent B index for every A index (same index # and description).

Figure 4.1: LUT Storage Sub-Menu

-
3. Sub-steps (i) through (vii) involve turning the transmitter on and off while monitoring its behavior. The optimal "Default LUT Height" value will be determined and then the new LUT will be saved. Repeat steps (i) through (vii) until the transmitter:
- does not overshoot, and
 - ramps up quickly and smoothly without alarms.
- (i) Activate the preset associated with LUT Index 1 (same mode, power level, frequency). This preset should correlate to the customer's licensed mode/power level/frequency
- (ii) Within the preset, under Other Audio Settings, change the LUT Index to Flat. Press the Activate button.
- (iii) Go to the Main screen and press RF On while monitoring the transmitter behavior.
- Does the transmitter output power overshoot? If so, press RF Off immediately and decrease the "Default LUT Height" by 0.01, press the Set button and repeat RF Off/On.
 - Does the transmitter power ramp up quickly (i.e., achieve 70% to 100% of power in less than 30 s) and smoothly without alarms (PA/Module Failures or Foldback)? If not, fine tune the ramp-up performance as detailed in ["Improving/Fine Tuning Ramp-Up Time" on page 4-10](#).
- (iv) Record the new "Default LUT Height".
- (v) With the transmitter operating at the preset power level and with all objectives satisfied, go the LUT Storage sub-menu (see the example in [Figure 4.1 on page 4-8](#)), select the associated LUT index (the line should turn blue and the LUT Name field should update to show the same name, see example above). Press the Save As button to overwrite the existing stored LUT.
- (vi) In the currently active Preset, change the Other Audio Settings -> LUT Index value back to the original number (e.g., 1 in this case). Press the Activate button.
- (vii) Press RF Off then RF On. The transmitter should satisfy the requirements of [Step 3](#).
-

4. If the LUT Storage sub-menu suggests there are other indexes stored, repeat only Step 3 (v) while operating in the applicable preset. Do not further change the "Default LUT Height" value; only overwrite the existing stored LUT. If the transmitter will only operate at the licensed mode/power level/frequency (typical), only one LUT is required. Delete the remaining stored LUTs to prevent inadvertent selections by highlighting them (the line should turn blue) and pressing the Delete button. LUTs can be saved at any time, and used for a given Preset by configuring the LUT Index for the associated stored index.
5. If exciter B is installed manually change over to exciter B (using the AUI Menu/Changeover screen) and repeat [Step 1](#) through [Step 4](#) for exciter B. Once complete, manually change over to exciter A.
6. Select the desired preset or operating mode. Note that for any FM+HD mode, the power level displayed in the AUI's Presets page is the desired analog power setting (TPO). The power reading at the top of the home page is also the analog portion of the FM+HD output.
7. The procedure is complete. Nautel recommends that you retain at the site the new RF Drive Power Scale Factor from "[RF Drive Sample Calibration](#)", [Step 8](#), the new Calibration Value from "[Exciter HD Calibration](#)", [Step 4](#), and the new Default LUT Height from "[LUT Re-Saving](#)", [Step 3](#) (iv) for both exciters A and B as applicable. Also, email the data to Nautel (support@nautel.com).
8. For future reference, if the NAPC156 Control Interface PWB requires replacement, you will need to manually re-enter the new RF Drive Power Scale Factor after the original factory EEPROM is loaded into the replacement PWB.

IMPROVING/FINE TUNING RAMP-UP TIME

The following procedure is only necessary to fine tune/improve ramp-up time, as referenced in paragraph 6.3, step (c3). While overshooting of the transmitter power is quite easy to identify, determining optimal ramp-up time is subjective.



Note:

When making changes to the "Default LUT Height", always ensure that the transmitter output power does not overshoot, and it ramps up quickly and smoothly without alarms.

1. When the transmitter has settled at power, monitor the AUI's AM-AM Correction plot and place the marker on the plot at the Table Index value shown in Table 1, noting that the values

are based on the mode/ injection level, and ensure the measured (LUT) Gain falls in the range specified.



Note:

The Table Index Full Scale value on the AUI's AM-AM Correction plot is actually 255, not 2047.

Table 4.1: AM-AM Correction Table Index Values and Expected LUT Gain vs. Mode

| Mode | Table Index Value | (LUT) Gain Range |
|--|-------------------|------------------|
| FM+HD Low Injection (e.g., -20 dB to -16 dB) | 120 | 0.36 to 0.44 |
| FM+HD High Injection (e.g., -15 dB to -10 dB) | 80 | |
| HD Digital | 30 | |

- If the Gain value in [Step 1](#) is greater than 0.44, increase the "Default LUT Height" value (and subsequently decrease the LUT Gain) to:

$$\text{Current Default LUT Height} \times \text{Measured Gain} / 0.44$$

Example: In [Step 1](#), if you measure a Gain value of 0.48 and your "Default LUT Height" value is 0.500, increase the "Default LUT Height" to 0.545 (or $0.500 \times 0.48 / 0.44$).

- If the Gain value in [Step 1](#) is less than 0.36, decrease the "Default LUT Height" value (and subsequently increase the LUT Gain) to:

$$\text{Current Default LUT Height} \times \text{Measured Gain} / 0.36$$

Example: In step (a), if you measure a Gain value of 0.32 and your "Default LUT Height" value is 0.500, decrease the "Default LUT Height" to 0.444 (or $0.500 \times 0.32 / 0.36$).

IMPROVING TRANSMITTER PERFORMANCE FOR IBOC PRESETS

After a power or frequency change to an operating FM+HD or HD preset, optimize the transmitter's performance as follows:

PARTS AND TOOLS

- Transmitter's AUI

PRELIMINARY CHECKS

1. Verify the transmitter is operating without fault at the licensed RF output power in FM+HD or HD mode, with standard modulating audio present.
2. Observe (maximize the display size) and save the AUI's existing Spectrum instrument panel (set to display transmitter output) and record the meter readings for Controller - DC-RF Efficiency and Controller - PA Volts (see [Menu - System Review](#)). Save the Spectrum display by remotely connecting to the AUI and using your keyboard's Print Screen button to copy the image, then paste the image into a compatible application (Paint, Word, etc.). The spectrum plot should indicate at least 3 dB of margin between the IBOC intermodulation products and the blue mask limit lines (see [Figure 4.2 on page 4-13](#)). Maximize the spectrum display size and measure points on the spectrum plot using the cursor (see ["Spectrum analyzer" on page 2-17](#) for details).

IMPROVING PERFORMANCE

1. From the transmitter's AUI, select **Local** control and then go to the **Menu - Presets** page. The active preset is displayed.
2. Click in the HD PA Volts field in the Mode section (see [Figure 4.2 on page 4-13](#)) and reduce the voltage value by 1 V (e.g., change 48.0 to 47.0). Press **Activate**.
3. Observe the Spectrum instrument panel again. Repeat [Step 2](#), as necessary, until the Spectrum's intermodulation products are within 3 dB of the blue mask limit line or at -77 dBc.
4. Verify that the Controller - DC-RF Efficiency meter reading has increased from the value recorded in [Step 2](#) of ["Preliminary checks"](#).
5. Repeat this procedure for all FM+HD or HD presets and if the licensed power level changes.

Figure 4.2: Spectrum Analyzer plot on AUI



Figure 4.3: Presets Page - Adjusting HD PA Volts setting



CHANGING THE RF OUTPUT CONNECTOR

If you need to change the size of the RF output connector, replace it as follows:



Note:

Nautel configures the transmitter with the customer's pre-ordered RF output connector. There are various factors that determine the appropriate size of the RF output connector, such as site location (altitude), power level, and available coaxial cable. The coaxial cable must be the same size as the RF output connector to physically fit together.

INTERVAL

As required.

PARTS AND TOOLS

Coaxial cable or hardline that matches new connector size, complete with field flange and inner male (bullet) connector.

Connector kit, available from Nautel. As a minimum, the following options are available:

- 3-1/8 inch EIA, M6 hardware (kit # 206-5225)
- 1-5/8 inch EIA, M6 hardware (kit # 206-5226); standard for NV5/NV3.5
- 7/8 inch EIA, M6 hardware (kit # 206-5227)

PROCEDURE

Take the following steps to change an NV5/NV3.5 RF output connector (See Figures 4.1, 4.2 and 4.3 as guides for assembly and disassembly):

1. Determine the size of the new RF output connector and order the appropriate kit from Nautel (see ["Parts and tools"](#) for options).
2. Unpack the new connector kit and inspect the parts for damage.
3. Turn off the transmitter and disable or lock out its ac power source.
4. Remove the old RF coaxial feed cable from the RF output connector, noting it is secured using 3/8 or 5/16 hardware.
5. Remove the old output plate and spacer plates, noting the plates are secured together as well as to the output power probe using eight M6 screws. Retain all hardware. If a 7/8 inch EIA

connector was installed, you will first need to remove the adapter secured to the output plate (see [Figure 4.6 on page 4-18](#)). If you are changing from between a 1-5/8 inch and 7/8 inch EIA connector, you need only add or remove the adapter (Nautel Part # JS59). In this case, proceed to [Step 9](#).

6. Remove the old output connector cup, noting it is secured to the output power probe with an M6 hex screw.
7. Install the new output connector cup using an M6 hex screw.
8. Assemble the new spacer plates and output plate together using hardware retained in [Step 5](#). Install the plates on top of the transmitter and secure to the output power probe using hardware retained in [Step 5](#). If a 7/8 inch EIA connector is being installed, you will also need to secure the adapter to the output plate (see [Figure 4.6 on page 4-18](#)).
9. Install the new coaxial RF feed cable on the new RF output connector using the 3/8 or 5/16 studs on the stud plate.

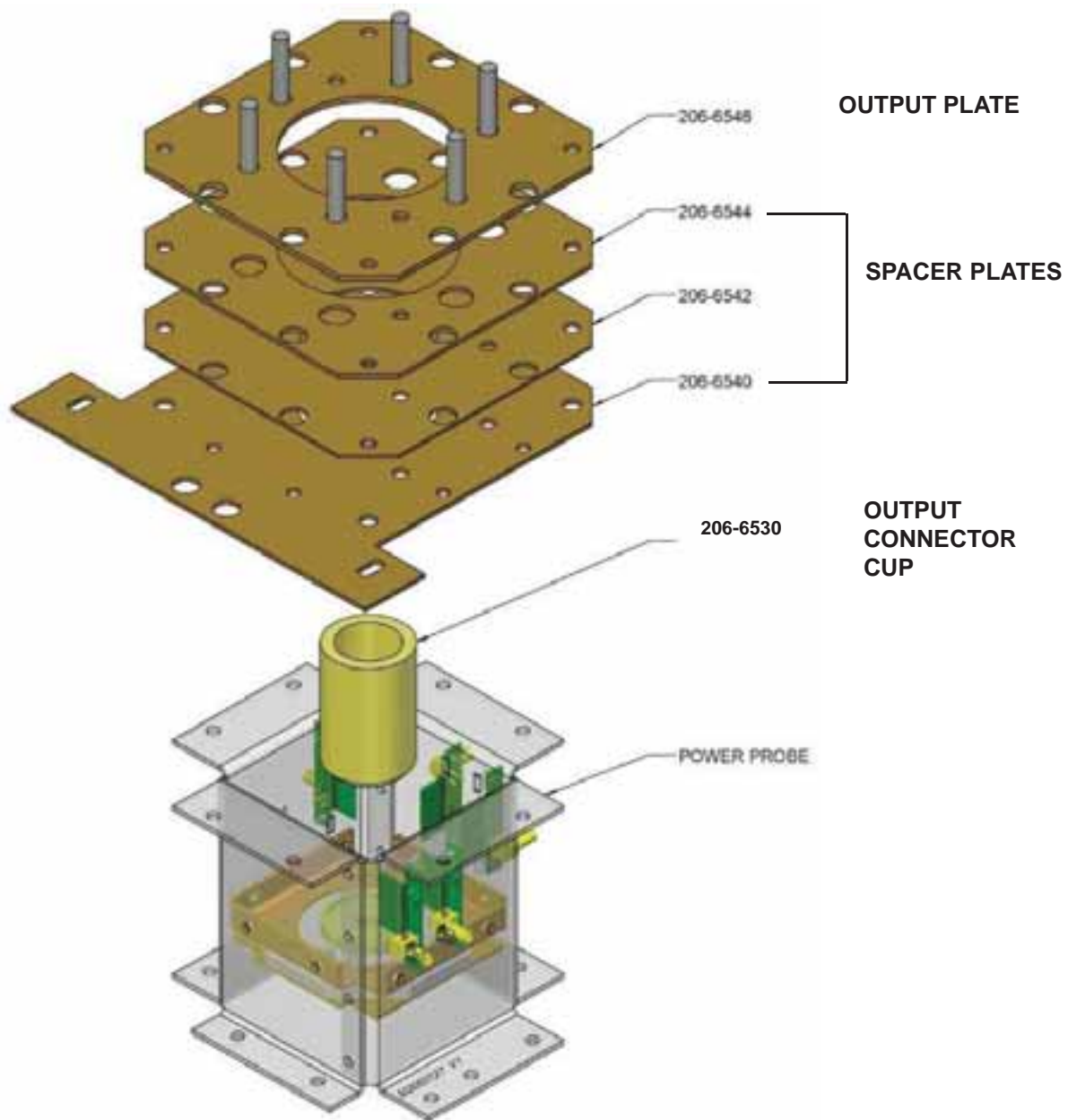
Figure 4.4: RF Output Connector Assembly Detail - 3-1/8 inch EIA

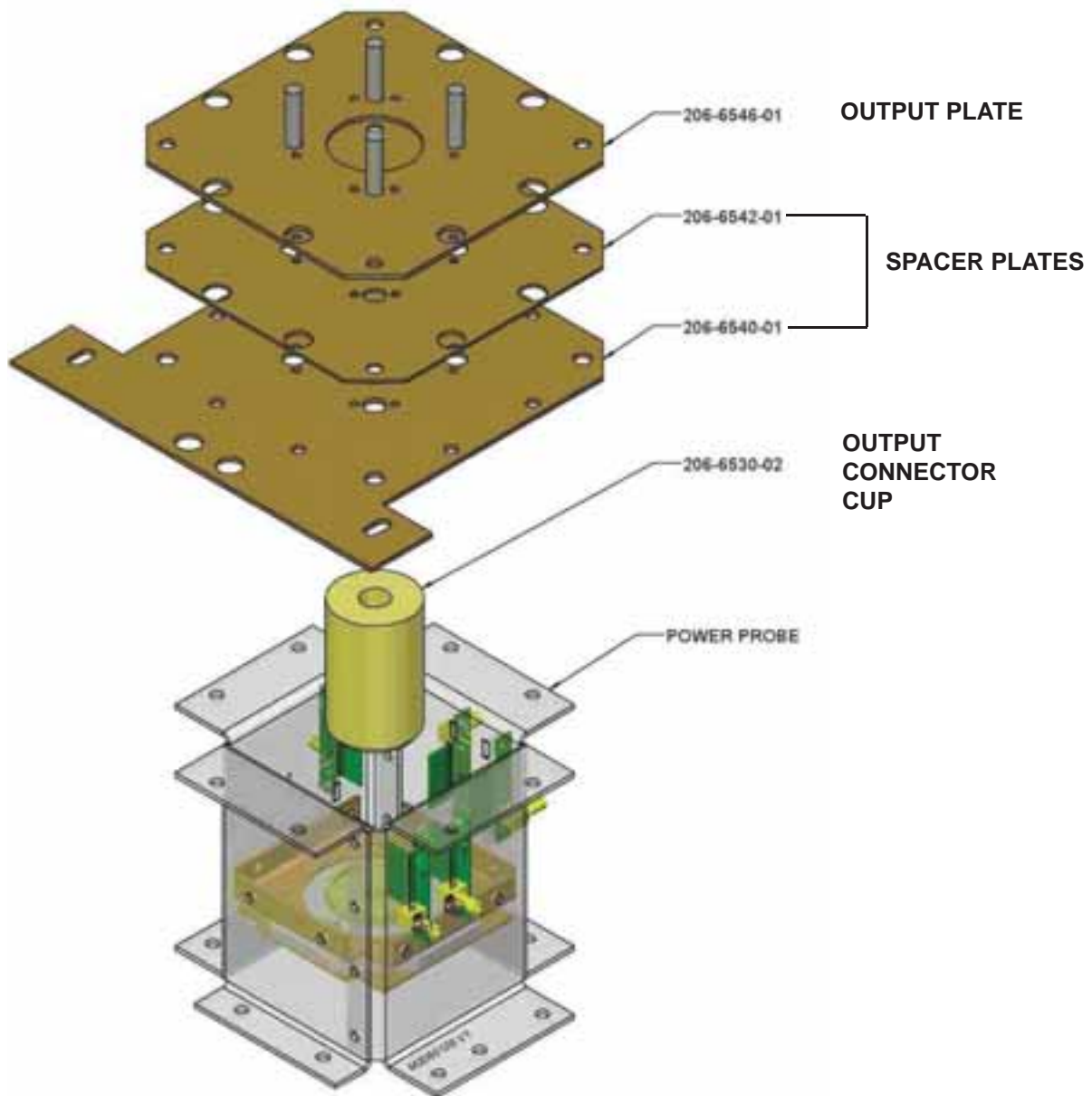
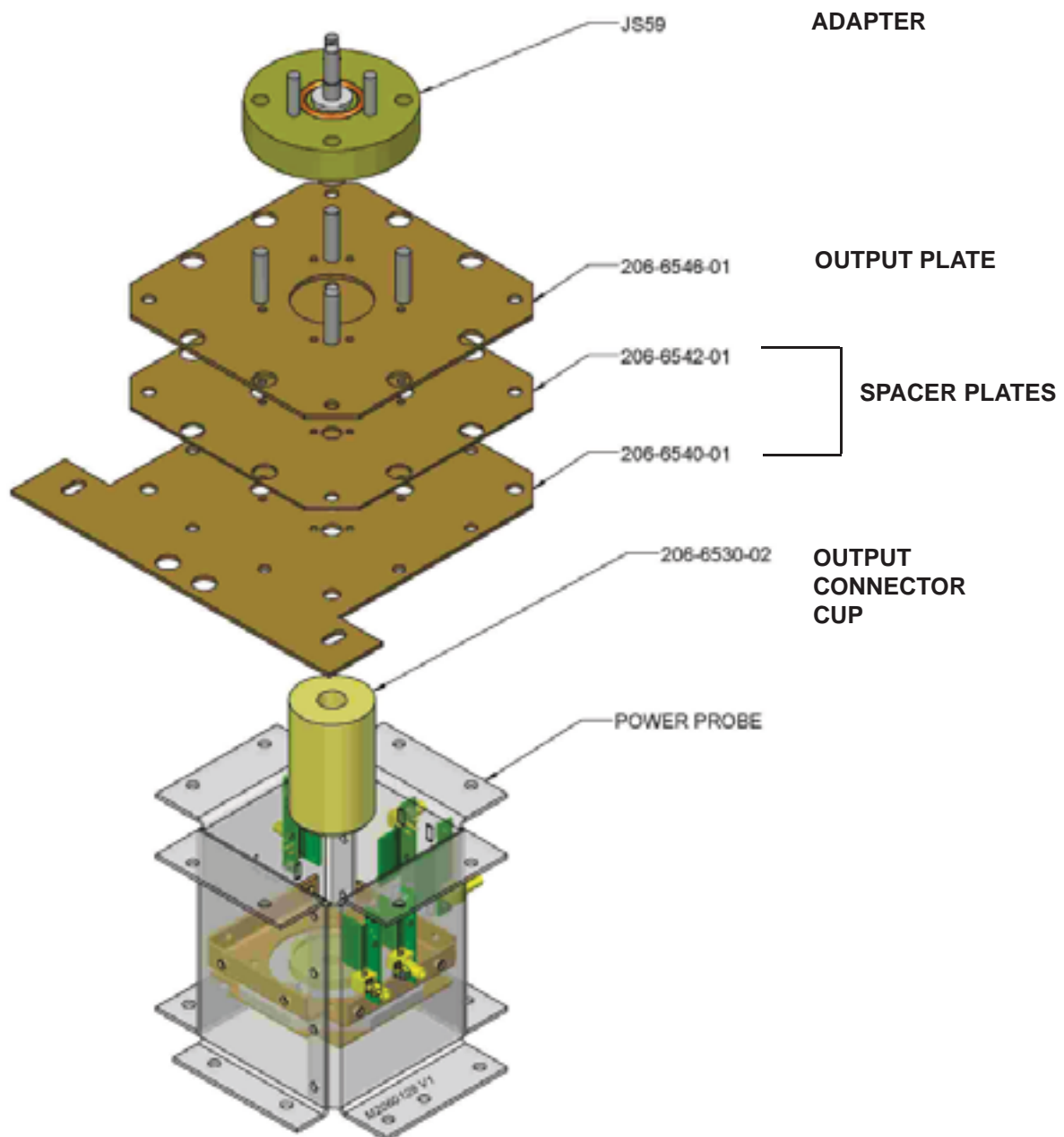
Figure 4.5: RF Output Connector Assembly Detail - 1-5/8 inch EIA

Figure 4.6: RF Output Connector Assembly Detail - 7/8 inch EIA

BYPASSING THE UPS INTERFACE OPTION

If you wish to bypass the UPS interface assembly (i.e. disable use of a UPS source), proceed as follows:

INTERVAL

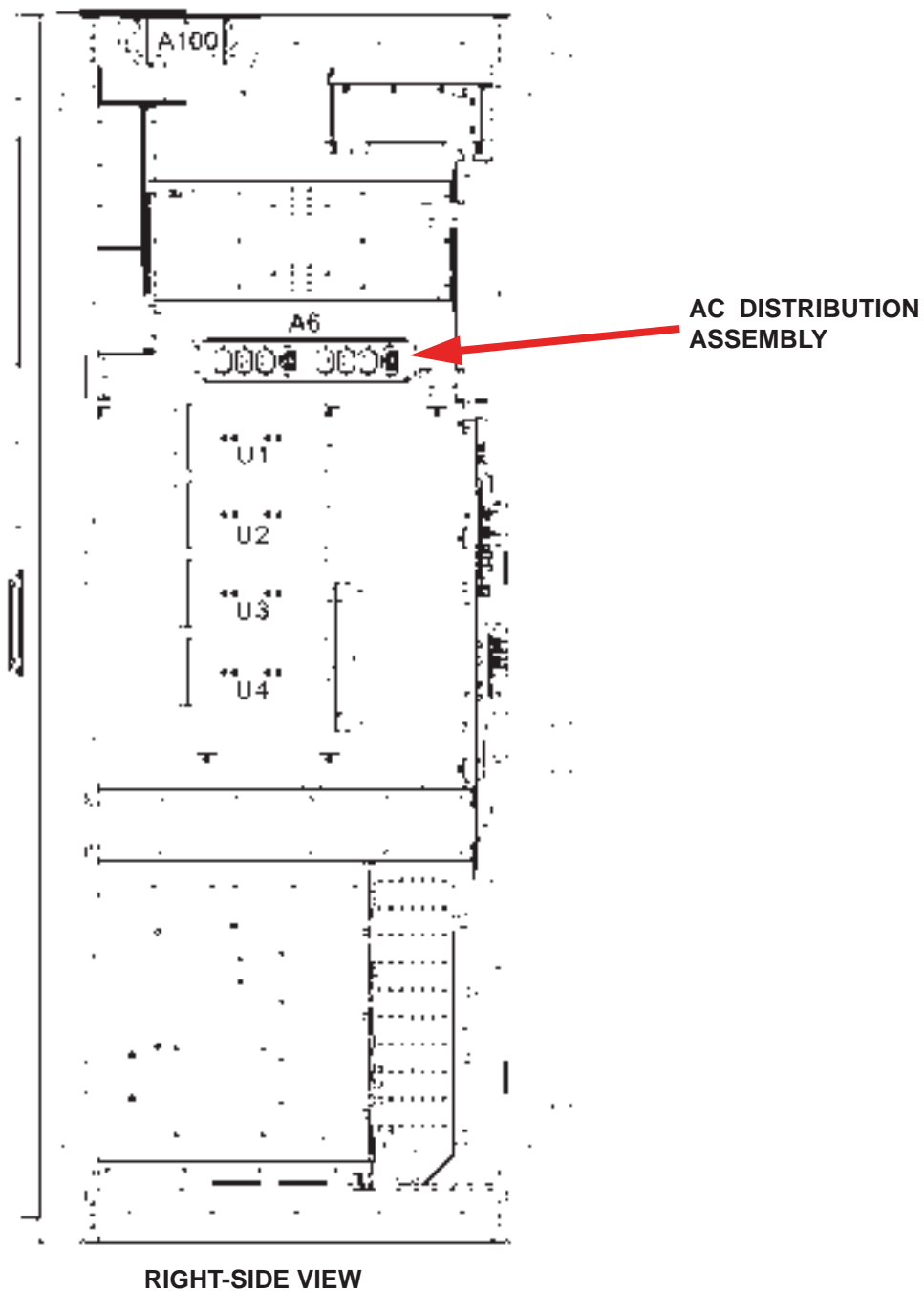
As required.

PARTS AND TOOLS

None.

PROCEDURE

1. Disconnect any user-provided ac power cables connected to the UPS interface assembly at the top of the transmitter.
2. Turn off the transmitter and disable or lock out its ac power source.
3. Open the rear door of the transmitter.
4. Locate the ac power distribution assembly (A6) (see [Figure 4.6 on page 4-19](#)). Disconnect ac power cables A100W1P2 and A100W2P2 from A6J1 and A6J5 respectively.
5. Locate ac power cables P1 and P4 that are tyrapped into the transmitter's cable harness, near the ac power distribution assembly. Cut the securing tyraps and connect P1 and P4 to A6J1 and A6J5 respectively. Neatly secure the connectors A100W1P2 and A100W2P2 into the cable harness.
6. Close the rear door of the transmitter.
7. Enable the ac power source and turn on the transmitter. Resume desired operation.

Figure 4.7: Ac Distribution Assembly Location

SECTION 5: LIST OF TERMS

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

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

AUI. The Advanced User Interface is the 17-inch front panel that allows for extensive control and monitoring of the transmitter.

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

DHCP. Dynamic Host Carrier Protocol.

DSP. Digital Signal Processing.

EEPROM. Electrically Erasable Programmable Read-Only Memory.

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

HD RADIO. High Definition (HD) Radio is another term for In-Band-On-Channel (IBOC) technology. HD Radio is a trademark of iBiquity Digital Corporation.

IBOC. Nautel In-Band-On-Channel technology provides high quality digital audio over existing FM radio channels.

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

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

LUT. Look-Up Table.

PRESET. A setting that controls power level, frequency and audio parameters. The NV5/NV3.5 allows you to pre-program multiple presets.

PWB. Printed Wiring Board.

SBC. Single Board Computer. Refers to the CPU and associated components located on the back of the transmitter's front door.

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

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

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

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

NV5/NV3.5

OPERATIONS AND MAINTENANCE MANUAL

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