VSHD Exciter

FOR USE WITH VS SERIES TRANSMITTERS

Technical Instruction Manual

Issue 2.0 ..... 04 May 2017

Nautel Limited
10089 Peggy's Cove Road,
Hackett's Cove, NS, Canada B3Z 3J4
T.877 6 nautel (628835) or +1.902.823.2233
F.+1.902.823.3183 info@nautel.com

U.S. customers please contact:
Nautel Inc.
201 Target Industrial Circle, Bangor ME 04401
T.877 6 nautel (628835) or +1.207.947.8200
F.+1.207.947.3693 info@nautel.com

e-mail: support@nautel.com
www.nautel.com

Warranty

by Nautel Limited/Nautel Inc. (herein after referred to as **Nautel**)

Nautel guarantees all mechanical and electrical parts of Nautel Transmitters for a period of forty eight months, and all other Nautel manufactured equipment (including Importers and Exporters) for a period of twelve months from date of shipment, provided the equipment has been installed, operated and maintained in accordance with Nautel's recommendations, and the equipment has not been misused, neglected or modified. Nautel's liability is limited, at the absolute discretion of Nautel, to repairing or replacing returned equipment that to the satisfaction of Nautel has been found defective.
Warranty for third-party items is provided by the Original Equipment Manufacturer. Exercise of such warranty shall be between the Buyer and the Third-Party.

1. Properly qualified technical personnel must install, maintain, and repair the equipment in accordance with Nautel recommendations and good engineering practice.

2. A "Part Failure" shall be deemed to have occurred when the part has become defective, or does not have the characteristics required for the specified equipment performance:

    a. when the equipment is operated within the design parameters, and
    b. when the equipment is installed and adjusted according to Nautel's prescribed procedures as stated in the instruction manual.

3. Nautel shall provide replacements for all "Parts" to the Buyer when they become defective during the warranty period, and upon the return of the defective part. Replacement parts warranty to be 90 days or end of original warranty; whichever comes first.

4. If the Buyer receives a replacement module, as part of Nautel's module exchange program, the old module must be returned to Nautel within 30 days of receipt of the new module, at the buyers expense. If the old module is not received after 30 days, the customer will be invoiced. The buyer is responsible for installing the replacement/repaired module in the transmitter.

5. In the event that a "Part" fails during the warranty period and causes damage to a subassembly which cannot be readily repaired in the field, the entire subassembly so damaged may be returned to Nautel for repair. The repairs will be made without charge to the Buyer.

6. Written authorization must be obtained before returning any equipment or goods for any reason. Equipment or goods returned under this warranty shall be delivered to Nautel's premises at the Buyer's expense. Where no-charge warranty replacements or repairs are provided under items 2, 3, 4, or 5, Nautel will pay that part of the shipping costs incurred in returning the part/assembly to the Buyer. Note: the Buyer is responsible for any and all import fees, duties or taxes.

7. Nautel does not warrant or guarantee, and will not be liable for:

    a. defects or failures caused in whole or in part by abuse, misuse, unauthorized repair attempts, unauthorized alteration or modification of the equipment;
    b. equipment built to customer specifications that is later found not to meet customer needs or expectation;
    c. performance of equipment when it is used in combination with other equipment not purchased, specified, or approved by Nautel;
    d. damages and performance limitations due to outside forces such as lightning, excessive heat or cold, excessive AC surges or high corrosive environments;
    e. changes made by personnel other than Nautel authorized personnel, including charges incurred; and
    f. for any costs for labor performed by the customer without Nautel's prior written approval.

8. Nautel does not warrant that software:

    a. is free of errors, bugs or defects;
    b. will be compatible with third party software;
    c. results, output or data provided through or generated by the software are accurate, complete, or reliable; and
    d. errors found will be corrected.

9. Nautel shall have the right and shall be provided full access to investigate whether failures have been caused by factors beyond its control.

10. In no event shall Nautel be liable for any consequential damages arising from the use of this equipment

11. This warranty is in lieu of all other express warranties of Nautel, whether express or implied, and Nautel does not assume, nor is any other person authorized to assume on Nautel's behalf, any other obligation or liability.

12. Third party items ordered, the guarantee/warranty of these items will be from the manufacturer of these items. Exercise of such warranty shall be between the Buyer and the third party provider.

13. Nautel provides telephone and email support for its products for the life of the product at no charge. After the warranty period, parts and on-site support for the equipment are offered at a rate to be determined upon request.

Customer Service Notice

A ‘Technical Assistance’ and ‘Plug-in Module Exchange’ service is available to Nautel users.

All equipment being returned to Nautel and all requests for repairs or replacements should be marked with a Nautel provided RMA number and addressed to the appropriate Nautel facility:

Nautel Limited 10089 Peggy's Cove Road Hackett's Cove, NS, Canada B3Z 3J4 Tel: 902-823-2233/Fax: 902-823-3183	Nautel Inc. 201 Target Industrial Circle Bangor, ME, USA 04401 Tel: 207-947-8200/Fax: 207-947-3693
24 Hour Answering Service (902) 823-3900	Toll Free (877) 662-8837

Factory Support

TECHNICAL ASSISTANCE

Nautel's field service department provides telephone technical assistance on a 24 hour, seven days a week basis. Requests by other media (facsimile or e-mail) will be responded to the next working day if received after Nautel's normal working hours. Contact the appropriate field service centre from the following:

U.S.A. customers use:	Nautel Incorporated 201 Target Industrial Circle Bangor, Maine 04401	T. +207-947-8200 (24 hours) or 877 6 nautel (628835) F. +207-947-3693
All other customers use:	Nautel Limited 10089 Peggy's Cove Road, Hackett's Cove, NS, Canada B3Z 3J4	T. +902-823-3900 (24 hours) or 877 6 nautel (628835) F. +902-823-3183 E-Mail support@nautel.com Web www.nautel.com

MODULE EXCHANGE SERVICE

In order to provide Nautel customers with a fast and efficient service in the event of a problem, Nautel operates a factory rebuilt, module exchange service which takes full advantage of the high degree of module redundancy in Nautel equipment. This module exchange service is operated from Nautel's factory in Bangor, Maine and Hackett's Cove, Nova Scotia. These two locations allow us to provide a quick turn around service to keep our customers on the air. During the transmitter's warranty period, up to thirteen months from shipment, repair and exchange of modules is at no charge to the customer. When the warranty has expired, a charge of 80% of the list price for all exchanged modules is made. If the faulty module is returned to Nautel within 30 days, a credit is issued reducing this charge by one half to 40% of the list price. U.S.A. customers are required to contact our Bangor, Maine facility. Canadian and overseas customers should contact our Nova Scotia, Canada facility.

EQUIPMENT BEING RETURNED TO NAUTEL

For all equipment being returned to Nautel and all requests for repairs or replacements:

- Obtain an RMA number from Nautel (you must have an RMA number to return equipment)
- Mark the item as 'field return'
- Mark the item with the RMA number assigned by Nautel
- Address the item to the appropriate Nautel facility

Complete and accurate information regarding the equipment being returned will ensure prompt attention and will expedite the dispatch of replacements. Refer to the nameplate on the transmitter and/or the appropriate module/assembly to obtain name, type, part and serial number information. Refer to the parts list of this manual or the appropriate service instruction manual for additional ordering information.

The following information should accompany each request:

* Model of Equipment
* Serial number of Equipment
* Name of Part/Assembly
Serial number of Part/Assembly
* Complete reference designation of Part/Assembly
* Nautel's part number of Part/Assembly
* OEM's part number of Part/Assembly
Number of hours in Use
Nature of defect
* Return shipping address

* Denotes minimum information required to order spare/replacement parts

Information to the User

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Contents Page

List of Tables

List of Figures/Drawings

Release Control Record

Issue	Date	Reason
2.0	4 May 2017	New hardware release of product (NAE103B)

VSHD Exciter
TECHNICAL INSTRUCTION MANUAL

Section 1 OVERVIEW

1.1 INTRODUCTION
The VSHD exciter (see Figure 1-1) provides a high quality VHF, frequency modulated, RF signal, designed to integrate with a VS series transmitter for IBOC transmission in either all-digital or hybrid modes. The VSHD exciter is frequency agile, requires no tuning for operation between 87.5 MHz and 108 MHz, and is capable of operation up to 50 W (in analog mode). Using 'direct-to-channel' conversion of the audio, the VSHD exciter provides superior signal reproduction and eliminates problems related to aging, microphonics, and filtering. Audio source options include AES/EBU (XLR), analog L/R, two modulated SCA inputs, two unmodulated SCA inputs, RBDS/RDS generator, and composite (balanced or unbalanced). The VSHD also accepts an internet playlist as a backup audio stream from the VS transmitter via a secondary AES/EBU input and provided cable.

The VSHD exciter has no user interface. It is controlled, locally or remotely, via the associated VS series transmitter's front panel display or remote AUI. Operation of additional menu screens and selection options that are not included in the VS transmitter's technical documentation are covered in this manual.

The VSHD exciter can be purchased and shipped with a VS series transmitter or provided as an HD upgrade. In the case of an upgrade, Nautel provides the Exgine hardware and DTS (formerly iBiquity Digital Radio) software required to broadcast your signal in HD.

Refer to Section 6 of this manual for electrical schematics of the VSHD exciter and VS transmitters that outline the electrical differences when configured for HD operation.

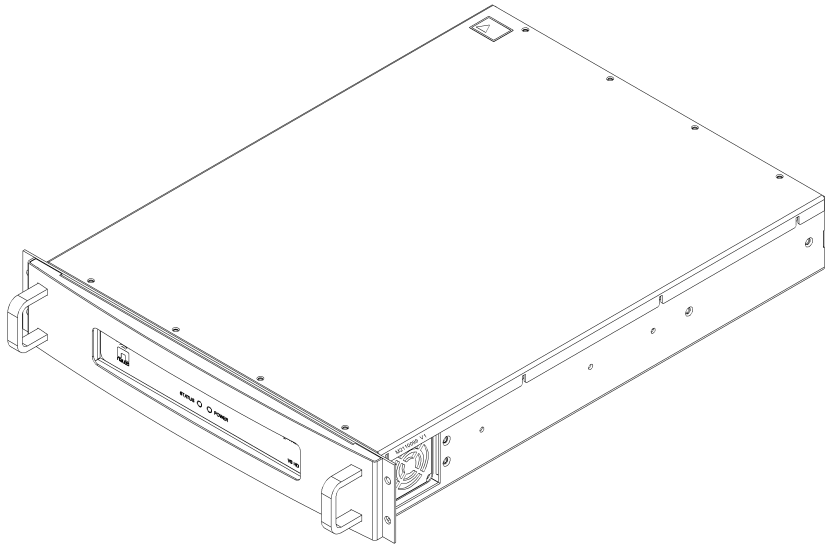


Figure 1-1: VSHD Exciter

1.2 FACTORY SUPPORT

Nautel provides after sales factory support. Technical assistance is available on a 24 hour, seven days a week basis. A factory service facility for repair of modules/assemblies is also available. Refer to the *Factory Support* portion of the *Warranty* pages at the front of this manual for additional information.

1.3 PURPOSE AND SCOPE OF MANUAL

This manual provides the information required to install, operate and maintain the exciter.

1.4 PURPOSE OF EQUIPMENT

The VSHD exciter is intended for use in conventional FM and/or HD Radio broadcasting stations. Remote control facilities are incorporated to allow unattended operation from a remotely located station studio.

1.5 MECHANICAL DESCRIPTION

The VSHD exciter is contained in a standard 19-inch rack mountable unit.

1.5.1 Dimensions

The VSHD exciter is an EIA standard rack mountable unit that measures 19 inches (483 mm) wide, 3.5 inches (89 mm) high (2RU), and 22 inches (559 mm) deep. All VS transmitter interconnections and user interface connections are made on the rear panel of the exciter.

1.5.2 Clearances

Ensure that the clearances at the front and the rear of the VSHD exciter's host cabinet allow sufficient room for easy installation and operation. Allow sufficient clearance on the sides of the VSHD exciter for adequate ventilation.

CAUTION

Do not block the vents in the side of the VSHD exciter. This is especially important in higher ambient temperature environments.

1.5.3 Weights

The VSHD exciter weighs approximately 19 lbs (8.6 kg).

1.6 COOLING REQUIREMENTS

The maximum chassis temperature of the VSHD exciter must not exceed 50°C (122°F). To satisfy this requirement:

Do not allow the VSHD exciter's room ambient air temperature to exceed 40°C (104°F) at sea level. De-rate 3ºC (5.4ºF) per 500 m – or 2ºC (3.6ºF) per 1,000 feet – above sea level.

Example:
At 1,600 m (1 mile) above sea level, the maximum ambient temperature should not exceed 30.4°C (87°F). Cooler temperatures are recommended, in order to improve the reliability of VSHD exciter.

If the VSHD exciter is used in high ambient temperature environments, make sure that all of its ventilation holes are completely free of blockage.

1.7 TRANSMITTER HARDWARE MODIFICATIONS

To operate in IBOC mode, the VS transmitter had to be modified from its original configuration to work with the VSHD exciter. RF drive for the VS transmitter system is provided by the VSHD Exciter for IBOC operation. The following modifications were implemented for VS transmitters at the factory prior to shipping or via modifications defined in the associated Information Sheet or Field Modification if an HD upgrade was performed in the field. Refer to following documents:
IS11004 (VS1)
IS11005 (VS2.5)
FM11005 (VS300)

VS300

The Pre-Amplifier (A4) must be bypassed during IBOC operation. This is accomplished by removing the RF drive cable connecting the Pre-amp to the Power Amplifier. For pre-correction to work properly, an 8 dB Attenuator assembly (A9) has been installed between the RF Drive of the VSHD Exciter and the Power Amplifier.
The Power Amplifier (A5) has L1 on the PA PWB removed for proper IBOC operation.

VS1

The internal RF drive cable that connects to RF Output (J14) of the Exciter/Control PWB (A1) has been re-routed to the external RF drive connector on the rear panel of the VS1. The IPA output cable has been disconnected from the Splitter PWB (A4) at pads '**S**' and '**R**' and tied back. The RF drive cable from the Pre-Amp/IPA PWB (A5).has been re-routed to the Splitter PWB (A4) at pads '**S**' and '**R**'.
Power amplifiers A6 through A9 have L1 removed on all PA PWB's for proper IBOC operation.

VS2.5

The internal RF drive cable that connects to RF Output (J14) of the Exciter/Control PWB (A1) has been re-routed to the external RF drive connector on the rear panel of the VS2.5. The IPA output cable has been disconnected from the Splitter PWB (A4J8) and tied back. The RF Drive cable at the Splitter input (A4J7) has been re-routed to A4J8.

Refer to Electrical Schematics, Figures 6-2 to 6-7 in Section 6.

VSHD Exciter
TECHNICAL INSTRUCTION MANUAL

Section 2 INSTALLATION

2.1 ENVIRONMENT REQUIREMENTS
Consider the following requirements when preparing to install the VSHD exciter.

2.1.1 Work Area
Nautel recommends that you provide a suitable work area with an adequate table surface adjacent to the VSHD exciter or host cabinet to permit bench adjustment/repair.

2.2 NON-TECHNICAL PRE-COMMISSIONING
On delivery of the VSHD exciter, complete the following non-technical procedures:

NOTE

Non-technical procedures are defined as being those procedures that do not require technical knowledge of exciter circuits or their operation to complete.

2.2.1 Acceptance of Shipment
Inspect all shipments for transit damage prior to acceptance.

2.2.2 Unpacking/Preparation for Installation
Adhere to any warnings or instructions posted on the shipping container. Packing lists provide detailed listings of shipment contents. Test results shipped with the exciter may be required in later steps. Remove the VSHD exciter from the shipping container and prepare for installation as follows:

Remove all plastic cap-plugs from BNC connectors on the rear of the exciter.

Verify that your associated VS transmitter has been physically modified to operate in conjunction with the VSHD exciter.

- If you received the VSHD exciter together with the associated VS transmitter, no verification is required. All physical modifications were performed at the factory.
- If you received the VSHD exciter for a pre-existing VS transmitter, perform the instructions in the appropriate Nautel Information Sheet [IS11004 (for VS1), IS11005 (for VS2.5) or FM11005 (for VS300)] before proceeding. If you are unsure of this requirement, contact Nautel.

2.2.3 Mounting in Equipment Rack

When mounting the equipment in a standard 19” equipment rack, provide adequate support at the bottom of the VSHD exciter. The VSHD exciter cannot support itself through front panel mounting only. New rail mounting hardware is provided. Airflow and cooling must also be considered. For ease of interconnection with the associated VS transmitter (interconnecting cables are provided by Nautel and are fixed length), mount the VSHD directly above or below the VS transmitter.

The following instructions detail how to mount the VSHD in a cabinet. Use the parts provided in the Packing Supplies (see Table 2-1) to install the VSHD exciter.

Table 2-1: Packing Supplies, VSHD Exciter – Nautel Part # 211-8981-01

ITEM #	LETTER	QTY	NAUTEL PART #	DESCRIPTION
2	-	1	211-3005	Ancillary Kit, VSHD
3	-	1	211-8982-01	Installation Kit, VSHD
4	E	2	211-8042-01	Slide Bracket 1
5	C	2	211-8044-01	Slide Bracket 2
6	A & B	1	HAS79	Slide Pair, Telescopic
7	D	2	211-8044-02	Slide Bracket 3

Tools Required:
1 and # 2 Philips head screwdrivers
7 mm nut driver (suitable for M4 hardware)

2.2.3.1 Parts Required

The following parts are required for the installation, see Figure 2-1 (included with the VSHD exciter). Parts are separately bagged and identified with their Nautel Part # (e.g., HB14). Cross-reference the Nautel Part # with the letter shown in Figure 2-1. These letters are used to identify the hardware in the following illustrations. Locate and set aside all parts before beginning. Additional parts included with your VSHD exciter are not utilized.

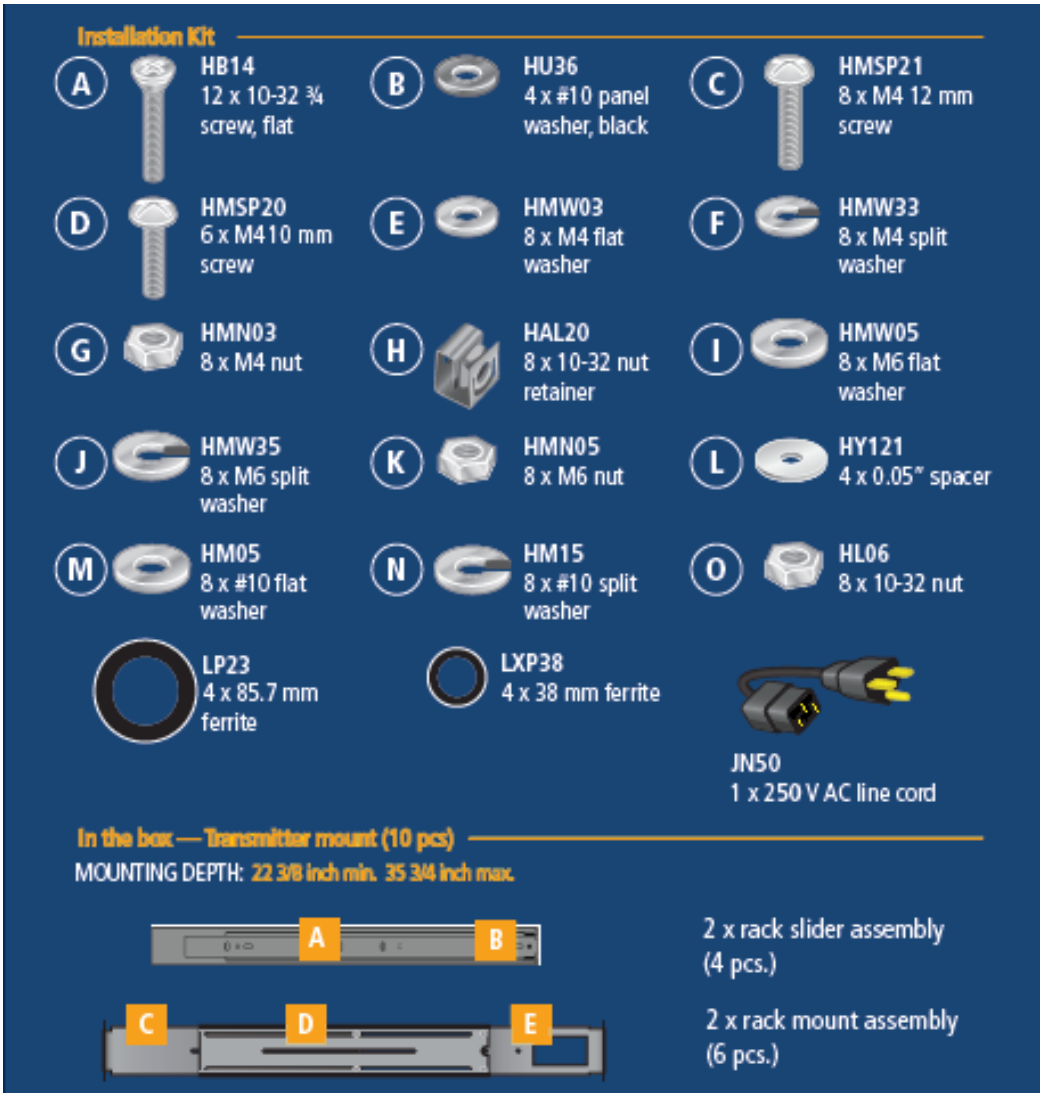


Figure 2-1: Parts required for Installation

2.2.3.2 Rack Slider Assembly

Assemble the Rack Slider as follows:

- Separate the slider assembly parts '**A**' and "**B**" by pressing the quick release button and pulling apart. See Figure 2-2.

Figure 2-2: Slider Assembly Release

- Assemble parts '**C**', '**D**' and '**E**', of the rack mount assembly. Tighten hardware connecting parts '**D**' and '**E**'. Leave the hardware connecting parts '**C**' and '**D**' finger tight to allow for rack depth adjustment. When the rack depth is known, tighten the hardware and repeat for the opposite side. See Figure 2-3.

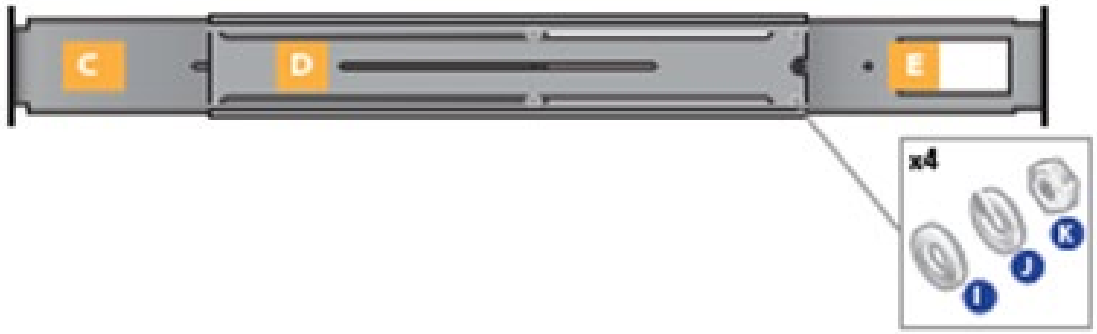


Figure 2-3: Rack Slider Assembly

- Attach part '**A**' of the rack slider to rack mount assembly parts '**C**', '**D**' and '**E**'. Repeat for the opposite side and tighten all hardware. See Figure 2-4.

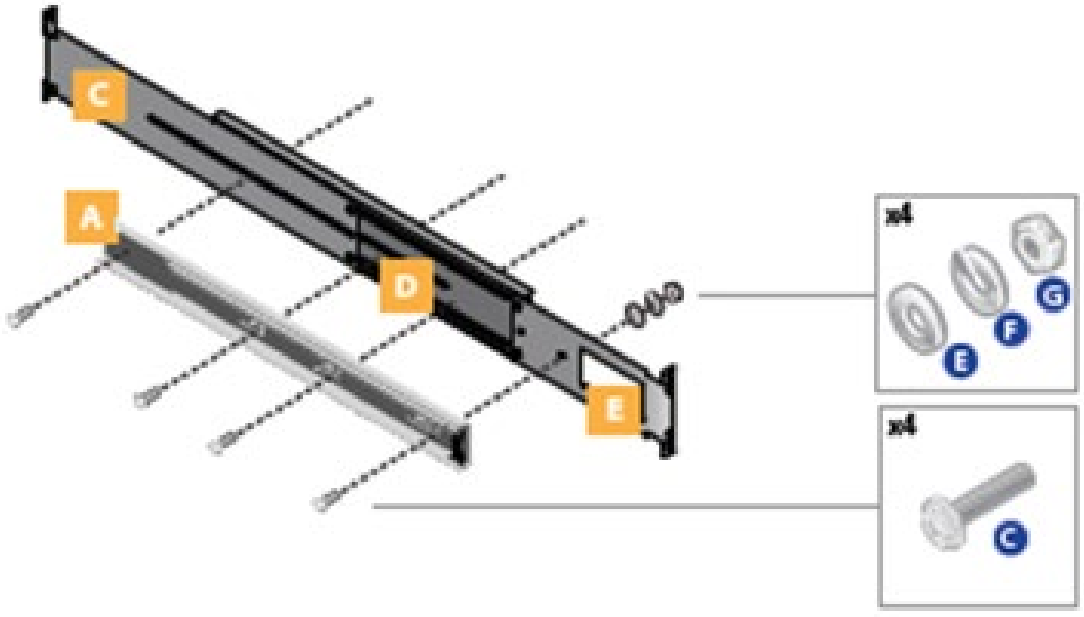


Figure 2-4: Slider Assembly to Rack Mount

NOTE

*Use spacer 'L' between slider and rack mount assembly as necessary to secure hardware passing through part '**D**' only.*

- For Nautel racks, install eight nut retainers '**H**' on the rack rails to align with four holes in the front of each rack mount assembly. Install four '**A**' screws in the outside nut retainers and tighten. Non-Nautel (threaded) racks do not require the nut retainers. See Figure 2-5.

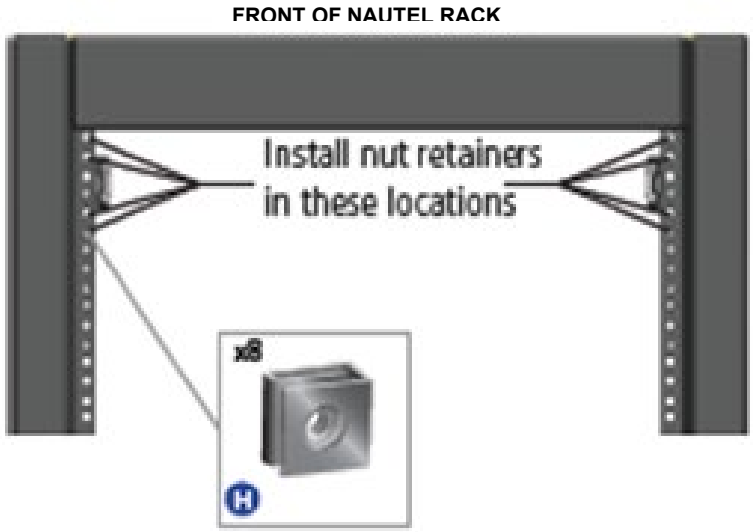


Figure 2-5: Installing Nut Retainers

2.2.3.3 Mounting the Slides

- Install the slide bracket on the screws against the back of the nut retainers (if used) and install securing hardware '**M**', '**N**', and '**O**'. Secure the rack mount assembly to the rack rear using four '**A**' screws and '**M**', '**N**', and '**O**' securing hardware. Tighten all hardware. See Figure 2-6.

NOTE

Front screws may have been installed in the previous step.

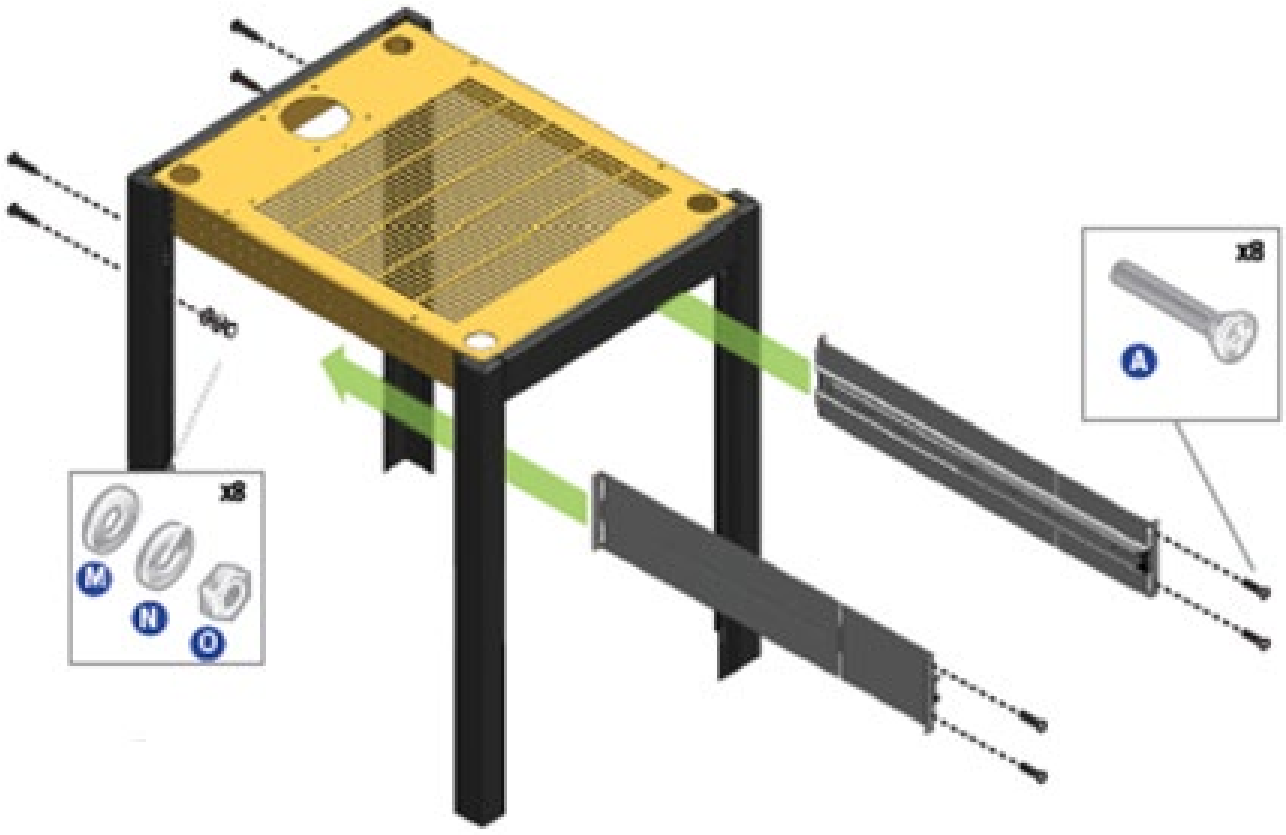


Figure 2-6: Mounting the Slides

NOTE

Before mounting the VSHD exciter in its host rack, refer to paragraph 2.3.3.1.3 to determine if it is necessary to configure the MPX input's jumper setting.

2.3.3.4 Mounting the VSHD Exciter

- Attach part '**B**' of the rack slider assembly to the exciter, ensuring correct orientation.

  See 1 .

  Once mounted in the rack, secure the exciter using '**A**' screws and '**B**' washers. See Figure 2-7.

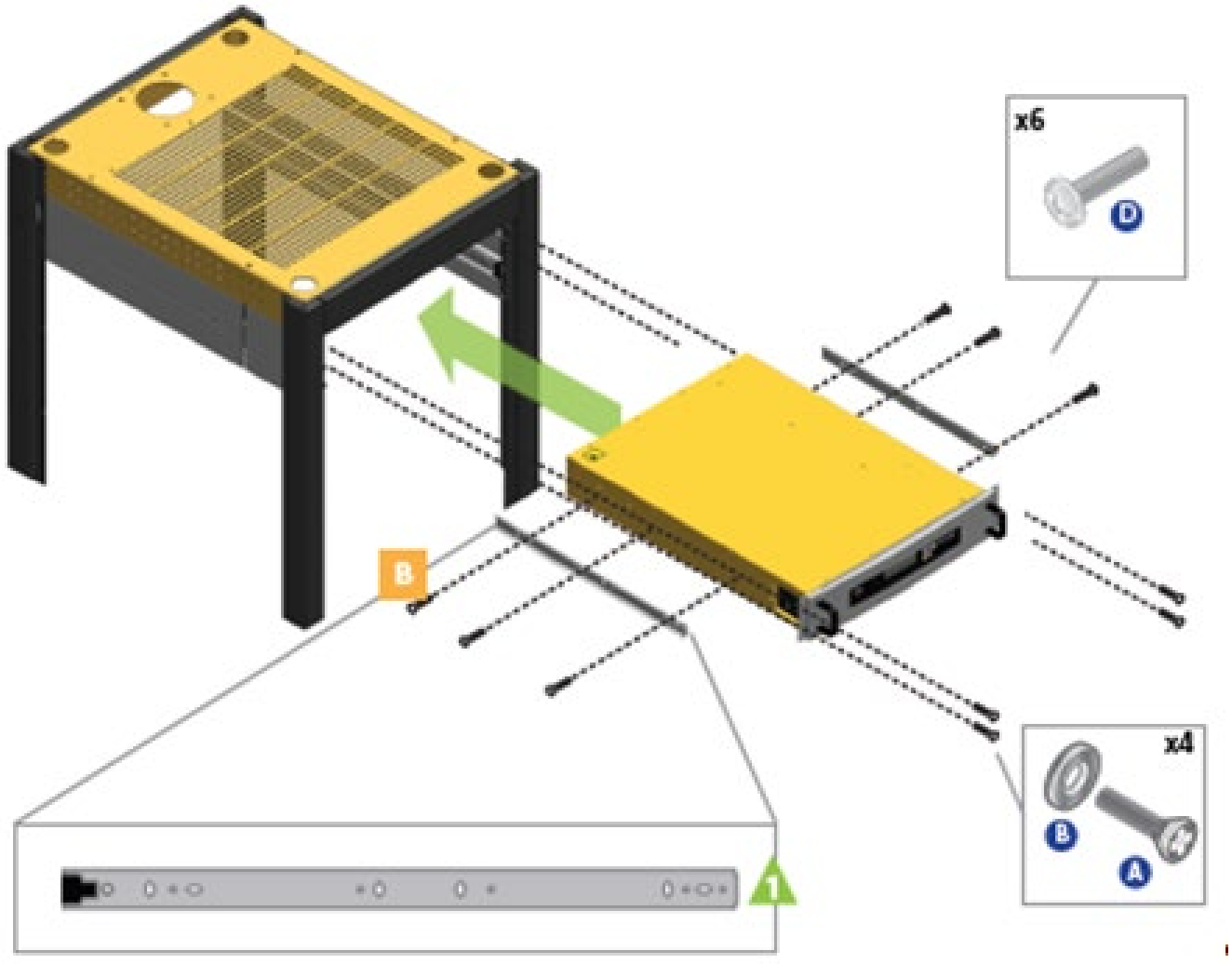


Figure 2-7: Mounting the VSHD Exciter

2.3 TECHNICAL PRE-COMMISSIONING

2.3.1 Electrical Power Connection

The VSHD exciter operates from a 100 – 240 V ac, 50/60 Hz, single-phase power source. The **AC INPUT (U1)** connector is located at the rear of the exciter (see Figure 2-8). Pass the line cord through a ferrite toroid a minimum of two complete turns around the toroid. Ferrite toroids (Nautel Part # LP23) and an ac line cord (Nautel Part # JN50) are included in the Installation Kit (Nautel Part # 211-8982-01) with the VSHD exciter.

It is highly recommended that the ac power source for the exciter is taken from a suitably rated uninterruptible power supply (UPS) with surge protection. This will ensure the exciter's continuous operation during short power outages and greatly reduce the risk of software corruption and failures.

2.3.2 Safety Ground Point Connection

The VSHD exciter has a safety ground post (E1) on its rear panel (see Figure 2-8). The ground post is a metric M5 thread. Connect the safety ground point of the VSHD exciter to the station's common point reference ground through a single isolated conductor. The conductor should be a low-impedance copper conductor (minimum ¾" braid, 4-inch strap or 0 AWG wire).

NOTE

Do not connect the VSHD exciter's ground point to the VS transmitter's safety ground stud. External equipment ground points should be avoided to reduce the risk of unwanted currents and transients affecting the exciter. Refer to the 'Recommendations for Transmitter Site Preparation' document supplied with all Nautel transmitters. This document outlines proper site layouts and common point grounding.

2.3.3 Program Input Connections

The VSHD exciter accepts a variety of analog and digital program inputs. This paragraph describes the requirements associated with the audio feeds to the exciter. All connections are made at the rear of the exciter (see Figure 2-8). Where D-sub connectors are used as the interface, Nautel provides the associated mating connector in the ancillary kit or installation kit to facilitate customer connections.

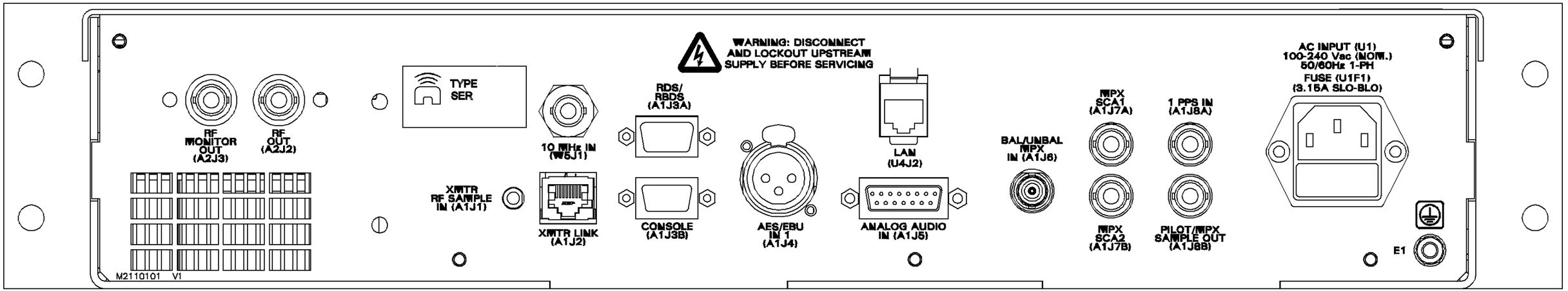
Analog inputs

- Left and Right Inputs – see 2.3.3.1.1
- SCA Generator Input – see 2.3.3.1.2
- MPX Input – see 2.3.3.1.3
- MPX SCA/RDS Inputs – see 2.3.3.1.4

Digital Inputs

- AES/EBU Input – see 2.3.3.2.1
- RDS/RBDS Generator Input – see 2.3.3.2.2
- Carrier Frequency and Pilot Phase Control – see 2.3.3.2.3

Pilot Sample Output – see 2.3.3.3



Dimensions = mm (inches)

VSHD Exciter – Rear View			
Issue 2.0	Not to Scale	Figure 2-8	Page 2-9 (2-10 Blank)

2.3.3.1 ANALOG INPUTS:

The digital exciter accepts the following analog inputs:

2.3.3.1.1 Left and Right Inputs

An analog left/right or monaural input (left only) (30 Hz to 15 kHz, -12 dBu to +12 dBu) can be applied to **ANALOG AUDIO IN** D-sub connector A1J5 [left (+ on pin 7, - on pin 8, shield on pin 15), right (+ on pin 13, - on pin 14, shield on pin 6)]. The associated VS transmitter's front panel or remote AUI allows for configuration of the audio input mode (left, right or stereo). Provision is made for adjustment of the input sensitivity and pre-emphasis. The input impedance for each input is 600 Ω. Exciters are factory configured to provide 100% modulation (± 75 kHz) with an analog L/R input level of precisely 1.24 V rms (4.7 dBu).

2.3.3.1.2 SCA Generator Input

Dual internal SCA generators can be interfaced via the **ANALOG AUDIO IN** D-sub connector (A1J5) [SCA1 (+ on pin 4, - on pin 5, shield on pin 12), SCA2 (+ on pin 10, - on pin 11, shield on pin 3)]. The input impedance is 600 Ω and the adjustment range is -12 dBu to +12 dBu. Exciters are factory configured for a 1.24 V rms (4.7 dBu) SCA generator input level.

2.3.3.1.3 MPX Input

Balanced and unbalanced wideband MPX (composite) inputs (30 Hz to 100 kHz) are provided on the **BAL/UNBAL MPX** BNC connector (A1J6). The **UNBAL/BAL** jumper (A1E1, see Figure 7-11 of this manual) inside the exciter allows selection between balanced (jumper installed between pins 2 and 3) and unbalanced (jumper installed between pins 1 and 2) mode. The default setting of this jumper is in the **BAL** (balanced) position. The levels are nominally 3.5 V pk-pk for 100% modulation (± 75 kHz) carrier deviation, and are adjustable between 1.0 V and 5 V pk-pk. The input impedance for each input is 1210 Ω.

If you are using the **BAL/UNBAL MPX IN** connector (A1J6) for an unbalanced input, remove the VSHD exciter's top cover and change the jumper setting for E1 on the exciter/control PWB (see Figure 7-11). Re-install the top cover.

2.3.3.1.4 MPX SCA Inputs

Two unbalanced inputs (20 kHz to 100 kHz) are provided on the **MPX SCA1** (A1J7A) and **MPX SCA2** (A1J7B) BNC connectors, which accept pre-modulated SCA information. The levels are nominally 2.8 V pk-pk for 10% modulation (± 7.5 kHz) carrier deviation, and are adjustable between 1.0 V and 5 V pk-pk. The input impedance for each input is 10 kΩ.

NOTE

If the MPX Input is being used as the main audio source with the MPX SCA Input enabled as well, the MPX SCA meter in the AUI and UI will display N/A.

2.3.3.2 DIGITAL INPUTS

The digital exciter accepts the following digital inputs:

2.3.3.2.1 AES/EBU Input

The VSHD exciter accepts AES/EBU digital audio via the **AES/EBU IN 1** 3-pin XLR connector (A1J4) (110 Ω balanced; supports sample rates between 20 kHz and 192 kHz). The associated VS transmitter's front panel or remote AUI allows for configuration of the audio input mode (left, right or stereo) and level (in dBFS).

A second AES/EBU option exists for use with a secondary digital audio source (e.g. Internet Playlist). This input is provided on the **ANALOG AUDIO IN** D-sub connector (A1J5; + on pin 1, - on pin 2, shield on pin 9). This input must be connected to the associated VS transmitter AES out on the **REMOTE I/O-A** D-sub connector (A1J2A; + on pin 12, - on pin 24, shield on pin 13). Nautel provides a cable (W2) in the Installation Kit (Nautel Part # 211-8982-01) with the VSHD exciter, if necessary. Both ends of this cable contain solder cup D-sub connectors, which allows the customer to install any additional wiring on the VSHD exciter's **ANALOG AUDIO IN** connector or associated VS transmitter's **REMOTE I/O-A** connector to accommodate other possible audio sources and transmitter remote controls.

NOTE

Refer to the associated VS transmitter's Operations and Maintenance Manual for more information on the Audio Player feature and its configuration.

2.3.3.2.2 RDS/RBDS Generator Input

The VSHD exciter accepts ASCII or UECP data for its internal RDS/RBDS generator via RS-232 on the **RDS/RBDS** D-sub connector (A1J3A). The data is framed and modulated on a 57 kHz sub-carrier, which forms part of the composite signal.

NOTE

The VSHD also supports stand-alone RDS/RBDS operation. In this mode, RDS/RBDS parameters are configured through the VS transmitter's AUI.

2.3.3.2.3 Carrier Frequency and Pilot Phase Control

The VSHD exciter provides carrier frequency and pilot phase control from a precision GPS reference on the **10 MHz IN** BNC connector (W5J1) (between 0.5 V and 2 V pk-pk sine wave input; 50 Ω) and **1PPS IN** BNC connector (A1J8A) (5 V TTL input level, 10 kΩ).

2.3.3.3 PILOT SAMPLE OUTPUT

The VSHD exciter provides a 19 kHz pilot sample (500 mV pk-pk) on the **PILOT/MPX SAMPLE OUT** BNC connector (A1J8B).

2.3.4 VSHD Exciter and VS Transmitter Interconnections

Several cables must be connected between the VSHD exciter and the associated VS transmitter to ensure proper operation. These cables (W1 through W4) are all included in the Installation Kit (Nautel Part # 211-8982-01) provided with the VSHD exciter. See Figure 2-8 to locate VSHD exciter connectors. Refer to the VS transmitter's *Installation Manual* for Pre-Commissioning instructions (setting up and configuring an external exciter and location of transmitter connectors).

NOTE

The lengths of cables in the "VSHD System Cables" bag require that the VSHD exciter be mounted in close proximity to the VS transmitter. For example, the Cat-5e cable (W1) is approximately two feet in length.

2.3.4.1 XMTR LINK – W1

Connect the serial link Cat-5e cable (W1) between the VS transmitter's **XMTR LINK** connector (A1J1, using the W1P1 end) and the VSHD's **XMTR LINK** connector (A1J2, using the W1P2 end).

2.3.4.2 AES/EBU FROM AUDIO OVER IP – W2

See 2.3.3.2.1 for details on using this connection. If used, connect the D-sub to D-sub cable (W2) between the VS transmitter's **REMOTE I/O-A** connector (A1J2A, using the W2P1 end) and the VSHD's **ANALOG AUDIO IN** connector (A1J5, using the W2P2 end).

2.3.4.3 XMTR RF SAMPLE – W3

Connect the BNC to SMA cable (W3) between the VS transmitter's **RF SAMPLE OUT** BNC connector [J1 (for VS300) or J3 (for VS1 or VS2.5), using the W3P1 end] and the VSHD's **XMTR RF SAMPLE IN** SMA connector (A1J1, using the W3P2 end).

2.3.4.4 RF OUT – W4

Connect the BNC to BNC cable (W4) between the VS transmitter's **RF DRIVE IN** BNC connector [J4 (for VS300) or J1 (for VS1 or VS2.5), using the W4P1 end] and the VSHD's **RF OUT** BNC connector (A2J2, using the W4P2 end).

2.3.5 LAN Connection

An Ethernet port is available on the **LAN** connector (U4J2) on the rear panel of the exciter. This port connects to your HD data source (Exporter Plus, etc.), either directly or via a LAN connection. When connected, a user can view the operational status of the VSHD exciter's internal Exgine PWB using a web-based browser. These status pages should be accessed for troubleshooting purposes only. Nautel recommends you use shielded Cat-5e Ethernet cable to make this connection. Refer to paragraph 3.1.6 – *Exgine Web Interface* for typical web pages associated with the Exgine PWB.

2.4 COMMISSIONING PROCEDURES

The commissioning procedures presented in this section assume that the VSHD exciter was received from the factory with an associated VS transmitter. If you received your VSHD exciter for a pre-existing VS transmitter, refer to the appropriate Information Sheet (VS1 and VS2.5) or Field Modification (VS300) for commissioning, operation and optimization instructions.

The following procedures are in a step-by-step format. They permit a person who is not familiar with the VSHD exciter to perform required checks. Complete the procedures in sequence.

The VSHD exciter is precisely calibrated and subjected to a burn-in during manufacture. It should not be necessary to change any adjustment, other than those specified.

NOTE

The VSHD exciter is part of an IBOC system with a VS series transmitter and should be commissioned in conjunction with the VS transmitter. Refer to the turn-on or commissioning procedures of the VS transmitter for more information (see the VS Installation Manual).

2.4.1 Turn-On Prerequisites

Verify the exciter is ready to turn on by completing the following steps:

(a) Verify all interconnect wiring is installed and installation requirements of paragraph 2.3 are complete.

(b) Ensure the ac power to the VSHD exciter and associated VS transmitter is switched off.

2.4.2 Initial Turn-On

(a) Verify the requirements of 2.4.1 are complete.

(b) Switch on ac power to the VS transmitter and VSHD exciter.

(c) Verify the VSHD's front panel **POWER** LED is on (green) and the **STATUS** LED is solid amber (standby).

(d) Navigate to the **Main Menu ► System Settings ► Calibration ► Cal Values** screen. Enter the screen for **Fwd Scale** (forward power scale factor) and **Rfld Scale** (reflected power scale factor) and record the scale factor calibration value for each parameter. Store this information in a safe place in the event that you need to replace the exciter PWB (A1).

(e) Select the desired preset and apply the desired program input to the VSHD exciter. Enable the VS transmitter's RF power (RF on). Verify that the **STATUS** LED turns green (RF on, no faults), and that operation is satisfactory.

(f) Using the spectrum analyzer on the remote AUI (to learn how to connect to the remote AUI refer to the VS transmitter's Operations and Maintenance manual), ensure that the transmitter's output spectrum complies with FCC and NRSC regulations and DTS (formerly iBiquity Digital Radio Corp.) "*HD Radio FM Transmission System Specification*" mask for Hybrid or All-Digital transmission. Verify that the **Average PA Dissipation** meter does not exceed 180 W at any time. Contact Nautel if necessary.

NOTE

Refer to the VS transmitter's Operations and Maintenance Manual for details on general operation of the VS transmitter. Refer to ***Section 3 – OPERATION*** *of this manual for details on the operational differences when using the VSHD exciter.*

VSHD Exciter
TECHNICAL INSTRUCTION MANUAL

Section 3 OPERATION

3.1 USER INTERFACE
The user can interface with the VSHD exciter through the associated VS transmitter's standard interface, either locally using the VS transmitter's front panel display or remotely, via a LAN connection, using the advanced user interface (AUI).

Refer to the associated VS transmitter's *Operations and Maintenance Manual* for a detailed description of the VS transmitter's general operating instructions. The information in this manual pertains to changes and additions to these operating instructions that occur when using the VSHD exciter.

Paragraphs 3.1.1 through 3.1.4 describe the operational differences when using the VSHD exciter. Where applicable, this manual references sections and figure numbers in the VS manual to illustrate the new or different features available with the VSHD exciter.

Paragraph 3.1.5 describes the status of the VSHD exciter's two front panel indicators – **STATUS** and **POWER**.

Paragraph 3.1.6 describes how to monitor and troubleshoot the VSHD exciter's internal Exgine PWB via a web-based browser.

3.1.1 Viewing Tool Menu Panels (AUI only)
The number of tool menu options increase when using the VSHD exciter (see Figure 3-1 compared to Figure 2-17 of the VS transmitter's *Operations and Maintenance Manual*).

Figure 3-1: Tool Menu Options

New tool menus include:

AM-AM Correction (see 3.1.1.1)

AM-PM Correction (see 3.1.1.1)

Power Distribution Graph (see 3.1.1.2)

Signal Constellation (see 3.1.1.3)

Oscilloscope (see 3.1.1.4)

3.1.1.1 AM-AM and AM-PM CORRECTION

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 3-2) and AM-PM Correction (see Figure 3-3), which can be viewed as instrument panels.

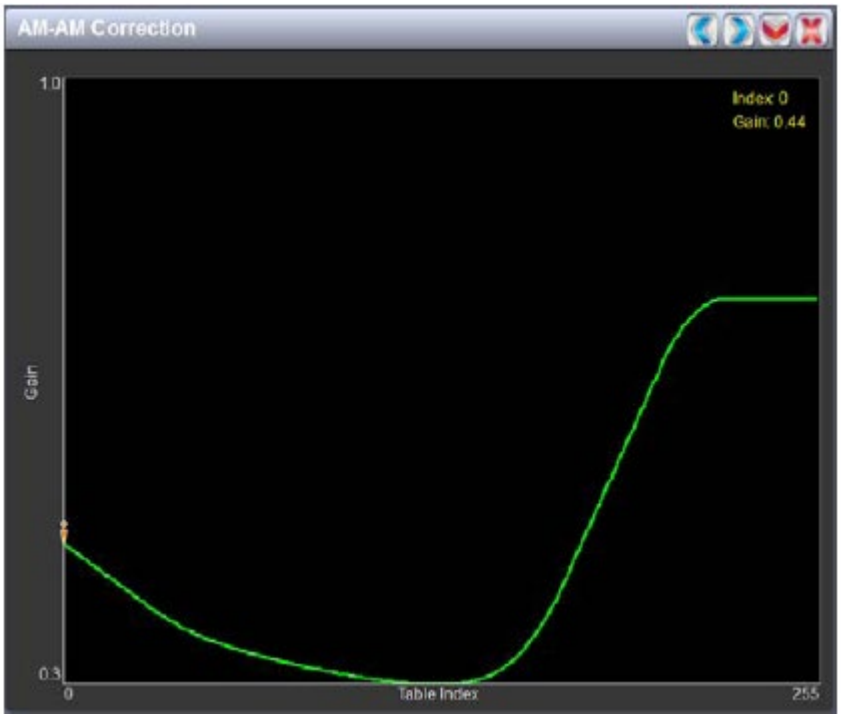


Figure 3-2: AM-AM Correction

AM-AM correction (see Figure 3-2): 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.

The LUT curve can show that at low transmitter output power, more RF drive power is required to correct for low final stage amplifier gain - the curve sharply increases as it drops to 0 table value. (This low gain can also be overcome using additional bias, however pre-correction is more efficient.) Equally, the curve could also increase sharply at the top end of the table, suggesting that high RF drive power (gain) is required to connect for low gain at final stage amplifiers (PA compression peak limiting). It is technically the inverse of the transmitter's power amplifier gain response.

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

Use the left (◄) and right (►) arrow buttons as fine adjustments.

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

Figure 3-3: AM-PM Correction

AM-PM correction (see Figure 3-3): This panel displays the phase correction being applied to the RF drive signal in order to compensate for the transmitter's (exciter +PA stage) phase non-linearity versus the output power. In Figure 3-3 the transmitter output power is low, so the curve in the plot shows positive phase correction. Inversely, a negative phase correction will be displayed in the plot given high output power levels. This correction is represented on the plot via the x-axis (table index value of between 0-255). 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 Table index) is noted in the upper, right-hand corner of the panel. Touch in other areas of the instrument to provide a coarse adjustment of the cursor position.

Use the left (◄) and right (►) arrow buttons as fine adjustments.

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

3.1.1.2 POWER DISTRIBUTION GRAPH

See Figure 3-4. 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 (0 dB) 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 instrument to provide a coarse adjustment of the cursor position.

Use the left (◄) and right (►) arrow buttons as fine adjustments.

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

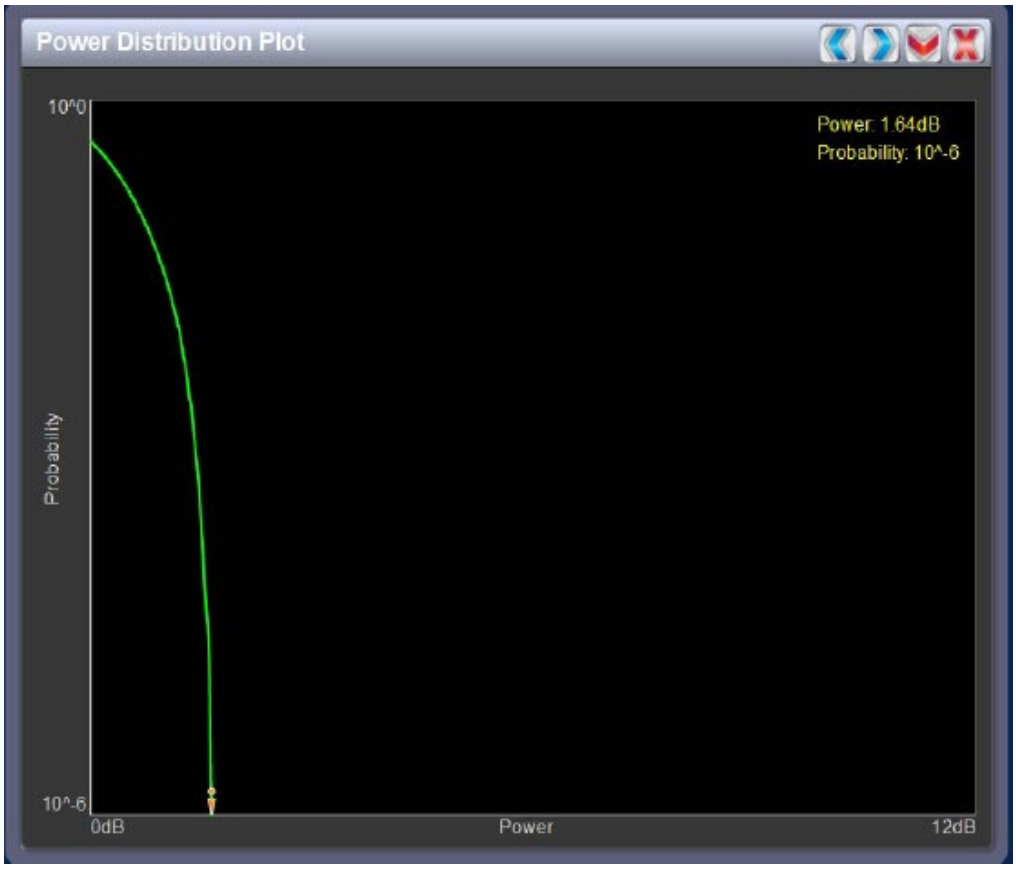


Figure 3-4: Power Distribution

3.1.1.3 SIGNAL CONSTELLATION

See Figure 3-5. 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. Sub-carrier group information is shown in the lower, right section of the screen. Displayed information includes the sub-carrier group name, the bandwidth that the selected carrier group occupies and the modulation error ratio (MER) for the selected carrier group. MER quantifies the performance of the transmitted digital signal as the ratio between the RMS power of the ideal signal and the RMS power of the received signal's error vector. A higher MER value is characteristic of a smaller error, and therefore a higher quality signal. There is a NRSC minimum requirement of a MER value of no less than 14 dB. Use the scroll bar 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 maximize or minimize buttons as required.

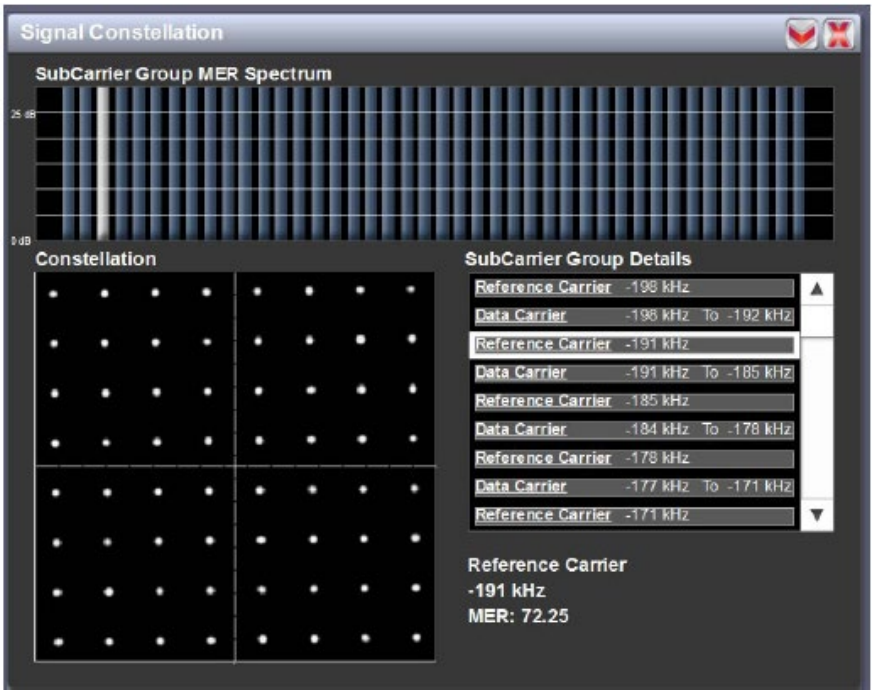


Figure 3-5: Signal Constellation

3.1.1.4 OSCILLOSCOPE

See Figure 3-6. This panel displays an oscilloscope to allow monitoring of audio input parameters. The oscilloscope displays a real-time waveform for the selected audio input (e.g., L/R audio input). The audio input(s) being monitored is displayed in the upper, left-hand corner of the panel (e.g., R in green, L in blue for L/R audio input.) The limits for the amplitude axis (volts/division) and time axis (microseconds/division) are preset in software for each selected input and cannot be adjusted. The following button controls are available:
Use the "cog" button to access the measurement source setting (*refer to the VS transmitter's Operations and Maintenance manual*). Use the drop-arrow to select from the various options - Precorrection Forward/Reverse (reverse and forward sample signals), MPX Audio, Left/Right Audio (left and right signals) or Audio I/Q (shows I and Q signals).

NOTE

If the front panel UI's test signal generator is enabled, the test signal may appear on certain oscilloscope displays. To view the actual audio input's signal, disable the test signal generator (refer to the VS transmitter's Operations and Maintenance manual).

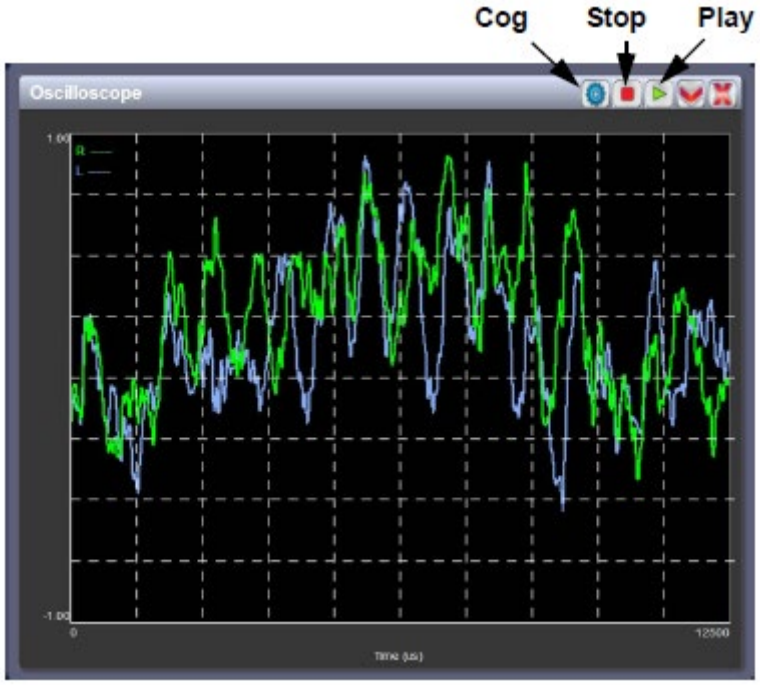


Figure 3-6: Oscilloscope (Left/Right Audio input shown)

3.1.2 Managing Presets

The preset page's **Mode** options increase when using the VSHD exciter (for the AUI, see Figure 3-7 compared to Figure 2.39 of the VS transmitter's *Operations and Maintenance Manual*; for the front panel UI, see Figure 3-8 compared to Figure 2.48 of the VS transmitter's *Operations and Maintenance Manual*). When the VSHD exciter is used, the **Mode** drop-down selection list is no longer disabled and instead includes the HD (all-digital), FM+HD (hybrid) and DRM+ modes of operation.

Basic preset operations such as loading, applying, reloading and saving are the same. The **General** and **Other Audio** tabs contain VSHD pertinent selections, which are described below.

3.1.2.1 USING THE AUI

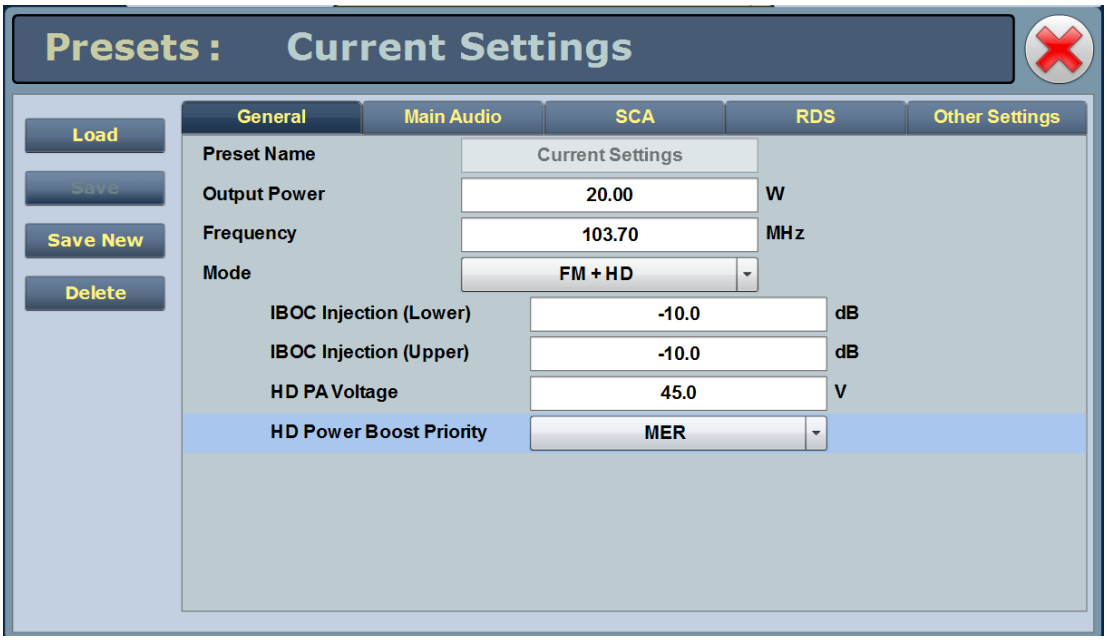


Figure 3-7: Presets Page - General tab

General tab changes/additions (see Figure 3-7):

- **Mode**: select FM, HD, FM+HD or DRM+. If HD or FM+HD, enter:

- **IBOC Injection (Lower):** for FM+HD and HD modes, enter value, in dB, between -20 and -10 dB for the IBOC injection level of the lower sideband of digital carriers. 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.

- **IBOC Injection (Upper):** for FM+HD and HD modes, enter value, in dB, between -20 and -10 dB for the IBOC injection level of the lower sideband of digital carriers. 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.

NOTE

The actual digital sideband power is 3 dB less than that indicated in the upper or lower IBOC Injection fields; Example: if -20 dBc is entered in the upper and lower IBOC Injection fields, the upper and lower digital sideband power levels are actually -23 dBc; this way, when added, the resultant total digital power level is -20 dBc.

For symmetrical sideband transmission: if -14 dBc IBOC Injection level is desired (total digital power of upper + lower sidebands is 4% of analog carrier power), set the upper and lower IBOC Injection levels to -14 dBc.

For asymmetrical sideband transmission, account for the fact that the actual sideband power level is 3 dB less than that shown. For example, if the upper digital sideband IBOC Injection level is entered as -14 dBc, the actual power level will be -17 dBc. This is equally true for the lower digital sideband.

- **HD PA Volts**: for FM+HD, HD and DRM+ modes, enter value, in volts, between 30.0 V and 53.0 V (default is 53.0 V). This value sets the drain voltage applied to the PAs in the RF power modules, from their associated power supplies. This value affects IBOC/DRM+ 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. You can also use the HD Optimizer feature in the front panel UI to maximize your transmitter's performance (refer to the VS transmitter`s Operations and Maintenance manual).

- **HD PowerBoost Priority**: for FM+HD only; select either MER (modulation error ratio or signal quality; default setting) or Efficiency.

  Selecting MER minimizes the aggressiveness of the HD PowerBoost function and makes maximizing MER the priority. Transmitter efficiency and power capability will be reduced as a result.

  Selecting Efficiency maximizes the aggressiveness of Nautel's HD PowerBoost process, an advanced peak-to-average power ratio reduction algorithm that prioritizes efficiency and power capability when reducing the peak-to-average ratio, while ensuring that the MER of the transmitted HD signal meets transmission requirement.

NOTE

HD PowerBoost is now standard as of VS SW 4.4. Transmitters shipped prior to VS SW 4.4 that haven't been upgraded may get 3 dB foldback and associated license alarms if "Priority Efficiency" is selected. Nautel recommends upgrading the software to VS SW 4.4 or later.

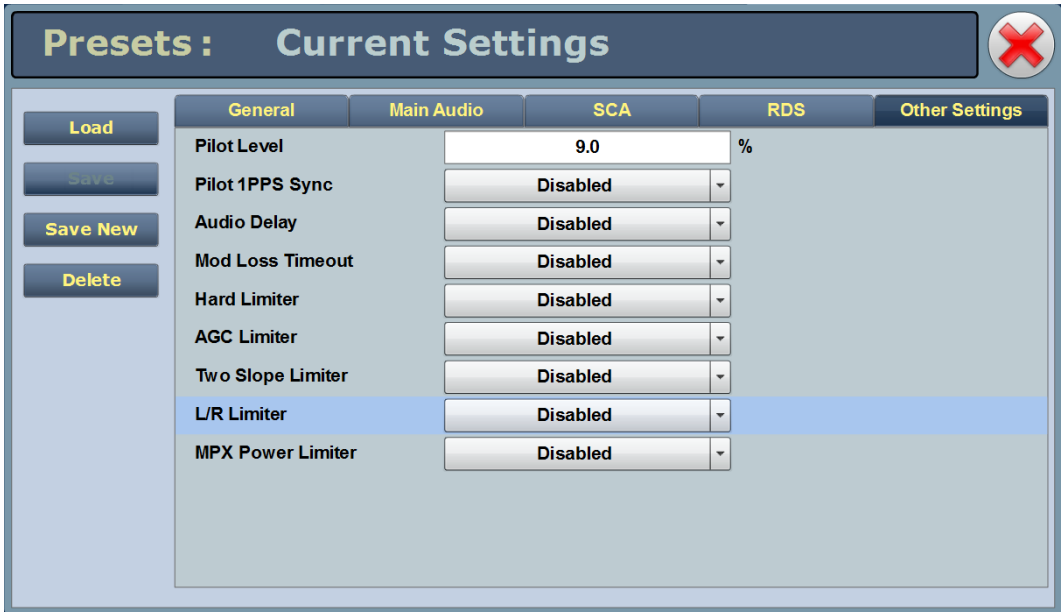


Figure 3-8: Presets Page – Other Settings tab

Other Settings tab changes/additions (see Figure 3-8):

- **Pilot Level:** enter value between 6 and 12 % (typically 9 %). This level is added to the composite baseband signal.
- **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).
- **Audio Delay:** select Enabled, then enter value in the allowable range of 0 to 12000 ms. Default is 0. Audio Delay is used to time align the receiver output of decoded analog and digital audio signals.
- **Mod Loss Timeout:** select Enabled or Disabled, as required. If Enabled is selected, the following sub-fields will appear:
    - **Action**: select the action to take on the loss of a modulating signal post the timeout period. Select Alarm Only (no resulting action), RF Inhibit (inhibits the RF output and fans until the audio returns) or Change Preset (changes the active preset).
    - **Mod Loss Preset:** displayed only if Action is set to Change Preset. Select the preset from the drop down list that will activate upon the loss of a modulating signal, post the timeout period.
    - **Timeout Minutes:** sets the delay, in minutes, between modulation loss detection and the resulting action. Enter a value in the allowable range of 0 and 255 minutes.

  - **Timeout Seconds:** sets the delay, in seconds, between modulation loss detection and the resulting action. Enter a value in the allowable range of 0 and 59.9 seconds.

  - **Threshold:** sets the threshold for modulation loss detection. Enter a value in the allowable range of 0 and 100%.

- **Hard Limiter:** select Enabled, then enter the hard limit threshold percentage (allowable range is 0-160%, defaulted to 140%). If enabled, the modulation level will be limited (audio signal clipped or distorted) if it exceeds the hard limit threshold.

- **AGC Limiter:** select Enabled, then enter AGC Limit percentage (allowable range is 0-160%, defaulted to 120%) and Time Constant (allowable range is 0-1000 ms, defaulted to 0 ms). 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:** 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.

  - **Threshold:** allowable range is 0-160%, defaulted to 120%.
  - **Gain:** allowable range is 0-100%, defaulted to 56.2%.

- **L/R Limiter:** this look-ahead limiter can be applied to the signal immediately before the stereo generator in the exciter. It has a fixed attack time (and corresponding delay) of approximately 1 ms. It can be configured to reduce the signal, if the gain setting is 0 dB or less, or can be used to perform an AGC function and boost quiet sections of the audio if a positive gain setting is used. If Enabled, enter the following parameters:

  - **Max Gain:** allowable range is -20 to 20 dB, defaulted to 0 dB.
  - **Decay Time:** allowable range is 0 to 60 s, defaulted to 0 s.
  - **Hold Time:** allowable range is 0 to 60 s, defaulted to 0 s.

- **MPX Power Limiter:** if Enabled, enter MPX RMS Limit. This limit allows the broadcast signal to remain in compliance with the MPX power limits as suggested in ITU-R BS.412-9. While the limiter will keep the transmitter in compliance, it is recommended that adjustment to the processing be made in such a way as to minimize the reductions performed by the limiter. Otherwise, the signal will not take advantage of the peak modulation capability available.

MPX RMS Limit: (allowable range is -12 to 12 dBr, defaulted to 0 dBr).

NOTE

MPX RMS is displayed as a percentage (%) on the meters screen. The percentage (%) equivalent for the dBr range shown above are 4.5% (-12 dBr) to 71.3% (12 dBr); default is 17.9% (0 dBr).
Convert to dBr as follows:
*MPX RMS in dBr = 20 log 10 [MPX RMS in % * (75 kHz/100%) * (√2/19 kHz)]*

3.1.2.2 USING THE FRONT PANEL

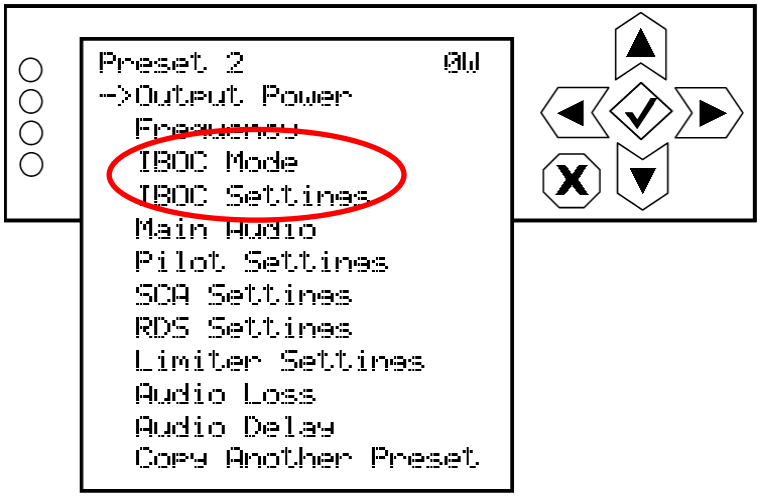


Figure 3-9: Preset Editing Menu

Preset editing menu changes/additions (see Figure 3-9):

Output Power: The output power setting, as displayed in the Output Power screen, varies with transmitter type and the IBOC Mode setting. Refer to Tables 3-1 and 3-2 for maximum and minimum power ratings.

NOTE

The power levels in the following tables are for reference only.
The power capability will vary vs frequency and MP mode (e.g. MP3). In addition, if the Spectrum/Efficiency Optimizer is enabled, but the transmitter spectrum limits cannot be achieved, the injection level and/or power level set-point will be reduced, if configured to permit these reductions. Refer to Section 3.1.3.2 for more information on configuring the Spectrum/Efficiency Optimizer.

NOTE

In IBOC mode of operation, the output power level varies with frequency for the VSHD transmitter system. Tables 3-1 and 3-2 are referenced at 98 MHz.
HD PowerBoost is now standard in VS SW 4.4 or later.

Table 3-1a: RF Output Maximum TPO (MER Priority, MP1)

TRANSMITTER TYPE	FM+HD (-20 dB)	FM+HD (-14 dB)	FM+HD (-10 dB)
VS300	295 W	185 W	119 W
VS1	1012 W	732 W	527 W
VS2.5	2368 W	1796 W	1273 W

Table 3-1b: RF Output Maximum TPO (Efficiency Priority, MP1)

TRANSMITTER TYPE	FM+HD (-20 dB)	FM+HD (-14 dB)	FM+HD (-10 dB)
VS300	314 W	233 W	133 W
VS1	1131 W	855 W	651 W
VS2.5	2518 W	2081 W	1511 W

Table 3-1c: HD Output Maximum TPO (MP1)

TRANSMITTER TYPE	HD (-20 dB)	HD (-14 dB)	HD (-10 dB)
VS300	113 W	92 W	83 W
VS1	480 W	390 W	350 W
VS2.5	960 W	780 W	700 W

NOTE

Power levels stated for minimum power are for all injection levels.

Table 3-2: RF Output Minimum Power Ratings (MP1)

TRANSMITTER TYPE	Hybrid (FM+HD)	HD (all-digital)
VS300	8 W	8 W
VS1	32 W	32 W
VS2.5	64 W	64 W

IBOC Mode: See Figure 3-10. Use the up and down buttons to locate the desired mode of operation – FM, FM+HD, HD or DRM+, then press the 'accept' (checkmark) button to save the change. Press the cancel (X) button to discard changes and return to the previous menu.

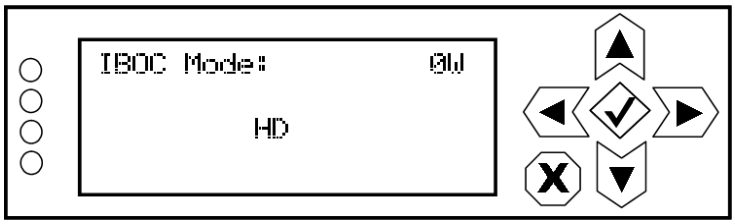


Figure 3-10: IBOC Mode screen

IBOC Settings: See Figure 3-11. When you select IBOC Settings from the Preset editing options screen (viewable only when IBOC Mode is set to HD or FM+HD), you can edit various IBOC operating parameters.

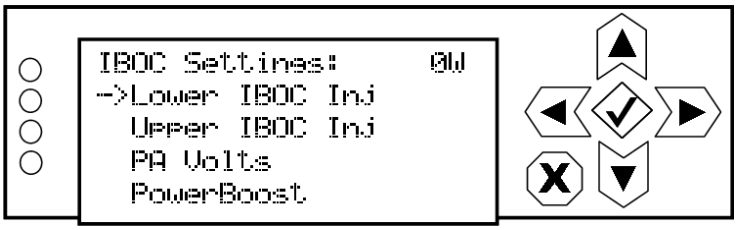


Figure 3-11: IBOC Settings menu

Use the up and down buttons to scroll through the IBOC settings menu options, then press the ‘accept’ (checkmark) or right arrow button to enter the selected editing screen.
Figure 3-12 shows the editing screens for the IBOC Settings menu for the UI and Figure 3-13 show the menu for the AUI. Press the cancel (X) button to discard changes and return to the previous menu.

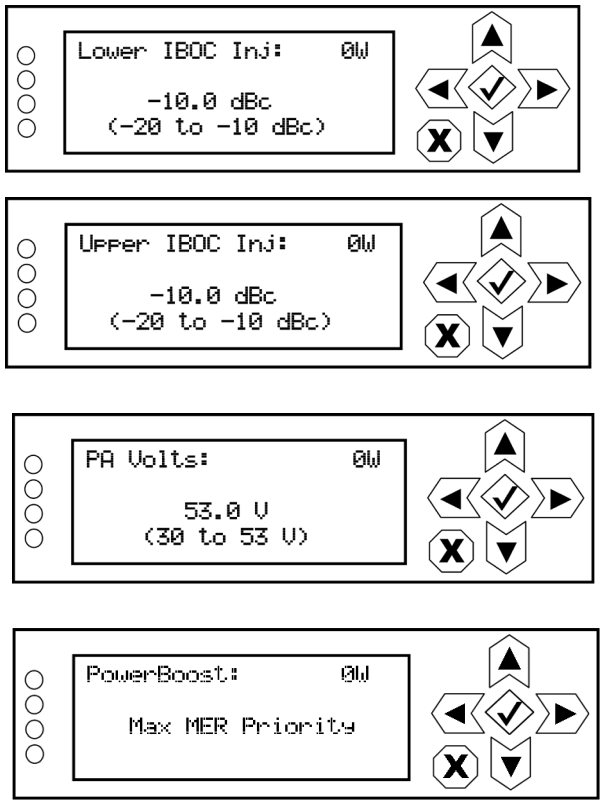


Figure 3-12: IBOC Settings editing screens

- **Lower & Upper IBOC Injection:** Use the up and down buttons to select an IBOC injection level between -20 and -10 dBc (in 0.1 dB increments), then press the ‘accept’ (checkmark) button to save the change. Press the cancel (X) button to discard changes and return to the previous menu.

- **PA Volts:** Use the up and down buttons to select a PA voltage between 30 and 53 V (in 1 V increments), then press the ‘accept’ (checkmark) button to save the change. Press the cancel (X) button to discard changes and return to the previous menu. Typically 53 V when Spectrum/Efficiency Optimizer is enabled.

- **PowerBoost:** Use the up and down buttons to select Max MER Priority or Efficiency Priority, then press the ‘accept’ (checkmark) button to save the change. Press the cancel (X) button to discard changes and return to the previous menu.

3.1.3 Changing System Settings

The AUI's **System Settings** page's selection options increase when using the VSHD exciter (see Figure 3-13 compared to Figure 2-86 of the VS transmitter's *Operations and Maintenance Manual*). The following additional pages are available:

- System Settings►IBOC Settings – see 3.1.3.1
- System Settings►Spectrum/Efficiency Optimizer – see 3.1.3.2
- User Settings►Exgine Settings – see 3.1.3.3

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.

3.1.3.1 IBOC SETTINGS

See Figure 3-13. Allows for setting of Forward Tap Delay and FM+HD and HD forward gain values. An IBOC power calibration function is available on this page.

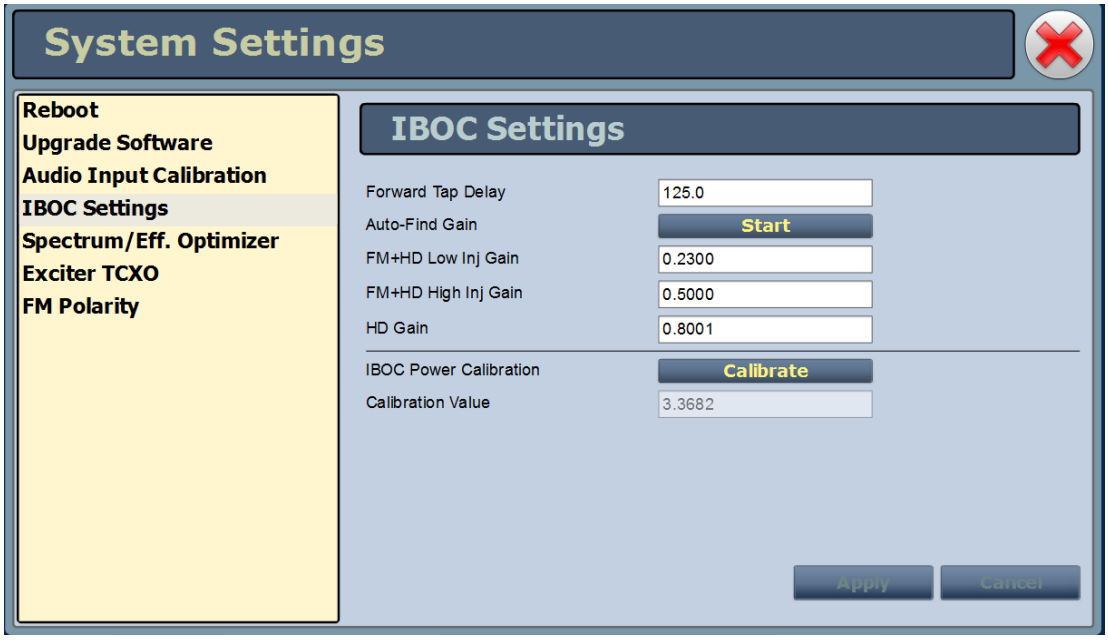


Figure 3-13: System Settings Page – IBOC Settings

3.1.3.2 SPECTRUM/EFFICIENCY OPTIMIZER

The Spectrum/Efficiency Optimizer page on the AUI (see Figure 3-14) allows users to optimize the transmitter's spectrum and/or efficiency by adjusting the following parameters:

- **Optimization Enabled** - Select **Yes** or **No**. Selecting **Yes** allows the optimizer to adjust the PA voltage setting to maximize efficiency based on the transmitter output spectrum. Depending on other settings in this section, it may require other actions to maintain the transmitter's compliance.

- **Reduce Digital Power If Required** - Select **Yes** or **No**. Selecting **Yes** enables a reduction in injection level (digital power) if the spectrum mask requires it.

- **Reduce Power Set-Point If Required** - Select **Yes** or **No**. Selecting **Yes** enables a reduction in the transmitter power set-point if the spectrum mask requires it.

- **Desired Mask Delta** - Set the desired clearance (between -10 dB and 0 dB) from the spectral mask. The default setting is -1 dB, which will maintain a 1 dB clearance from the mask for maximum efficiency. This setting will not cause any reduction in output power.

- **Required Mask Delta** - Sets the value (between -10 db and 10 dB) that is considered to be absolutely required. If this level is exceeded, the digital power from the transmitter will be reduced if the PA voltage is at maximum. If the spectral mask still cannot be met and the setting for it is enabled, the transmitter power set-point will be reduced.

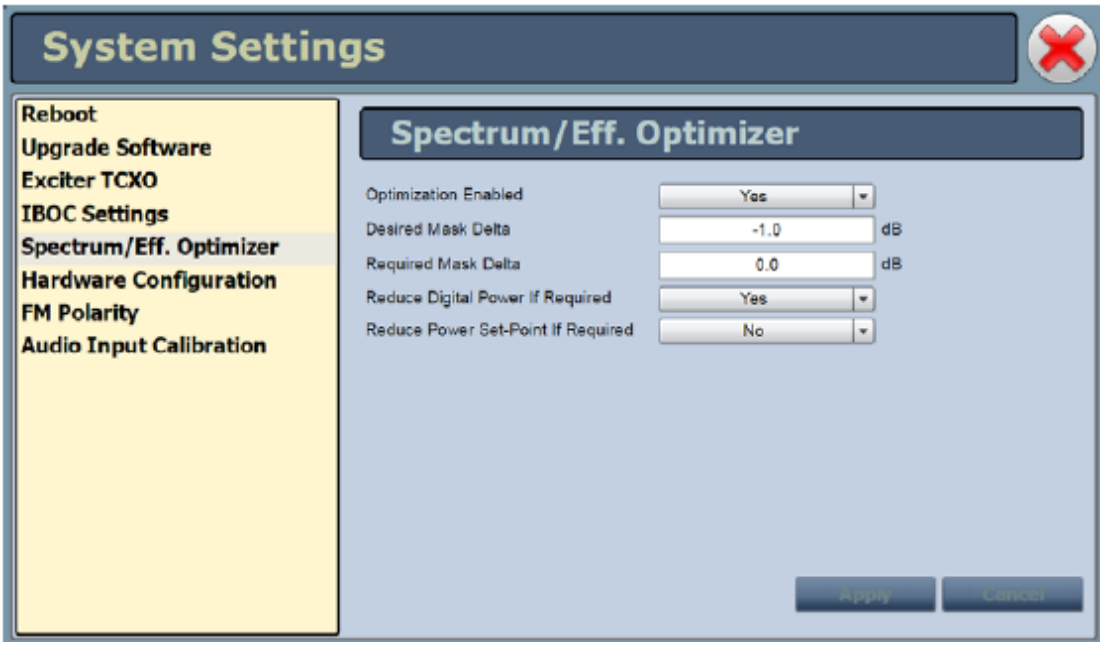


Figure 3-14: System Settings Page – Spectrum/Efficiency Optimizer

Optimizing HD Parameters from the Front Panel UI
From the front panel UI, you can enable and configure various HD signal parameters (e.g., injection level, TPO, etc.) in an attempt to optimize the digital signal's overall efficiency. To view the HD Optimizer screen, select **User Settings ► HD Optimizer** from the Main Menu. This menu has five sub-menu options (see Figure 3-15):

- Enable
- Reduce Inj
- Reduce TPO
- Desired Delta
- Required Delta

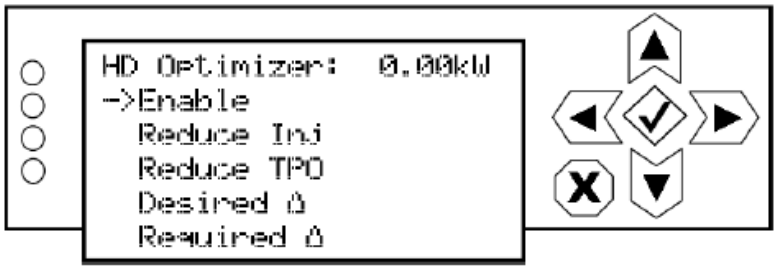
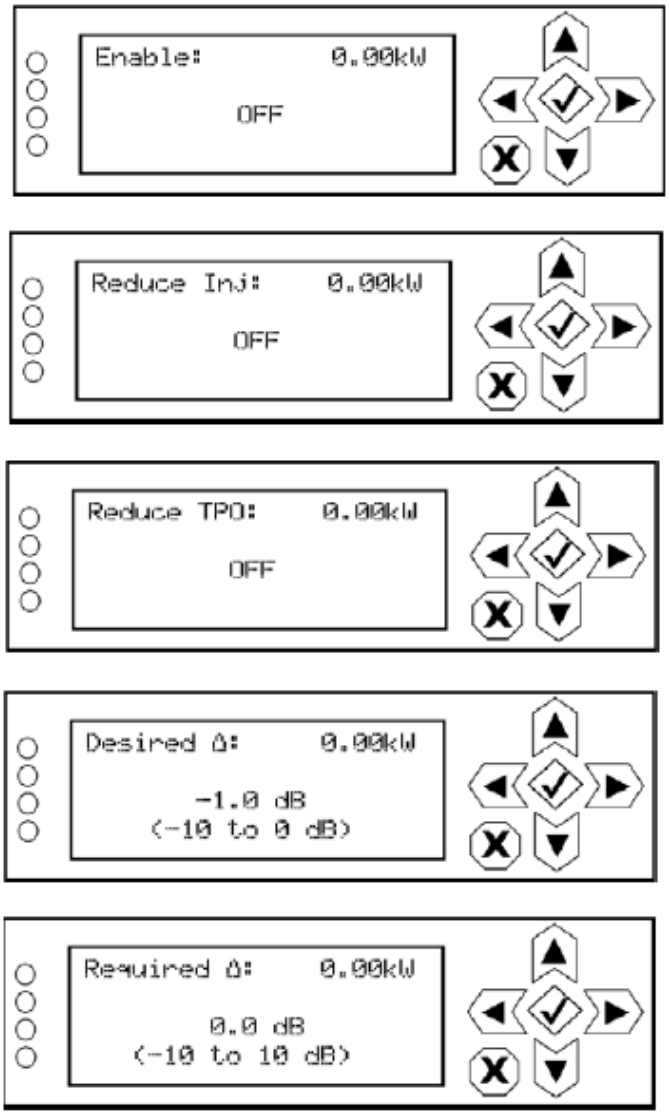


Figure 3-15: Front Panel UI HD Optimizer Menu

Use the up and down buttons to move the cursor to the desired setting and then press the right button to enable editing of the setting. Figure 3-16 shows the editing screens for the HD Optimizer menu. Within any of the editing screens, use the up and down buttons to edit a setting. Press the accept (checkmark) button to save the change. Press cancel (X) to discard changes and return to the previous menu.



Select ON to allow the optimizer to adjust the PA voltage setting to maximize efficiency based on the transmitter output spectrum. Depending on other settings in this section, it may require other actions to maintain the transmitter's compliance. Select OFF to disable. When disabled, other HD Optimizer settings will have no effect.

Select ON to enable a reduction in IBOC injection (digital power) if the spectrum mask requires it. Select OFF to disable this setting.

Select ON to enable a reduction in the power set-point if the spectrum mask requires it. Select OFF to disable this setting.

Set the desired clearance (between -10 dB and 0 dB) from the spectral mask. The default setting is -1 dB, which will maintain a 1 dB clearance from the mask for maximum efficiency. This setting will not cause any reduction in output power.

Sets the value (between -10 dB and 10 dB) that is considered to be absolutely required. If this level is exceeded, the digital power from the transmitter will be reduced if the PA voltage is at maximum. If the spectral mask still cannot be met and the setting for it is enabled, the transmitter power set-point will be reduced. Default setting is 0.0 dB.

Figure 3-16: HD Optimizer Screens

3.1.3.3 EXGINE SETTINGS

See Figure 3-17. Allows for configuring IP information for the Exgine Settings. You can select the digital carrier status (on or off), protocol (UDP or TCP), and set network information such as Exgine IP, Netmask, Gateway and E2X (Exgine) Port. The Exporter IP setting determines which Exporter Plus to interface with if more than one Exporter Plus exists on a common network. The MAC Address is for display purposes only; it cannot be edited. Press **Set** to save changes.

NOTE

The Exgine IP address must be entered manually; there is no DHCP option to auto-assign its IP address.

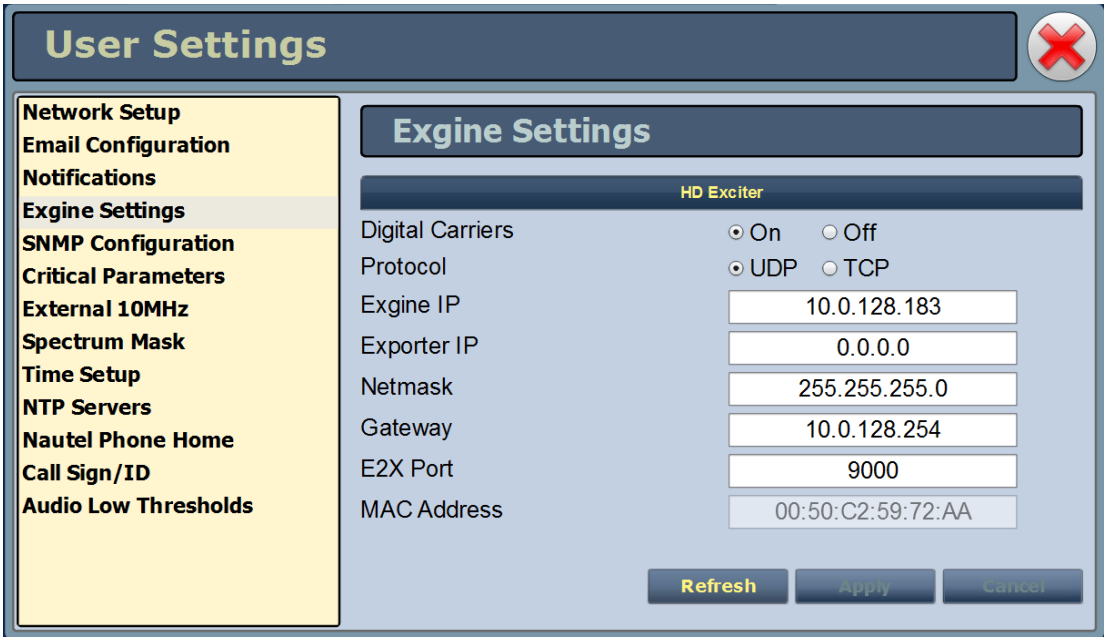


Figure 3-17: User Settings Page – Exgine Settings

3.1.4 Configuring RF Drive Source

The front panel UI's **RF Drive Source** screen selection options increase when using the VSHD exciter (see Figure 3-18 compared to Figure 2-101 of the VS transmitter's *Operations and Maintenance Manual*).

Figure 3-18: RF Drive Source Screen

Use the up and down buttons to toggle between Internal VS Exciter, VS HD Exciter and External FM Exciter. Press the 'accept' (checkmark) button to save the change. Press cancel (X) to discard changes and return to the previous menu.

NOTE

If you select **VS HD Exciter**, make sure the associated VS transmitter has been physically modified to operate with the VSHD exciter [see Section 2.2.2 for details].

3.1.5 Front Panel Indicators

The VSHD's front panel features two LED indicators – **STATUS** and **POWER** (See Figure 3-19).

STATUS – LED that indicates the state of the VSHD exciter using one of three solid colours or flashing two colours.

- solid amber – standby
- solid red – a fault exists; RF is inhibited
- solid green – RF on, no faults
- flashing amber/green – RF on, minor fault (e.g., low audio)
- flashing red/green – RF on, major fault (e.g., no HD data, no reverse path)

POWER – LED that indicates the status of ac power applied to the VSHD exciter. The LED is green when ac power is applied.

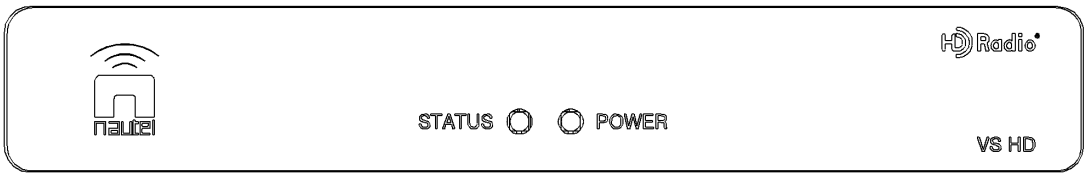


Figure 3-19: VSHD Front Panel Indicators

3.1.6 Exgine Web Interface

This section describes how to monitor and troubleshoot the VSHD exciter's internal Exgine PWB using a web-based browser.

If HD data is being applied to the VSHD exciter via a local area network (LAN) connection, determine the IP address of the Exgine using the associated transmitter's user interface (see 3.1.3.3) and enter the address into the web browser's address bar on a PC or laptop that is connected to the same LAN.

If HD data is being applied directly to the VSHD exciter [e.g., using an Exporter Plus connected directly to the VSHD exciter's **LAN** port (U4J2)], an Ethernet switch must be used to allow a PC or laptop with a web browser, and the HD data source, to connect to the VSHD exciter's **LAN** port connection. Determine the IP address of the Exgine using the associated transmitter's user interface (see 3.1.3.3) and enter the address into the web browser's address bar on a PC or laptop.

Figures 3-20 through 3-24 show examples of the web pages that are displayed. Brief descriptions of each page are provided below.

Statistics tab: Displays statistics for data packets. Note that the page must be manually refreshed in the web browser to receive updated packet information.

Status tab: Displays the Exgine status. Intended for troubleshooting purposes only.

Alarms tab: Displays the active Exgine specific alarms. Intended for troubleshooting purposes only.

Configuration tab: Allows access to configuration files. This tab should not be accessed unless directed by Nautel.

Maintenance tab: Allows access to calibration files as well as firmware upgrade and Exgine restart options. This tab should not be accessed unless directed by Nautel.

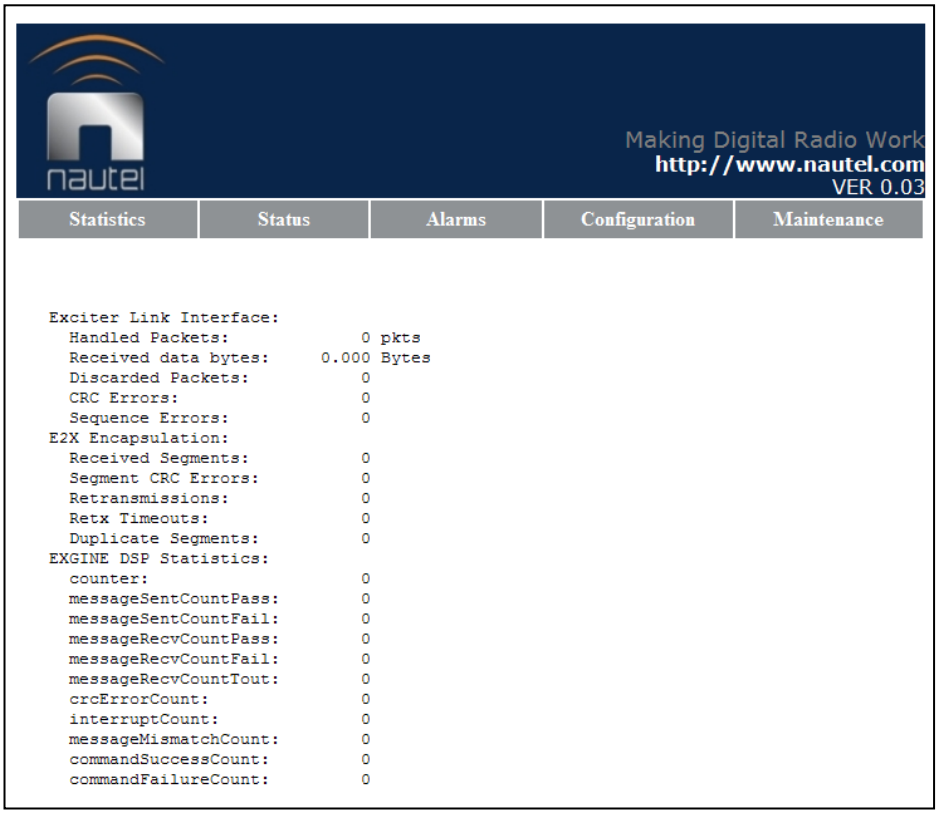


Figure 3-20: Statistics tab

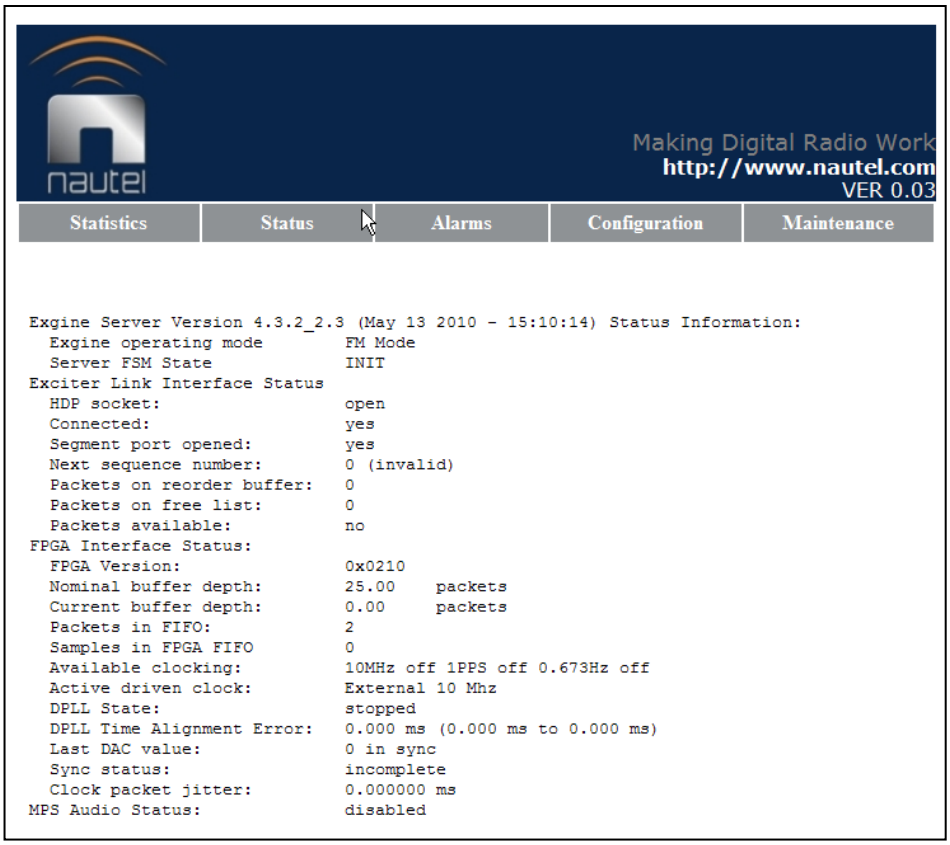


Figure 3-21: Status tab

Figure 3-22: Alarms tab

Figure 3-23: Configuration tab

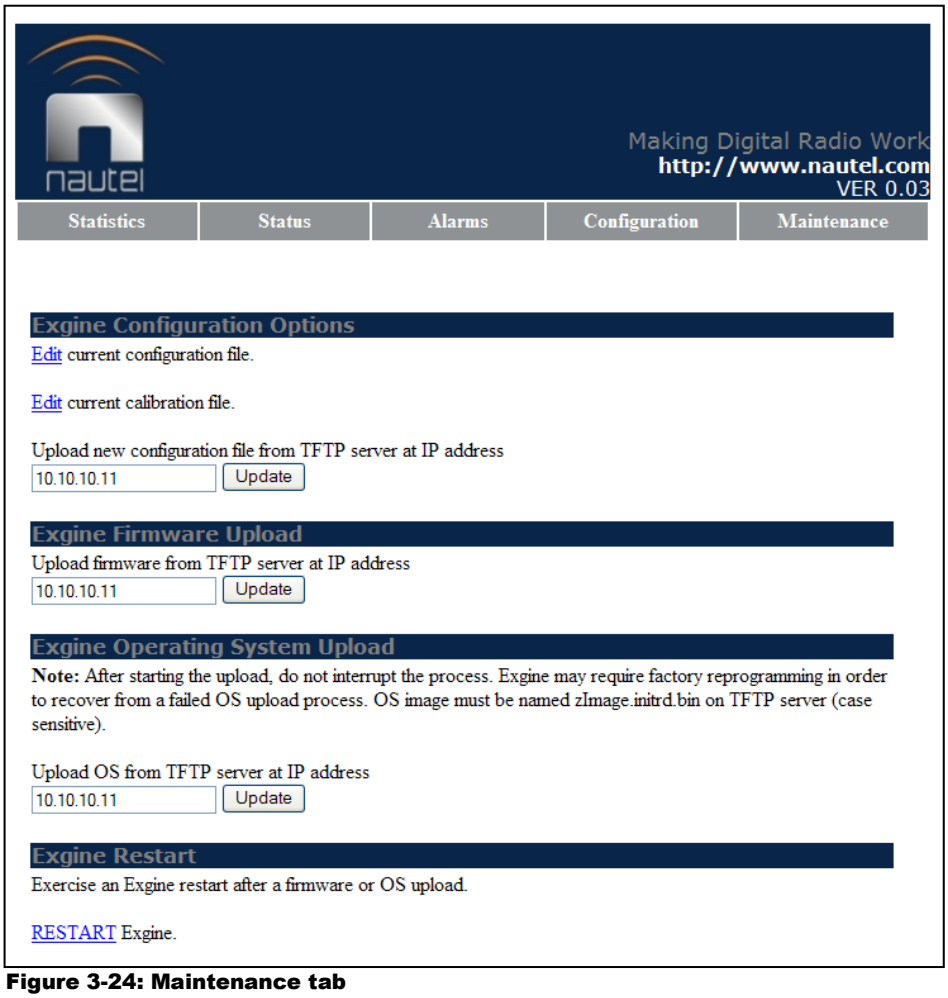


Figure 3-24: Maintenance tab

3.2 SOFTWARE UPGRADES

The VSHD exciter receives software upgrades as part of the associated VS transmitter's software upgrade process. The VSHD exciter and VS transmitter upgrades are part of the same .tgz file. If the VSHD exciter is selected, the VS transmitter will automatically detect that the VSHD is present. If necessary, refer to section 4 of the VS transmitter's *Operations and Maintenance Manual* for the software upgrade procedure.

VSHD Exciter
TECHNICAL INSTRUCTIONS

Section 4 MAINTENANCE

4.1 GENERAL
This section contains maintenance information for the VSHD Exciter.

4.2 BATTERY REPLACEMENT
The VSHD`s exciter PWB (A1) contains a battery backup circuit that provides a memory of date and time information during ac power failures. The battery should be replaced at least once a year or whenever the Exciter - Low Battery alarm appears (on the front panel UI or via remote AUI). Chemical leakage from an old battery can cause damage.

NOTE

The exciter PWB's battery is used only for the RTC clock (clock, logs, and RDS clock information, if used). If the battery fails or an ac power loss occurs, the state prior to the event is retained; the transmitter recovers to the same preset, remote enabled/disabled mode, and RF on/off mode (these settings are stored in EEPROM). Reset the clock(s) and note that logged events that occurred before replacing the battery will be reflected by the time error.

To replace the exciter PWB's battery, perform the following steps:

(a) Gain access to the exciter PWB (A1) by removing the top cover and retain hardware.

(b) Replace battery BT1 on the VSHD exciter PWB. Refer to Figure 7-11 for the location of the PWB.

(c) Re-install the top cover with the hardware retained in step (b).

(d) Verify any battery related alarms have cleared.

NOTE

Battery Low related alarms can persist for up to 24 hours, or until the microprocessor checks the state. We recommend you wait a reasonable period of time before assuming the battery replacement was not effective. Cycling the ac power will force a battery check.

4.3 EXCITER PWB (NAPE86*) REPLACEMENT

CAUTION

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

To replace the VSHD exciter PWB (A1), perform the following steps:

(a) Disconnect all cabling and ac power to the VSHD exciter.

(b) Remove the exciter's top cover and retain hardware.

(c) At the rear panel, remove any securing hardware for connectors that protrude through the rear panel. Retain all hardware for re-installation.

- Locate the two DB-25 connectors (J2A and J2B) and the two DB-9 connectors (J5A and J5B) on the rear panel. Using a 5 mm nut driver or socket, remove the mounting nuts.
- Locate the AES/EBU XLR audio connector (J3) on the rear panel. Remove the two small pan-head Phillips screws.
- Remove the silver push button lock ("push" lever) on the XLR connector. Locate the HAS78 removal tool from the ancillary kit, provided with the VSHD exciter (if not found there, check the VS transmitter`s ancillary kit). Follow the manufacturer's instructions in Figure 4-1 to remove the push button. You will need to access the front and rear of the receptacle to remove it.

(d) See Figures 2-8 and 4-2. Remove the locking rings from the five BNC connectors (J4A, J4B, J6A, J6B, and J7). To remove the locking rings, use small 4-6 inch slip-jaw pliers. Gently loosen (do not tightly pinch or deform) each locking ring. Typically, half a turn with the pliers will loosen a locking ring enough to remove it by hand. Remove and retain the locking rings.

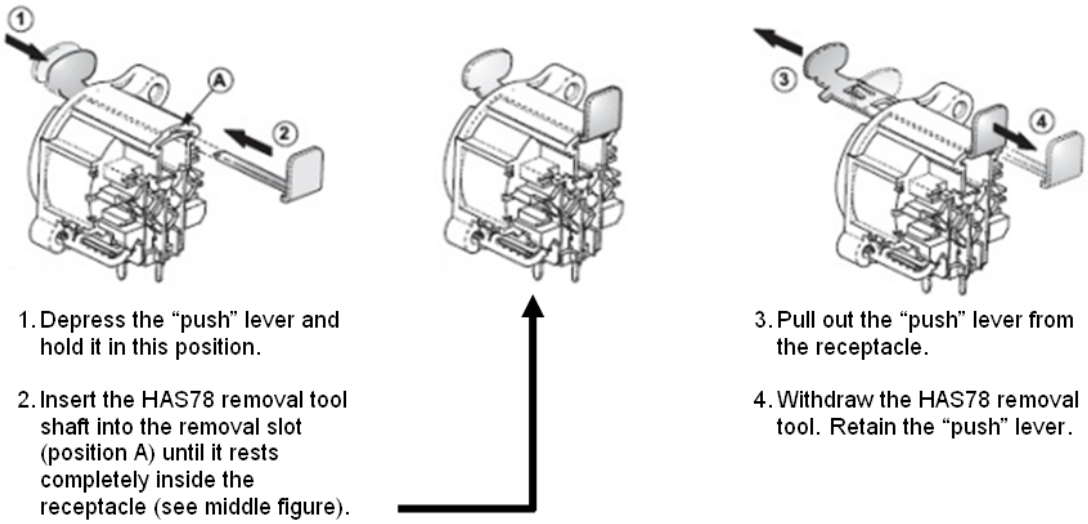


Figure 4-1: Removing the XLR connector's "push" lever"

Figure 4-2: Loosening the BNC connector's locking ring

(e) Remove the three small Philips screws, which mount the front of the exciter PWB to the chassis, located along the edge of the PWB. Retain hardware for re-installation.

(f) Slightly lift the front edge of the exciter PWB and withdraw towards the front of the exciter.

(g) Locate or obtain a replacement exciter PWB (NAPE86*). Remove the `push` lever from the XLR connector as described in Step (c).

CAUTION

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

(h) Install the replacement PWB. Replace all hardware for the through-chassis connectors. Take care not to over-tighten the BNC connector locking rings.

(i) Install the three Philips screws that mount the front of the exciter PWB to the chassis.

(j) Install the `push` lever into the XLR connector. Align it with the slot located on the top section of the connector body and gently press it into position.

(k) Reconnect all internal and external cables to the exciter PWB. If necessary, refer to Figure 2-8 and 7-10 of this manual for connector mating details for A1.

(l) Remove the “Interlock” jumper, if applicable, from J2A pins 19 and 20.

(m) Re-install the exciter’s top cover.

(n) The new exciter PWB is shipped with all standard or default power presets and audio settings. Re-install the exciter in its host cabinet (if provided), reconnect all interconnect cables and restore operation by enabling ac. Check and restore presets and audio settings to your specific configuration.

(o) Locate the Scale Factors data recorded during the commissioning (see Section 2.4.2) and navigate to the **Main Menu ► System Settings ► Calibration ► Cal Values** screen. Enter the recorded scale factors in the **Fwd Scale** and **Rfld Scale** screens.

(p) Restore RF power and verify proper operation.

VSHD Exciter
TECHNICAL INSTRUCTIONS

Section 5 PARTS LISTS

5.1 PART INDEX TABLES
Part index table(s) for all electrical and mechanical parts that have been assigned a reference designation are provided. Refer to the preamble in the Parts List section, of the host transmitter's instruction manual, for explanation of list contents. Individual part number indexes are provided for all assemblies that have been assigned a Nautel configuration control number (e.g., NAE103A). The part number indexes, which are presented in alphanumeric order, are divided into columns to aid in locating specific information.

5.2 MANUFACTURERS' CODE INDEX
Table 4-1 provides a cross-reference from the original equipment manufacturers (OEM) codes to the manufacturer's name.

To determine a specific part's manufacturer contact information, enter the five-character OEM (CAGE) code for that part in the following website:

https://www.logisticsinformationservice.dla.mil/BINCS/

Upon entering the OEM (CAGE) code number, manufacturer pertinent information (address, telephone number, fax number, etc.) shall be displayed. Please contact Nautel if a part cannot be obtained.

Table 5-1: Manufacturers' Code Index

02660	Amphenol Corporation	75915	Littelfuse Inc.
07JE4	Connex Conector Corporation	ERNI	Erni
37338	Nautel Limited	MEAN WEL	Mean Well
70903	Belden Wire and Cable Co.	SCHURTE	Schurter Electronic Components
71468	ITT Corporation		

211-8984 Cable Set Assy, VSHD System

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
W01	Cable, Cat5e, 2', Booted	UA74	DCA3148	70903
W2P1	Conn, Shell, D-Sub, 25 pin, T-Screw	JK16	DBBS-25	71468
W2P1	Conn, Socket, D-Sub, 25 pin, solder	JS28	DBM-25S	71468
W2P2	Conn, Socket, D-Sub, 15-pin,solder cup	JS102	162 A 10029 X	
W2P2	Conn, Shell, D-Sub, 15-Pos, T-Screw	JT33	DABS-15	71468
W3P1	Conn, Coax, BNC, Plug,50ohm,Crmp,RG58/303	JF33	31-4320	02660
W3P2	Conn, Coax, SMA, Plug, Crimp, RG58	JT104	132113(RoHS)	07JE4
W4P1	Conn, Coax, BNC, Plug, 50ohm,Crimp,RG142	JDP41	36875	02660
W4P2	Conn, Coax, BNC, Plug, 50ohm,Crimp,RG142	JDP41	36875	02660

NAE103B VSHD, HD Exciter Assy

REFDES	DESCRIPTION	NAUTEL #	VENDOR #	OEM CODE
A01	Exciter PWB Assy, (with Power Boost)	NAPE86A	206-3150-01	37338
A02	PA Module Assy, 300W	NAA58B	206-1300-02	37338
A03	Exgine PWB Assy, NVE & PowerBoost	NAPE74C/01	198-3076-04	37338
A04	LED PWB Assy	206-3060	206-3060	37338
B01	Fan Assy - ZAP39	206-3019-01	206-3019-01	37338
U01	Conn,Power Entry,C14,c/w fuseholder	JT91	6200.2300(ROHS)	SCHURTE
U01	Conn,Rear Cover,for Schurter6200 Series	JT92	0859.0047(ROHS)	SCHURTE
U01F1	Fuse, 3.15A 250V, 5x20mm, Anti-surge	FA40	215 3.15	75915
U02	Pwr Sply,+/-15V,+5V,40W,85-264Vac/120-370Vdc	UG51	T-40C	MEAN WEL
U03	Power Supply, 27V@200W, 85-264VAC, PFC	UG67	SP-200-27	
U04	Conn,Coupler,RJ45,Feed-Thru,Shielded	JA76	133421(ROHS)	ERNI

VSHD Exciter
TECHNICAL INSTRUCTIONS

Section 6 WIRING INFORMATION

6.1 INTRODUCTION
This section contains wiring information for hard-wired assemblies of the subject unit. Refer to Table 5-1 for an itemized listing of assemblies that have wiring lists.

6.2 WIRING LISTS NOT PROVIDED
Separate wiring lists are not provided for some assemblies. These assemblies include:

Assemblies that have separate maintenance manuals are not provided. Refer to the associated maintenance manual for detailed wiring information of these assemblies.

Assemblies that have their wiring information adequately depicted/tabulated on their assembly detail drawings are not provided. Refer to the associated assembly detail drawing for detailed wiring information of these assemblies.

6.3 PRINTED WIRING PATTERNS
The need for printed wiring pattern information is beyond the scope of this manual; therefore, detailed printed wiring patterns for printed circuit boards are not included.

6.4 WIRE COLOURS
Every effort is made to manufacture the assemblies using wire that is the colour tabulated in the 'Code' column of the wiring list tables. In some instances, a white wire will be substituted. In this case identification must be determined by locating the assigned identification number.

5.5 WIRING LISTS PROVIDED
The wiring lists tabulated in Table 5-1 are provided. These lists provide, non-printed wiring pattern, point-to-point (source/destination) inter-connecting information.

Table 6-1: Wiring Lists Provided

TABLE	TITLE
Table 6-2	Wiring List – VSHD Exciterxxx
Table 6-3	Connector Mating Information – VSHD Exciter
Table 6-4	Connector Mating Information – VSHD Exciter/VS Transmitter Interconnect

Table 6-2: Wiring List – VSHD Exciter

Source	Destination	Wire #	Colour	Size	Remarks
P1	U3-L	1	Gray	14	
P2	U3-N	2	Gray	14	
E1	U3-GND	3	Yllw/Green	14	
U3-L	U2-L	4	Gray	14	
U3-N	U2-N	5	Gray	14	
U3-GND	U2-GND	6	Yllw/Green	14	
E1	U1-GND	7	Yllw/Green	14	
U2-(+5V)	P4-6	8	White	22	
U2-COM	P4-5	9	Black	22	
U2-COM	P4-7	10	Black	22	
U2-(+5V)	P6-4	11	White	22	
U2-(+5V)	P3-11	12	White	22	
U2-(+5V)	P3-23	13	White	22	
U2-COM	P3-12	14	Black	22	
U2-COM	P3-24	15	Black	22	
U2-COM	U3-(-V)	16	Black	16	
U2-(+V)	P3-25	17	White	22	
U2-(-V)	P3-13	18	White	22	
U3-(+V)	A2E3-A	19	White	16	
U3-(+V)	P3-1	20	White	22	
U3-(+V)	P5-5	21	White	22	
U3-(+V)	P5-9	22	White	22	
U3-(-V)	A2E8	23	Black	16	
P3-2	P5-7	24	Black	22	
P3-3	P4-1	25	White	22	
P3-4	P5-4	26	White	22	
P3-5	P5-6	27	Black	22	
P3-7	P6-2	28	White	22	
P3-14	P5-8	29	Black	22	
P3-15	P5-2	30	White	22	
P3-17	P5-3	31	White	22	
P3-20	P6-1	32	White	22	

Table 6-3: Connector Mating Information – VSHD Exciter

Connector	Mate
P1	U1-L
P2	U1-N
P3	A1J9
P4	A3J5
P5	A2P1
P6	A4J1
A2P1	P5
B1P1	A1J12
W1P1	A1J15
W1P2	A2J1
W2P1	A1J11
W2P2	A3J8
W3P1	A1J14
W3P2	A3J2
W4P1	A3J1
W4P2	U4J1
W5J1	EXT 10 MHz
W5P1	A3J3
W6P1	A3J4
W6P2	A1J13

Table 6-4: Connector Mating Information – VSHD Exciter/VS Transmitter Interconnect

Connector	Mate
W1P1	XMTR - XMTR LINK
W1P2	EXCTR - XMTR LINK
W2P1	XMTR - REMOTE I/O A
W2P2	EXCTR - ANALOG AUDIO IN
W3P1	XMTR - RF SAMPLE OUT
W3P2	EXCTR - XMTR RF SAMPLE IN
W4P1	XMTR - RF DRIVE IN
W4P2	EXCTR – RF OUT

VSHD Exciter
TECHNICAL INSTRUCTIONS

Section 7 ELECTRICAL SCHEMATICS AND ASSEMBLY DETAIL DRAWINGS

7.1 INTRODUCTION
This section contains electrical schematics and assembly detail diagrams for the subject equipment. Refer to Table 7-1 for an itemized listing.

7.2 COMPONENT VALUES
Unless otherwise specified on the logic/ schematic diagram:

- Resistor values are shown in ohms.
- (K = 1000 and M = 1 000 000).
- Resistor power ratings are not shown when less than 0.5 W.
- Capacitor values are shown in microfarads (μF).
- Unidentified diodes are part number 1N4938.

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

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

7.5 REFERENCE DESIGNATIONS
Reference designations were assigned in accordance with American National Standard ANSI Y32.16-1975 - Reference Designations for Electrical and Electronic Parts and Equipment. Each electrical symbol has been identified with its basic reference designation. To obtain the full reference designation for a specific part, this basic identifier must be prefixed with the reference designation assigned to all higher assemblies.

7.5.1 Types of Inputs/Outputs
On electrical schematics, names used to describe two-state (logic) inputs/outputs are prefixed by a '#'. Those inputs/outputs representing a one-state or analog signal will have no prefix.

7.5.2 Logic Level/Convention
The '#' prefix identifies an input/output that has two distinct states - 'high' and 'low'. A suffix, '+' or '-', identifies the active (true) state of the input/output. The 'high' (+) will be the more positive of the two levels used to represent the logic states. The 'low' (-) will be the less positive of the two levels used to represent the logic states. Two types of logic, positive and negative, may be represented on a particular schematic. In positive logic, 'high' represents the active (true) state and 'low' represents the inactive (false) state. In negative logic, 'low' represents the active state and 'high' represents the inactive state.

7.6 UNIQUE SYMBOLOGY

Nautel utilizes unique symbology on electrical schematics to describe two-state (logic) inputs/outputs that differ from those inputs/ outputs having only one distinct state or multiple states (analog).

7.7 IDENTIFICATION OF SCHEMATIC DIAGRAMS

A number that is both the figure number and the page number identifies each illustration in this section. The numbers are assigned sequentially and are prefixed by the “Figure'. The electrical schematics/logic diagrams included in this section are listed in Table 7-1.

7.8 TROUBLESHOOTING AIDS

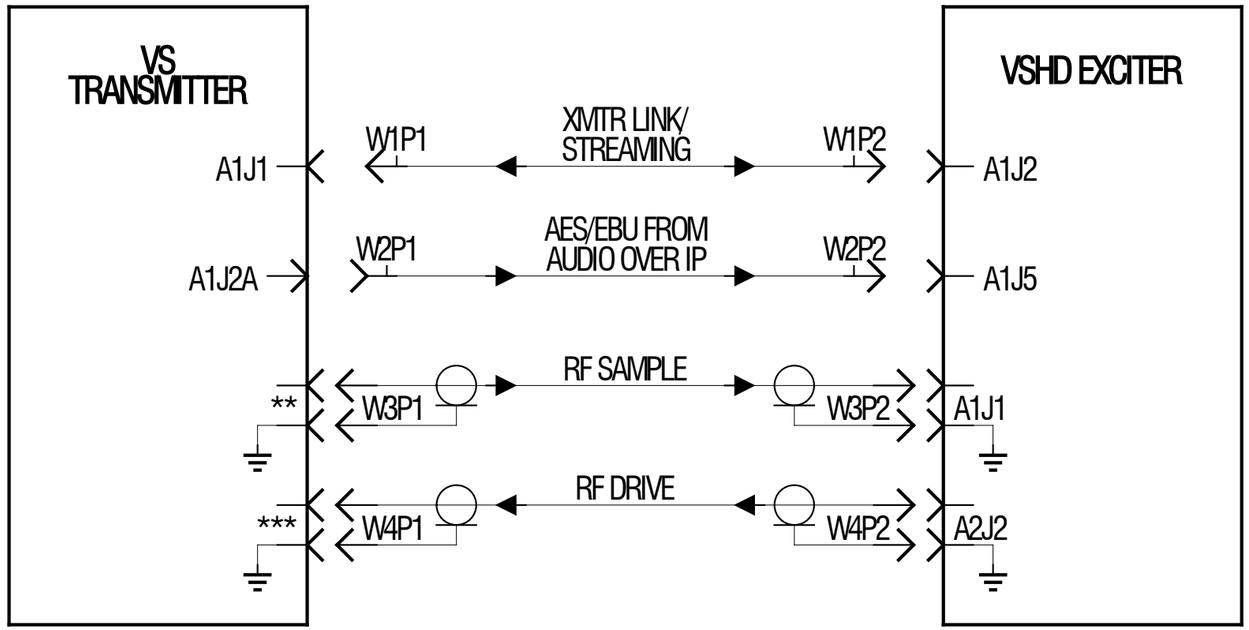
Waveforms and/or voltage levels are provided on some electrical schematics to aid in troubleshooting. Where applicable, accompanying text is included to establish conditional operating parameters that apply to the corresponding waveforms or voltages.

7.9 STRUCTURE OF SCHEMATICS

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

Table 7-1: List of Drawings

Figure	Description
Figure 7-1	Electrical Schematic – Interconnection Between VS Transmitter and VSHD Exciter
Figure 7-2	Electrical Schematic – VS300 & VSHD Exciter (Control/Monitor Stage)
Figure 7-3	Electrical Schematic – VS300 & VSHD Exciter (RF Drive & RF Power Stage)
Figure 7-4	Assembly Detail – Modified VS300 for use with VSHD Exciter
Figure 7-5	Electrical Schematic – VS1 & VSHD Exciter (Control/Monitor Stage)
Figure 7-6	Electrical Schematic – VS1 & VSHD Exciter (RF Drive & RF Power Stage)
Figure 7-7	Electrical Schematic – VS2.5 & VSHD Exciter (Control/Monitor Stage) Sheet 1 of 2
Figure 7-8	Electrical Schematic – VS2.5 & VSHD Exciter (Control/Monitor Stage) Sheet 2 of 2
Figure 7-9	Electrical Schematic – VS2.5 & VSHD Exciter (RF Drive & RF Power Stage)
Figure 7-10	Electrical Schematic – VSHD Exciter (NAE103B)
Figure 7-11	Assembly Detail – VSHD Exciter – Top View (cover removed)



B2110001 V1

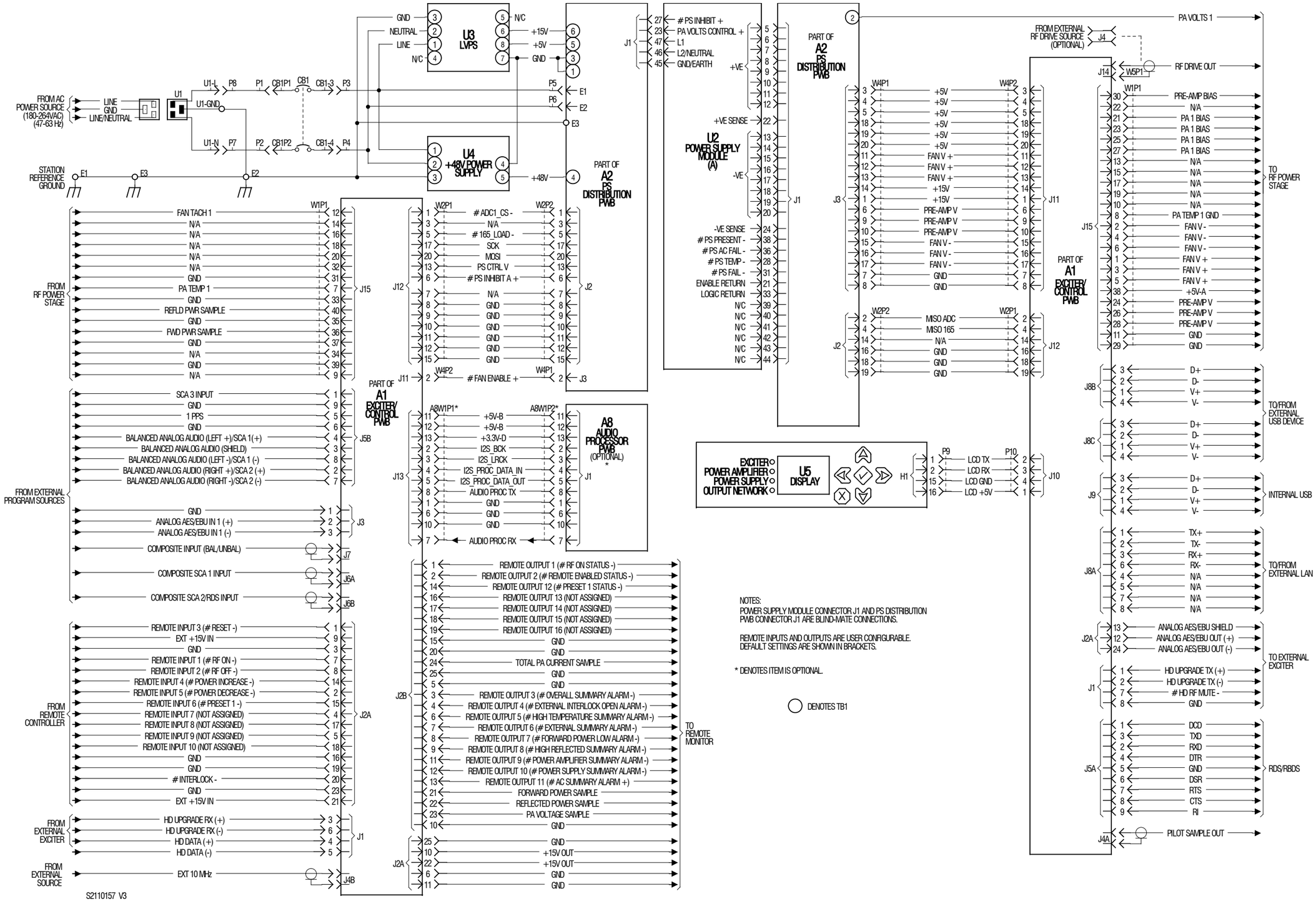
** DENOTES CONNECTOR DESIGNATION IS TRANSMITTER DEPENDENT:

J1 FOR VS300
J3 FOR VS1 OR VS2.5

*** DENOTES CONNECTOR DESIGNATION IS TRANSMITTER DEPENDENT:

J4 FOR VS300
J1 FOR VS1 OR VS2.5

Electrical Schematic – Interconnections Between VS Transmitter and VSHD Exciter			
Issue 2.0	Not to Scale	Figure 7-1	Sheet 1 of 1



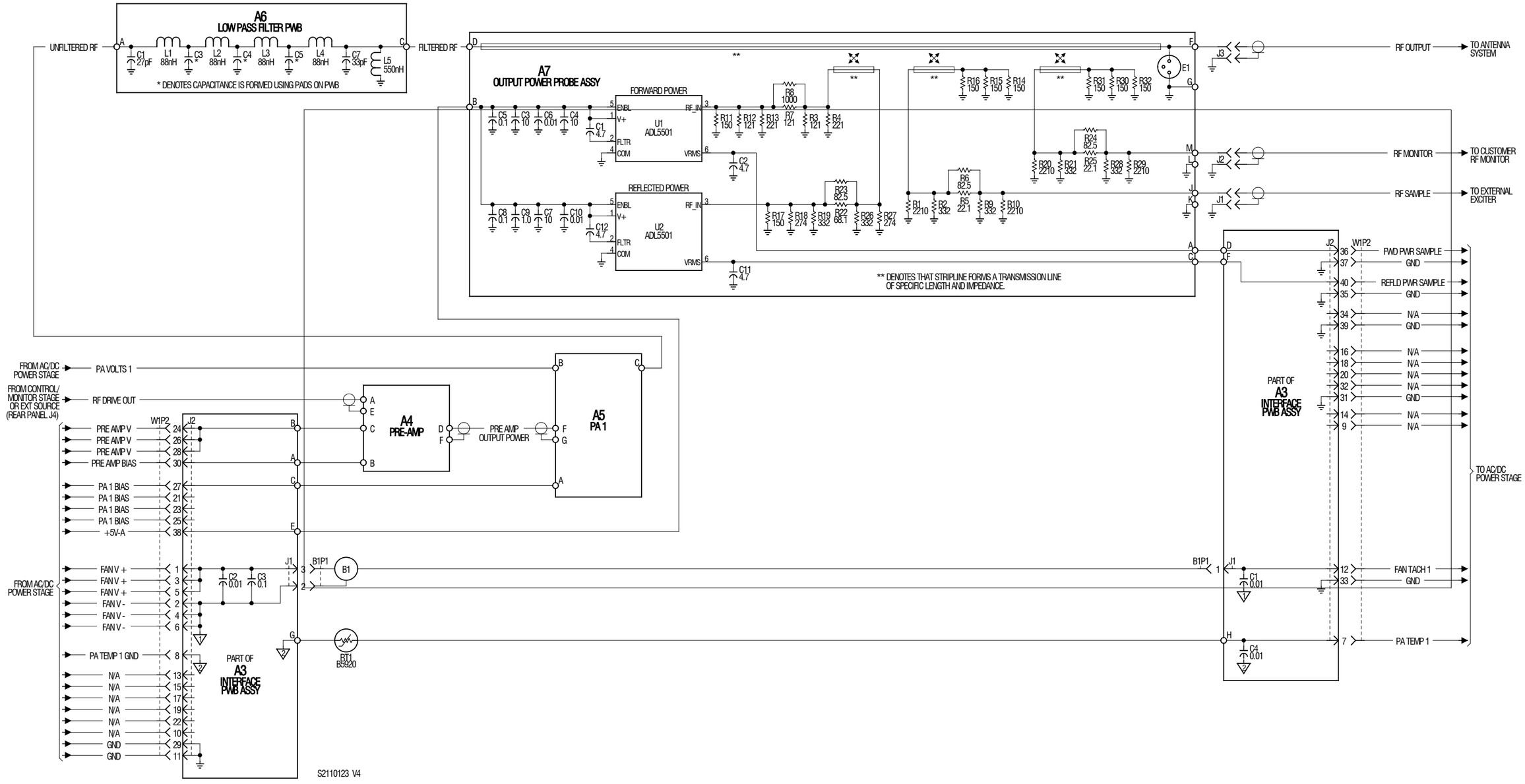
NOTES:
POWER SUPPLY MODULE CONNECTOR J1 AND PS DISTRIBUTION PWB CONNECTOR J1 ARE BLIND-MATE CONNECTIONS.

REMOTE INPUTS AND OUTPUTS ARE USER CONFIGURABLE. DEFAULT SETTINGS ARE SHOWN IN BRACKETS.

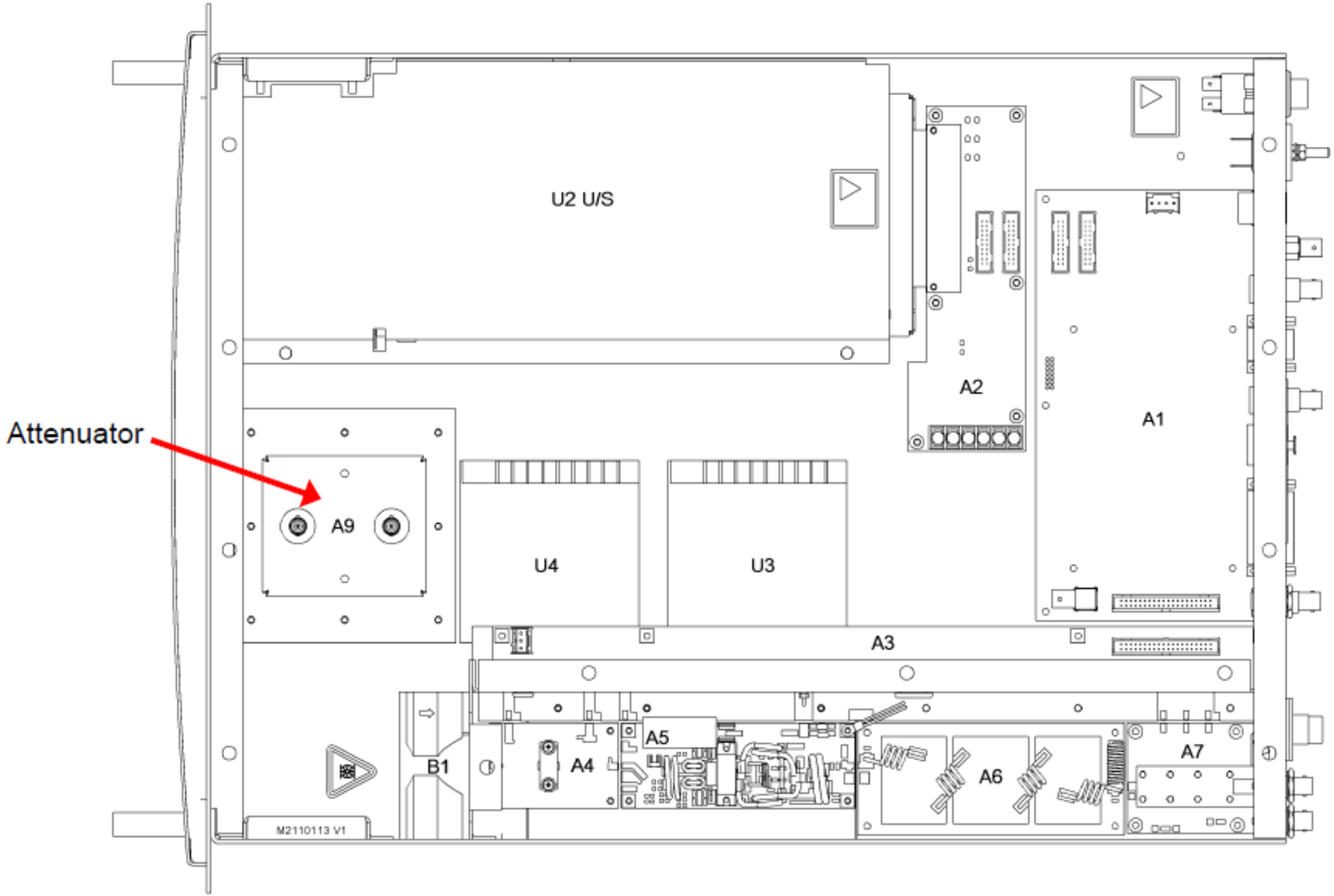
* DENOTES ITEM IS OPTIONAL.

○ DENOTES TB1

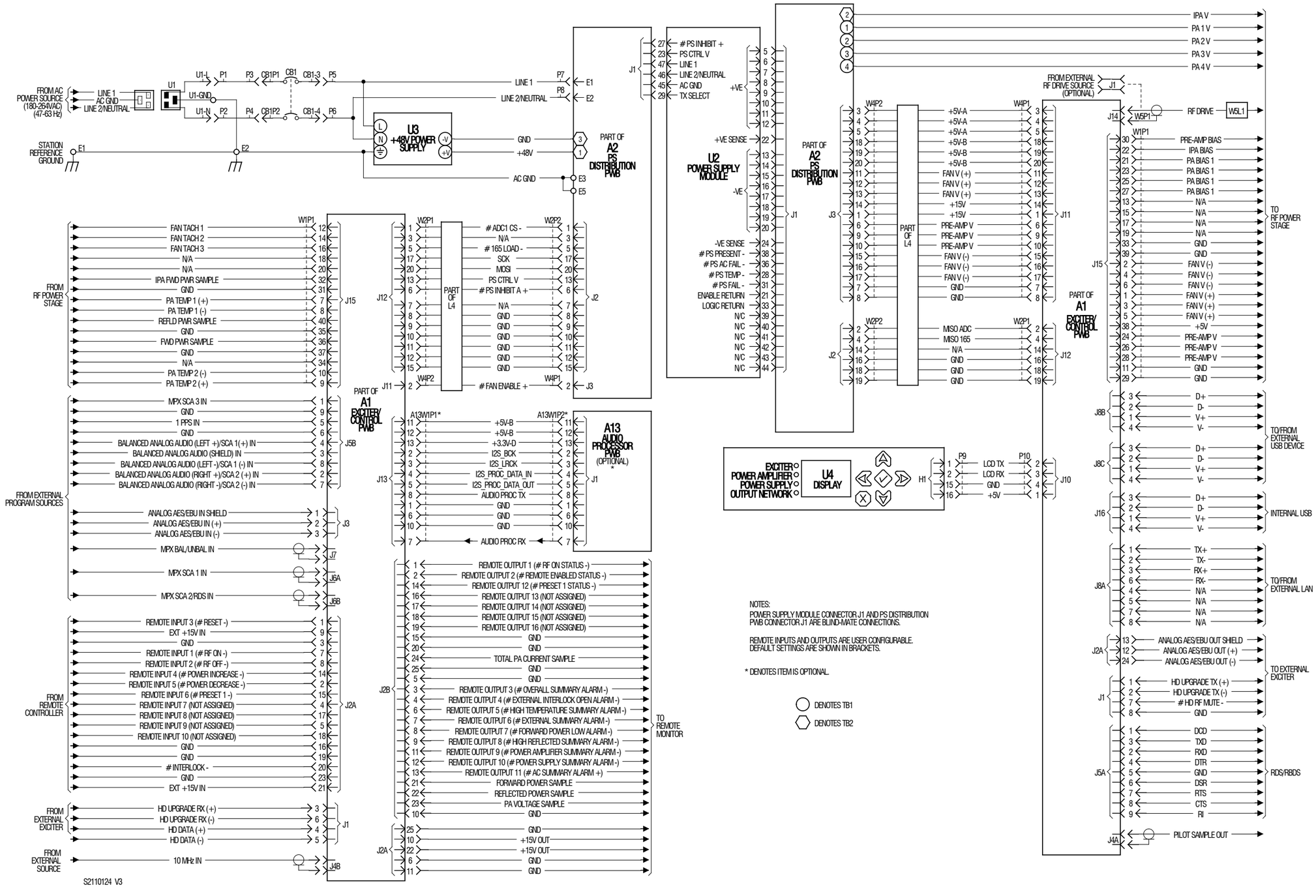
Electrical Schematic – VS300 & VSHD Exciter (Control/Monitor Stage)			
Issue 2.0	Not to Scale	Figure 7-2	Sheet 1 of 1



Electrical Schematic – VS300 & VSHD Exciter (RF Drive and RF Power Stage)			
Issue 2.0	Not to Scale	Figure 7-3	Sheet 1 of 1



Assembly Detail – Modified VS300 for use with VSHD Exciter			
Issue 2.0	Not to Scale	Figure 7-4	Sheet 1 of 1



NOTES:
POWER SUPPLY MODULE CONNECTOR J1 AND PS DISTRIBUTION PWB CONNECTOR J1 ARE BLIND-MATE CONNECTIONS.

REMOTE INPUTS AND OUTPUTS ARE USER CONFIGURABLE. DEFAULT SETTINGS ARE SHOWN IN BRACKETS.

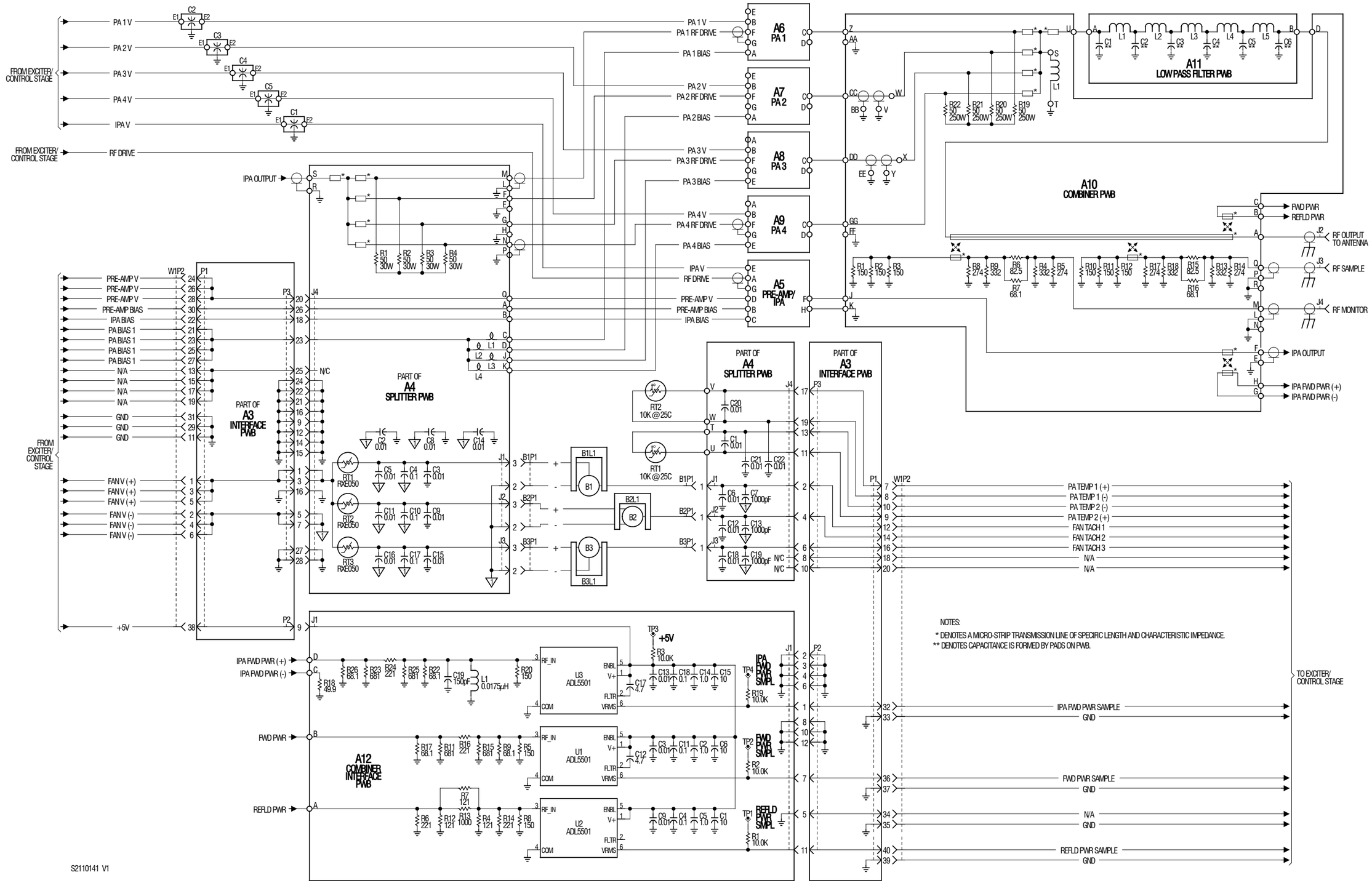
* DENOTES ITEM IS OPTIONAL.

○ DENOTES TB1

⬡ DENOTES TB2

S2110124 V3

Electrical Schematic – VS1 & VSHD Exciter (Control/Monitor Stage)			
Issue 2.0	Not to Scale	Figure 7-5	Sheet 1 of 1



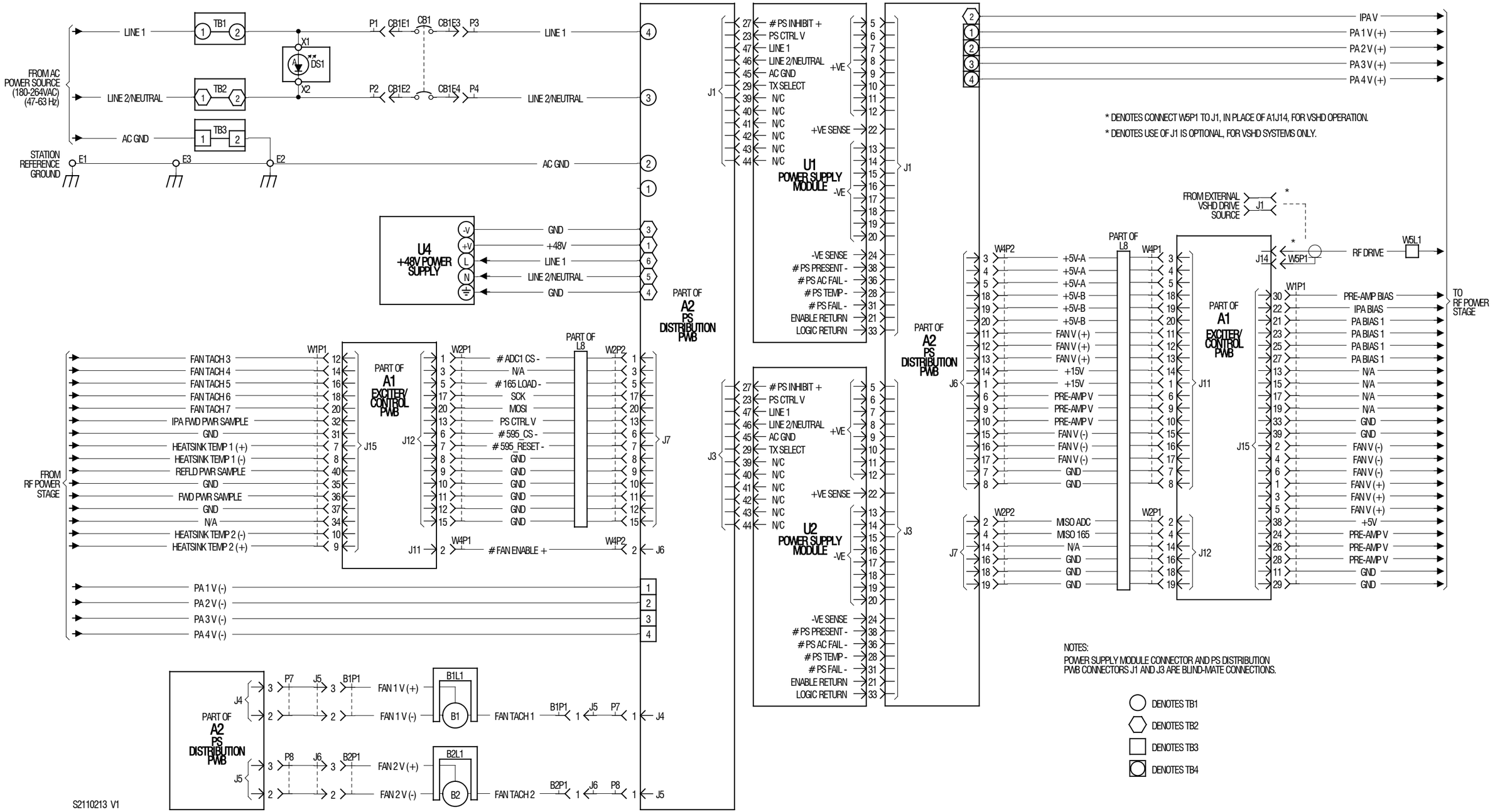
NOTES:

* DENOTES A MICRO-STRIP TRANSMISSION LINE OF SPECIFIC LENGTH AND CHARACTERISTIC IMPEDANCE.

** DENOTES CAPACITANCE IS FORMED BY PADS ON PWB.

Electrical Schematic – VS1 & VSHD Exciter (RF Drive and RF Power Stage)			
Issue 2.0	Not to Scale	Figure 7-6	Sheet 1 of 1

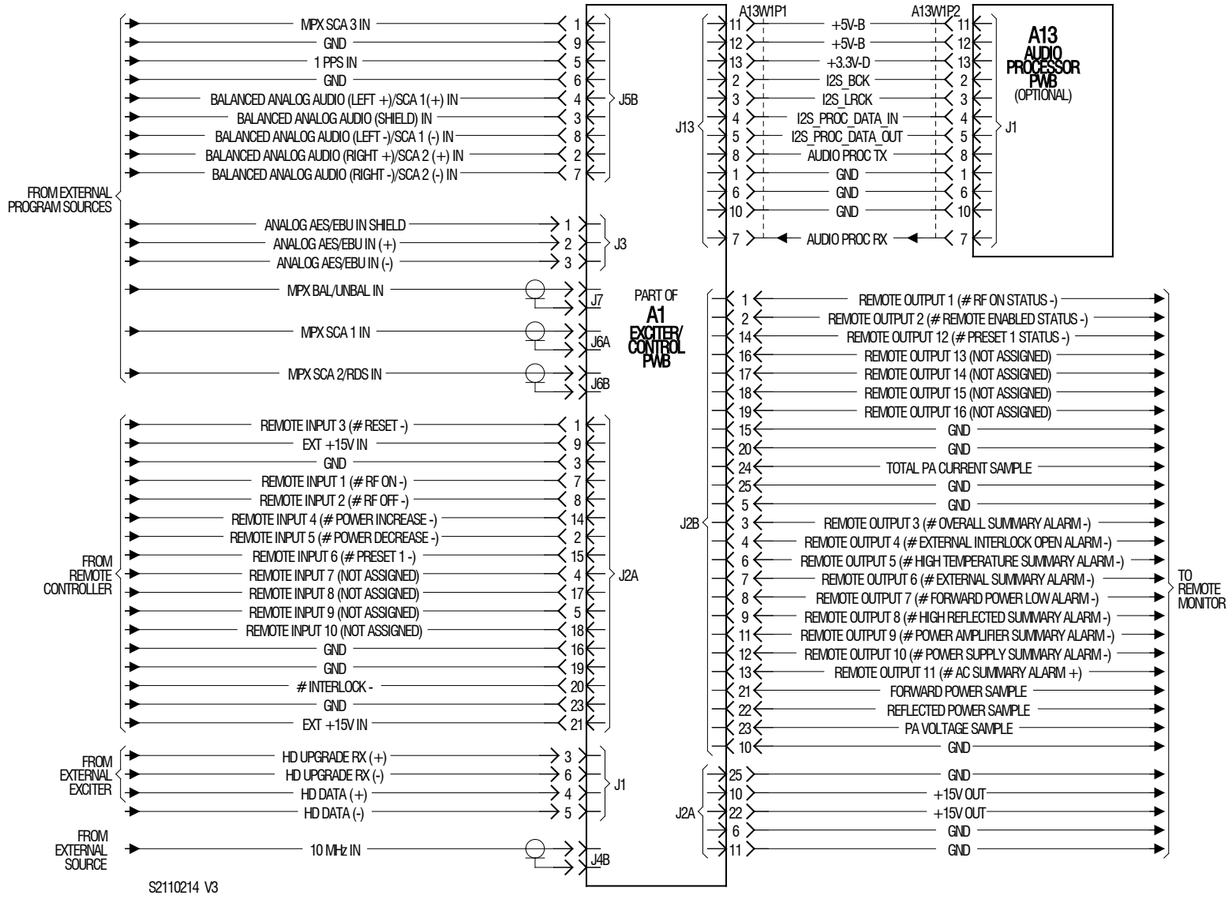
nautel

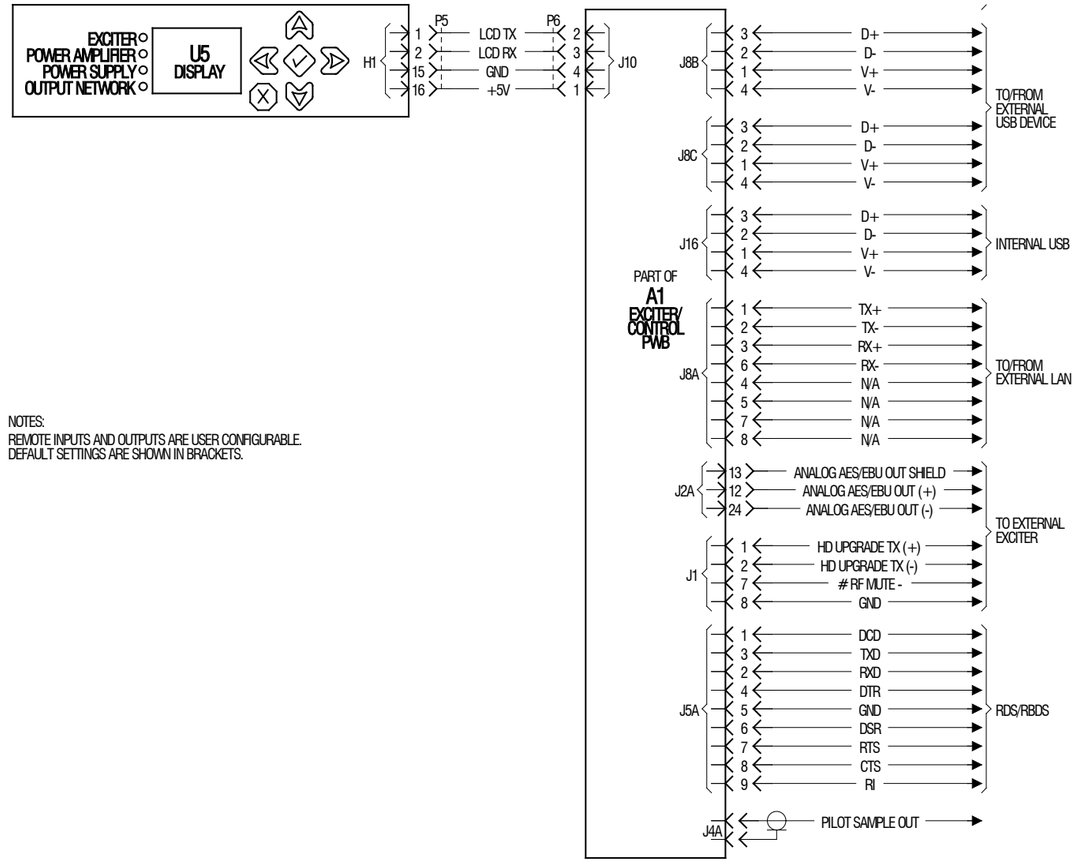


NOTES:
POWER SUPPLY MODULE CONNECTOR AND PS DISTRIBUTION PWB CONNECTORS J1 AND J3 ARE BLIND-MATE CONNECTIONS.

DENOTES TB1
DENOTES TB2
DENOTES TB3
DENOTES TB4

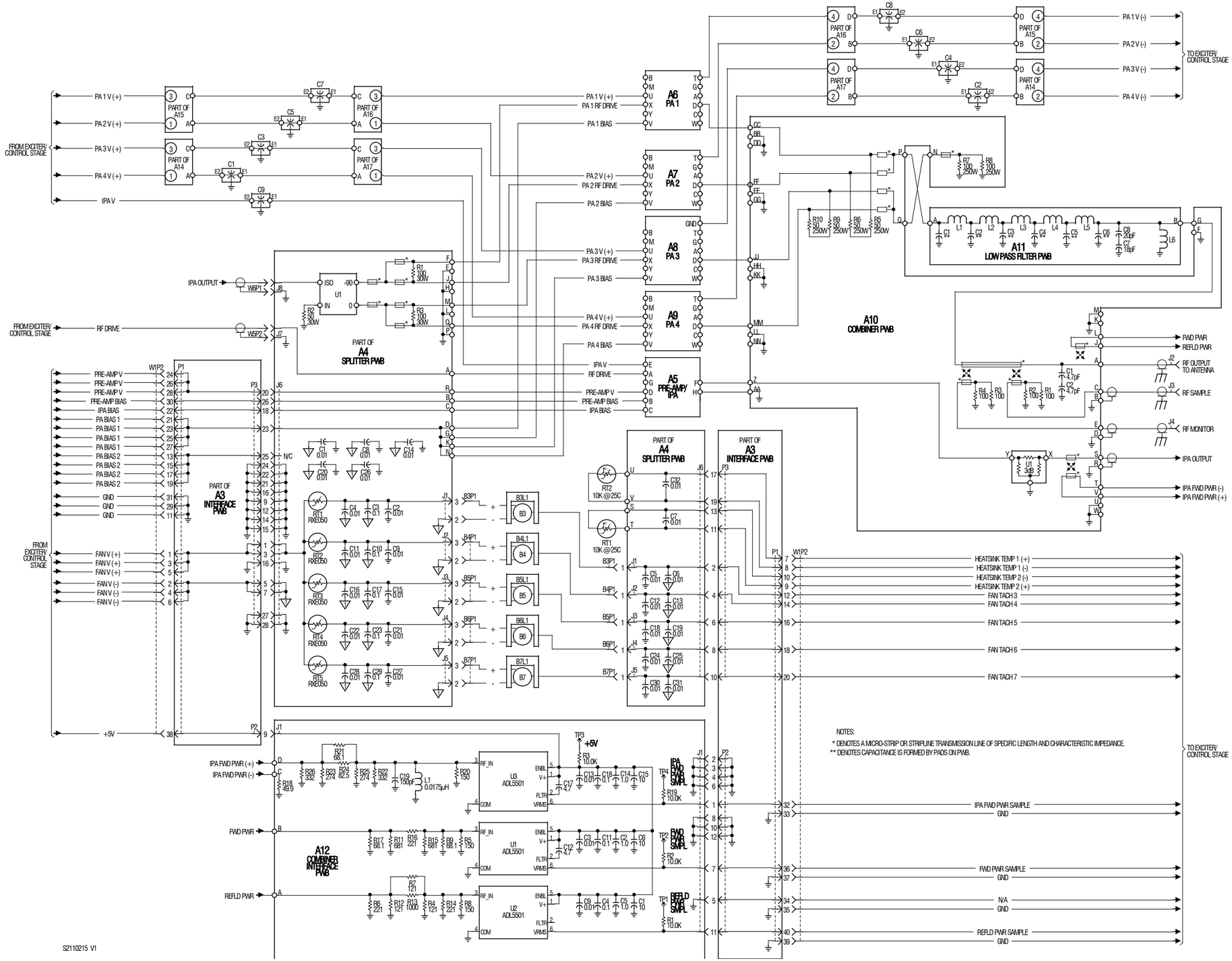
Electrical Schematic – VS2.5 & VSHD Exciter (Control/Monitor Stage)			
Issue 2.0	Not to Scale	Figure 7-7	Sheet 1 of 2



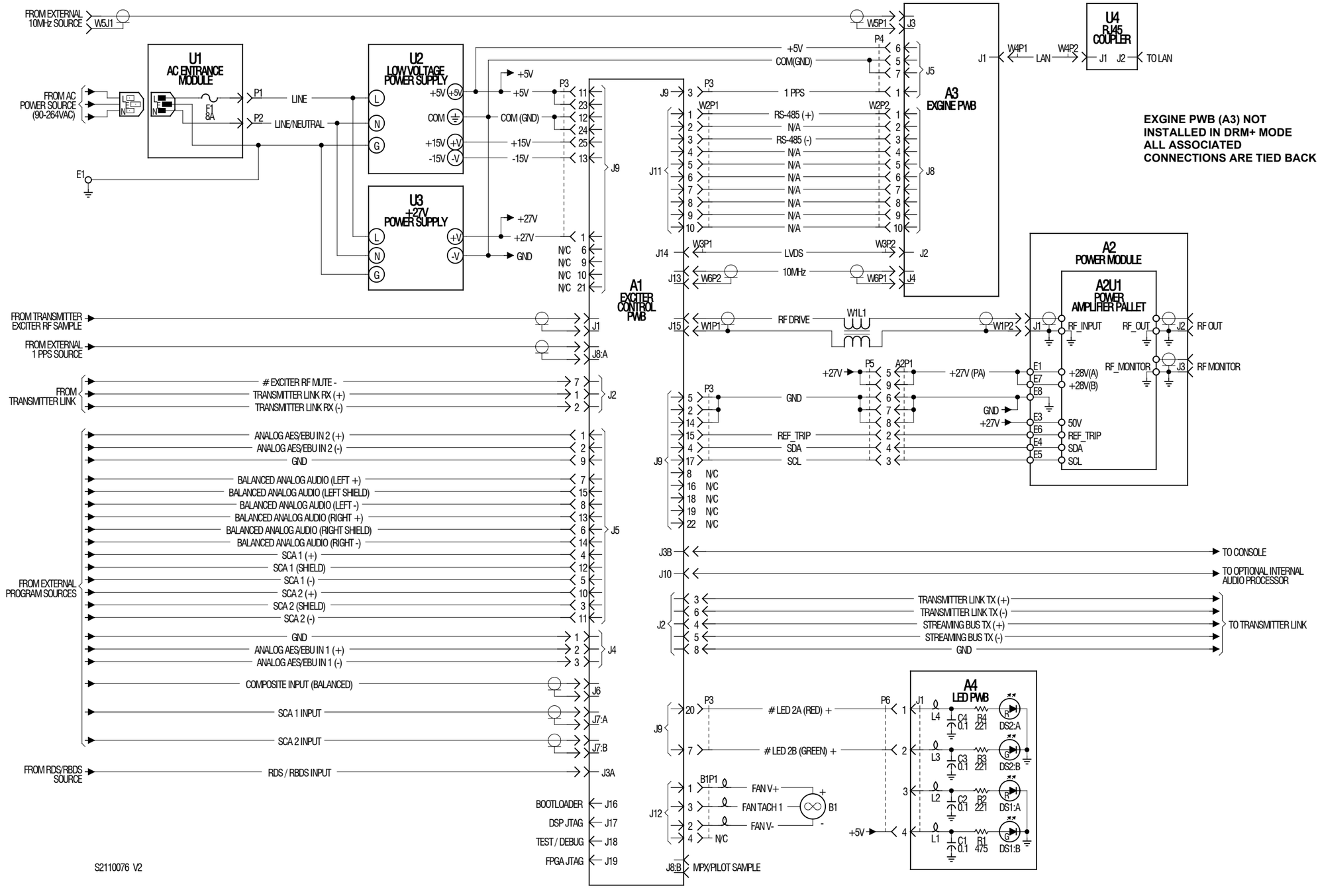


NOTES:
REMOTE INPUTS AND OUTPUTS ARE USER CONFIGURABLE.
DEFAULT SETTINGS ARE SHOWN IN BRACKETS.

Electrical Schematic – VS2.5 & VSHD Exciter (Control/Monitor Stage)			
Issue 2.0	Not to Scale	Figure 7-8	Sheet 2 of 2

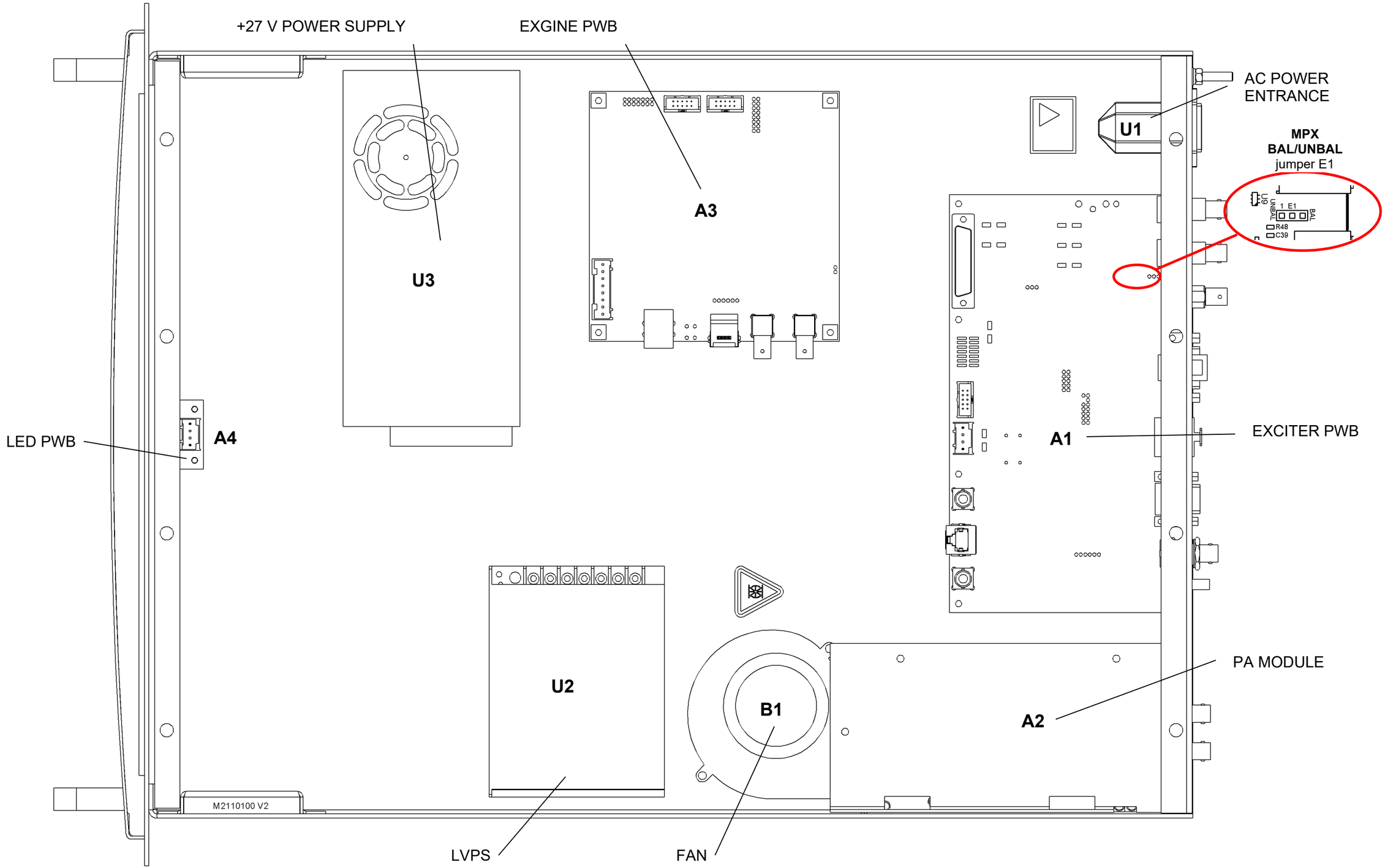


Electrical Schematic – VS2.5 & VSHD Exciter (RF Drive and RF Power Stage)			
Issue 2.0	Not to Scale	Figure 7-9	Sheet 1 of 1



S2110076 V2

Electrical Schematic – VSHD Exciter (NAE103A/B)			
Issue 2.0	Not to Scale	Figure 7-10	Sheet 1 of 1



Assembly Detail – VSHD Exciter – Top View (cover removed)			
Issue 2.0	Not to Scale	Figure 7-11	Sheet 1 of 1