



NXSeries 5 – 2000 kW MW

NX Series High Power - AM/MW/LW

HFCC



B15 Brisbane, Australia

Presented by Chuck Kelly

Agenda

- Introduction
- NX Series Overview
- NX Digital
- NX Efficiency
- NX Control
- Firmware Release 4 Quick Summary
- NX Combiner
- NX Long Wave
- Nautel Systems Integration
- Nautel Support
- Your questions



NAUTEL COMMON CONTROL:



NXSeries MW
5 kW–2.0 MW



VSSeries FM
300 W–2.5 kW



Advanced User Interface (AUI)



NTSeries UHF
150 W–500 W



NVSeries FM
3.5 kW–88 kW



NV^{LT}Series FM
3.5 W–40 W

NX Series: High Power Solid-State

NX Innovation

- Industry's top efficiency: up to 90%
- Adaptive pre-correction
- RF + audio spectrum analyzers
- 1.8 MHz Direct digital modulation
- Intuitive touch-screen interface
- Ultra-compact
- Digital: All DRM modes + HD Radio



NX5/10

NX25

NX50

NX100



NX200

NX300

NX400

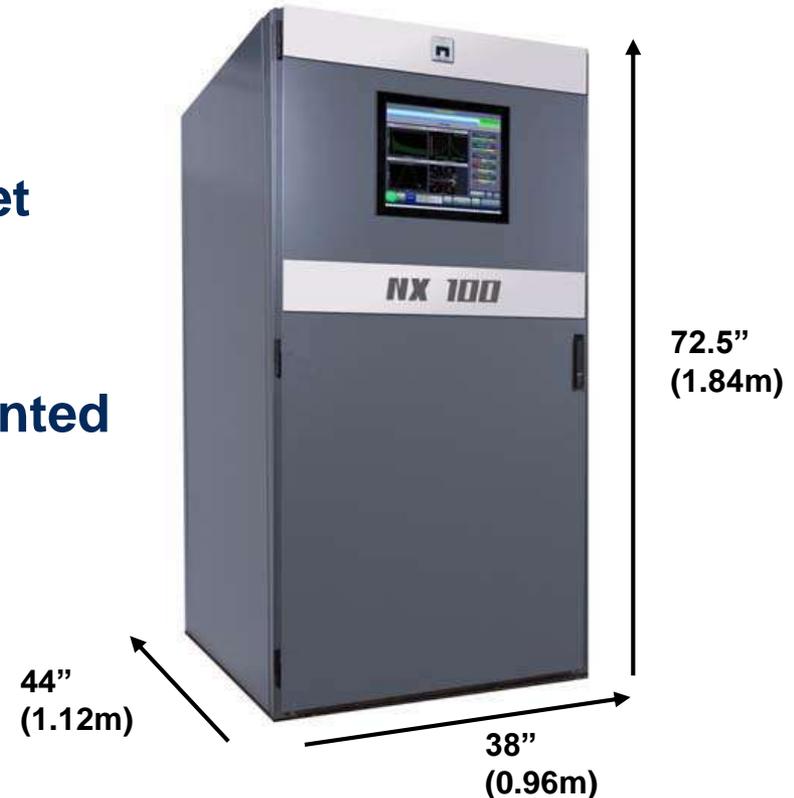


Combined Solutions up to 2MW

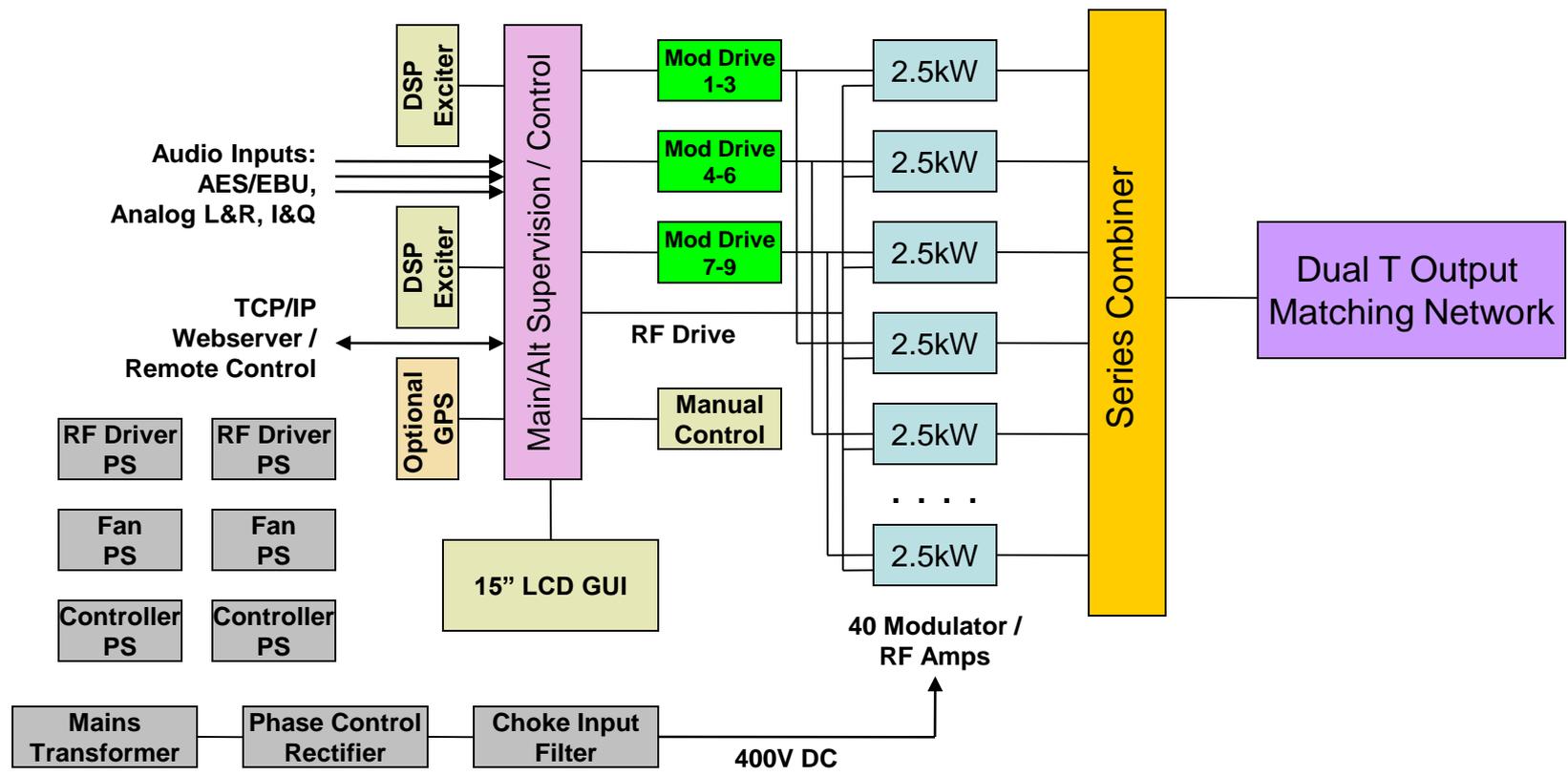
NXSeries: 100kW Building Block

Ultra-compact !

- NX25 / NX50 / NX100: Same size cabinet
- NX100 and higher have small external transformer cabinet which can be mounted adjacent to or remotely



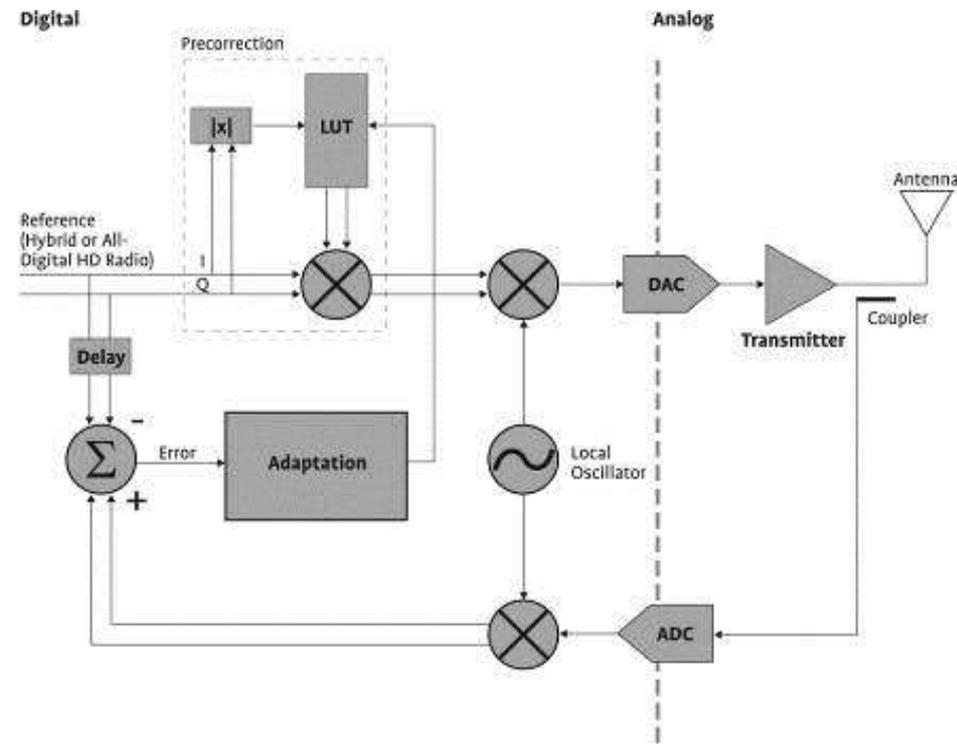
NX100: Block Diagram



Dynamic Pre-Correction

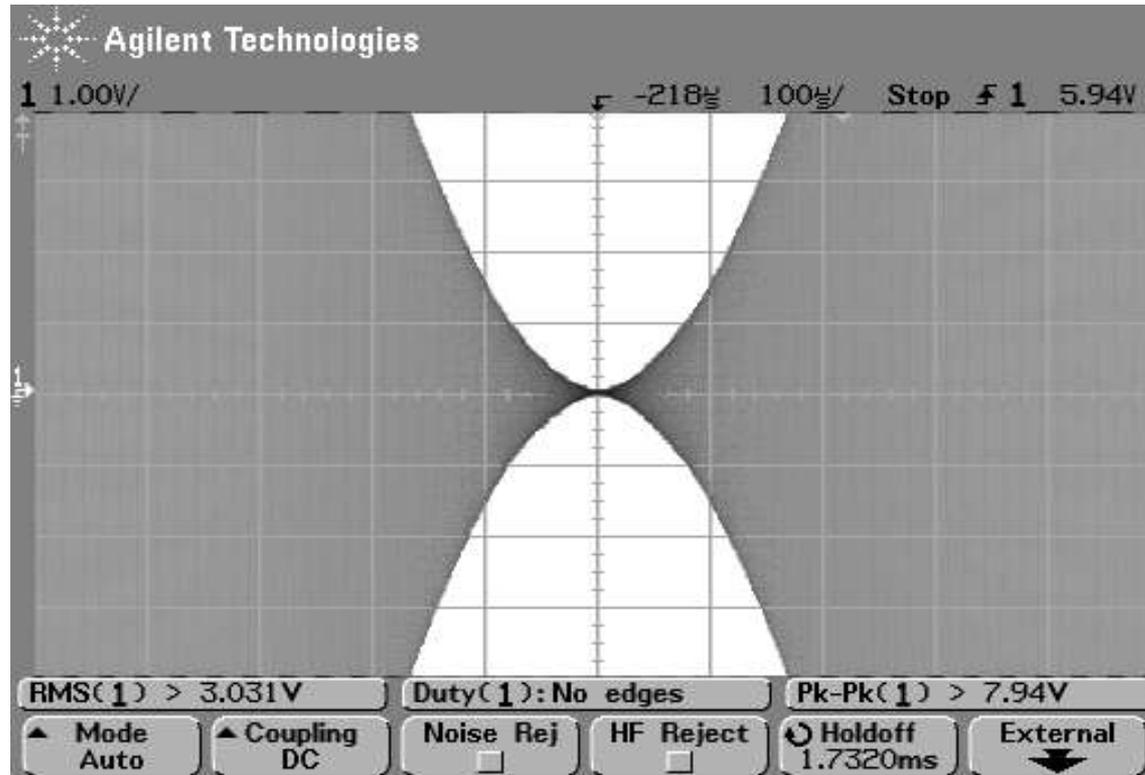
“The NX Series of AM transmitters are the first high power AM transmitters to be provided with Dynamic Pre-correction”

- Corrects primary forms of distortion
- Applies to analog + digital broadcasting
- More Linear – Clean Spectrum
- Adaptive envelope equalization
- Adaptive AM-AM correction
- Adaptive AM-PM correction



Performance Results - AM

No visible distortion in the trough with AM to AM correction

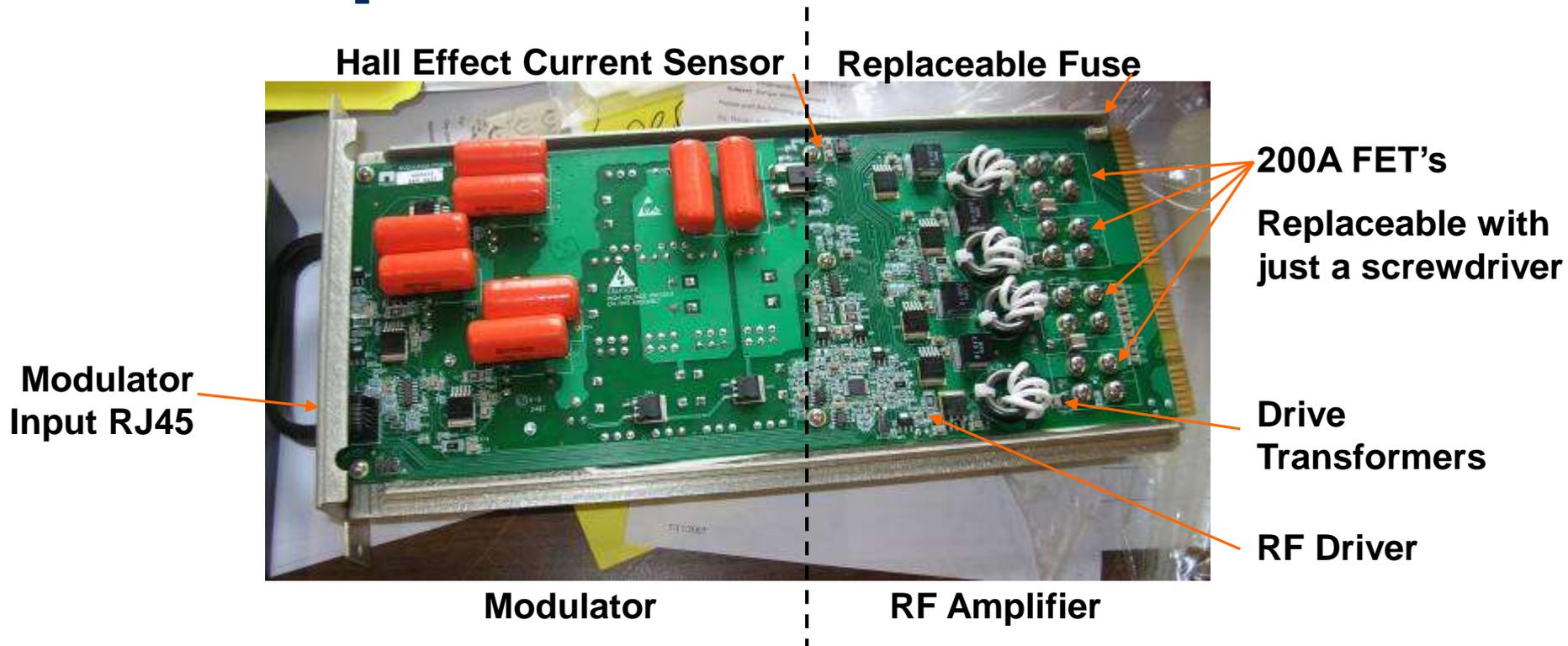


Main/Alternate Supervision & Control

- Interfaces dual DSP excitors
- Provides uninterrupted modulation + RF
- Dual AES/EBU inputs, Analog L&R, and I&Q inputs.
- Optional GPS input card for ultimate frequency accuracy.
- Parallel remote control
- Full web server TCP/IP control.
- Failsafe manual basic control.



RF Amplifier / Modulator Module

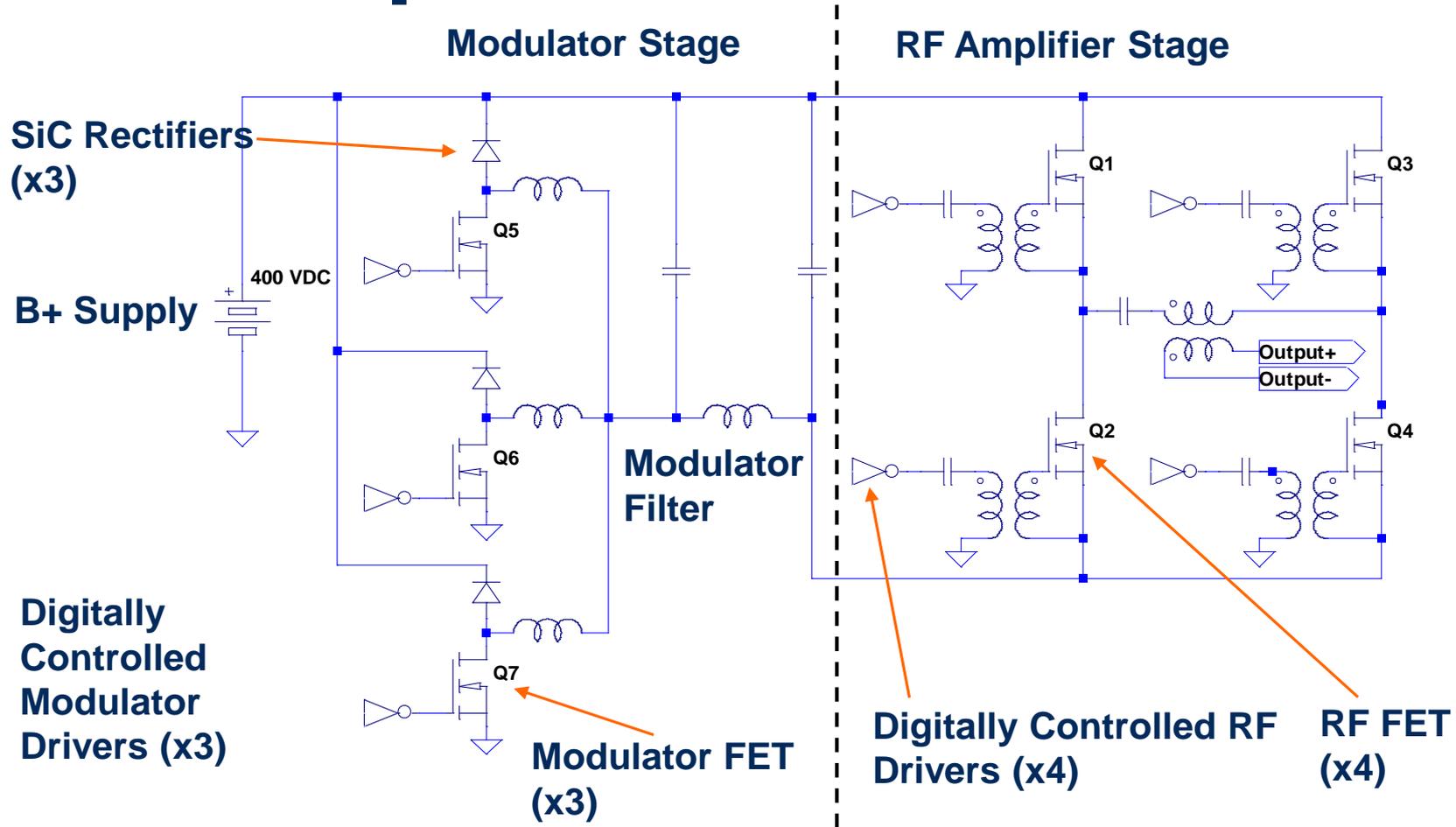


98%
PA Efficiency

12kW continuous power rating

(NX module operated at 2.5kW of carrier)

RF Amplifier/Modulator Module



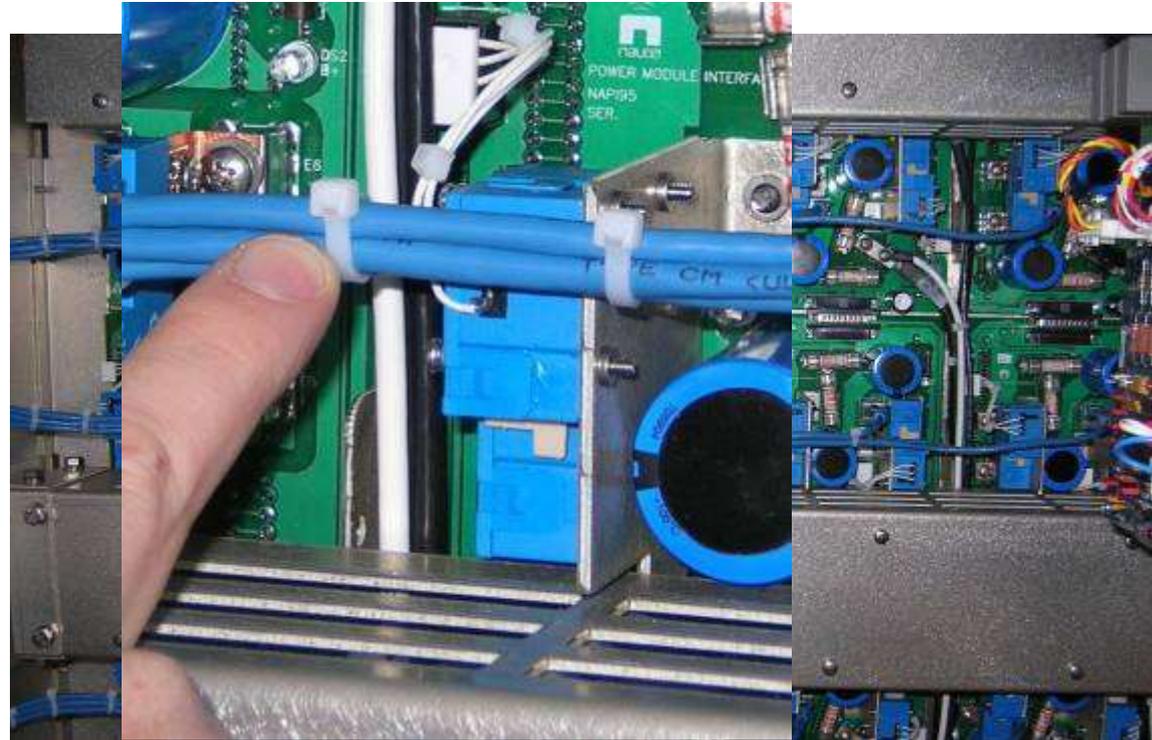
RF Amplifier / Modulator Module

- No adjustments – no pots
- Broadbanded – entire AM band
- Hot pluggable
- Heavy gold connectors both sides
- Heat sink: 2.5 x required size
- High Efficiency Silicon Carbide modulator diodes
- Balanced RS422 modulator and RF drive.



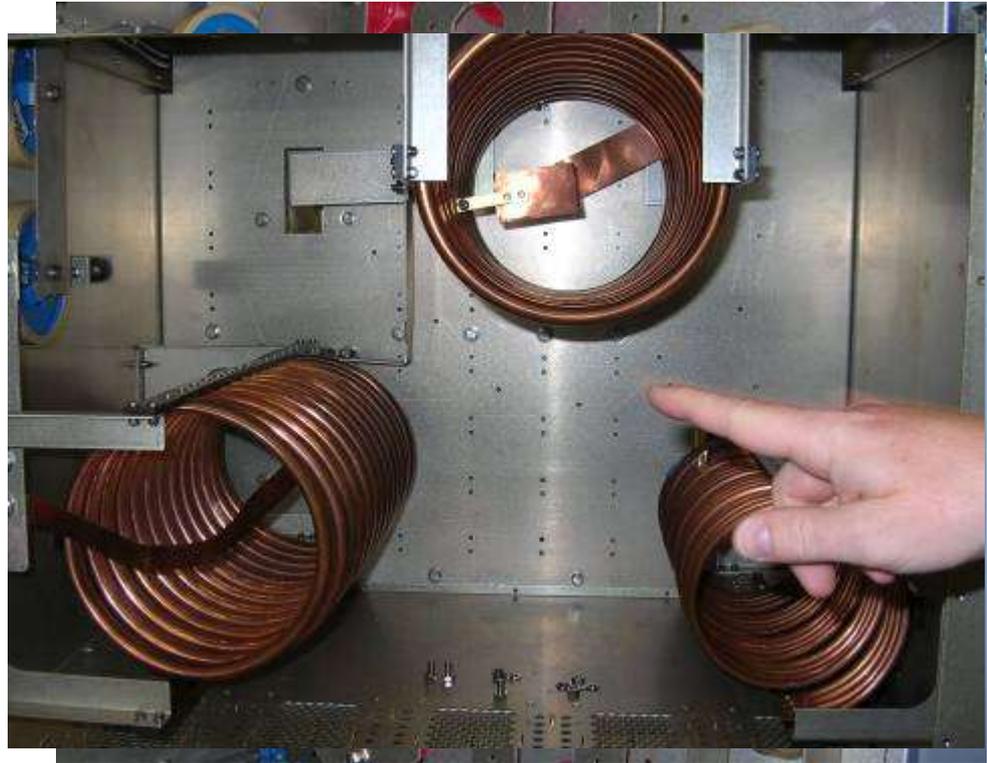
Series Combiner

- Consists of a two parallel copper pipes with ferrite cores which couple the RF output.
- Can handle many times the required power.
- Broadbanded.
- Module isolation relay is one of only two moving parts in the NX (the other is the fans)

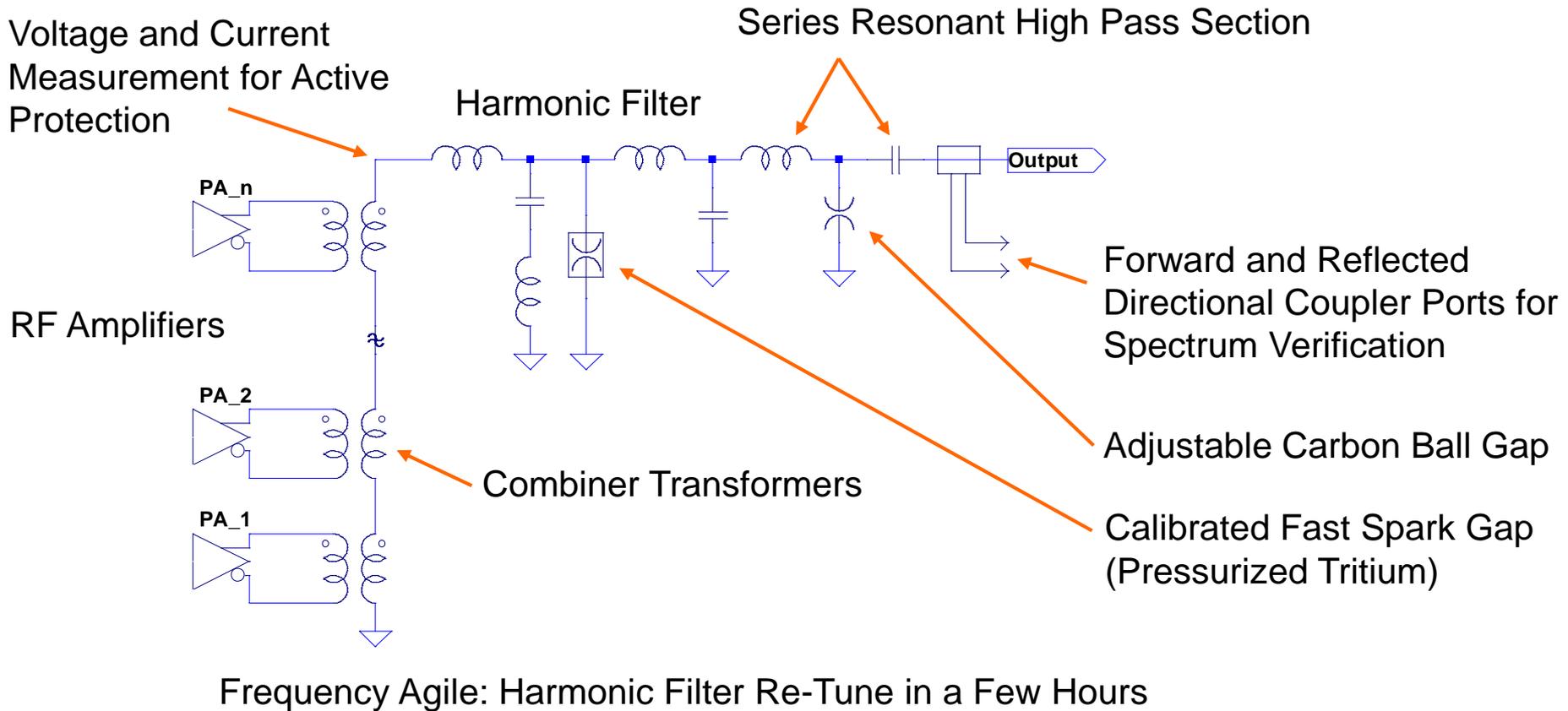


Output Network

- The Output Network is the ONLY frequency dependant section in the NX Series.
- Consists of two T networks, with a shunt 3rd harmonic trap.
- This is a low Q filter, which provides minimal amplitude and phase distortion to the RF signal.
- Adjustment of the NX series from one frequency any other in the AM band may be accomplished in just a few hours.
- Kit with frequency dependant parts for all MW frequencies is available.

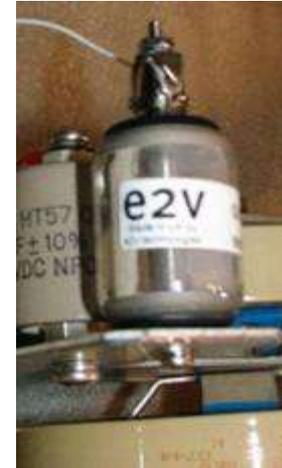


Combiner/Filter & Transient Protection



Lightning/Transient/AC Protection

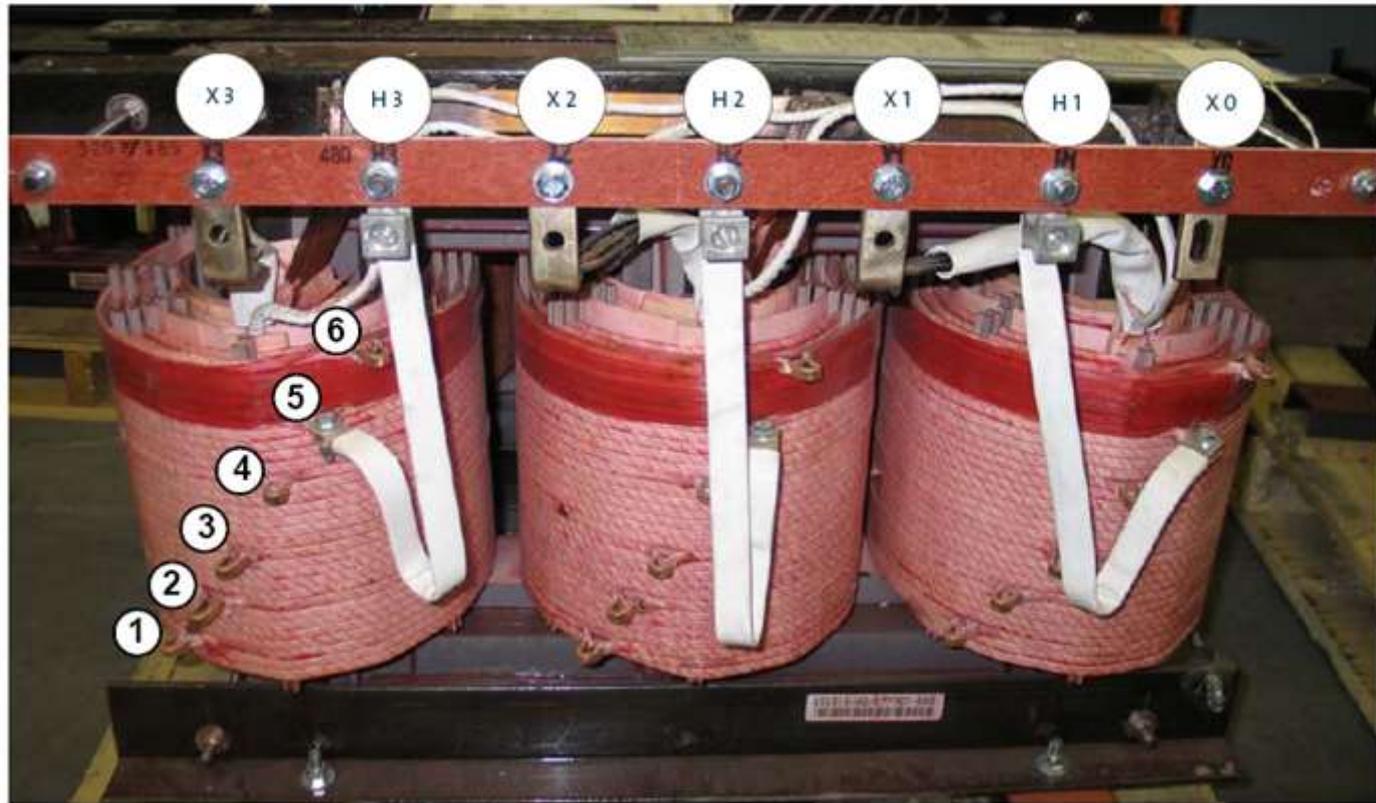
- ~10 uS Active VSWR Shutdown
- Series Capacitor/High Pass Stage
- Carbon Adjustable Ball Gap
- Static Discharge Choke
- Calibrated Fast Spark Gap (Pressurized Tritium)
- MOV Protection on Incoming AC
- Transient Attenuator Capacitors on AC Transformer Secondary (Common Mode)
- AC Surges Corrected by Phase Controlled B+ Rectifiers (Differential Mode)



NX50 Power Transformer

Figure 3.1: NX50 power transformer line voltage tap layout

Voltage (V ac)	Tap
350	6
380	5
410	4
450	3
480	2
510	1



Three-phase primary winding tap nominal voltages (rms, phase-to-phase)

Cooling

- 10 Ball Bearing DC Fans arranged in hot pluggable trays – two for each tray.
- Transmitter will operate with just one working.
- Typical fan life is over 11 years.
- Fan operation and speed is monitored by the controller.
- In a 100kW transmitter, only 10kW of heat is produced, about the same as a typical 10kW FM transmitter.
- Air is drawn in from the rear, through a washable metal air filter.



Power Supplies

- Three phase AC power of a broad range of configurations are fed through a large, high efficiency transformer in a separate cabinet. 250V three phase is fed to the transmitter.
- The 250V feed is rectified through a phase controlled three phase rectifier bank which provides voltage control and soft start.
- Ten large fuses protect banks of 4 modules.
- Filtering is done by dual choke input filters with a large bank of electrolytic capacitors.
- All LVPS (Controller, RF Drive, Fan) are completely redundant.



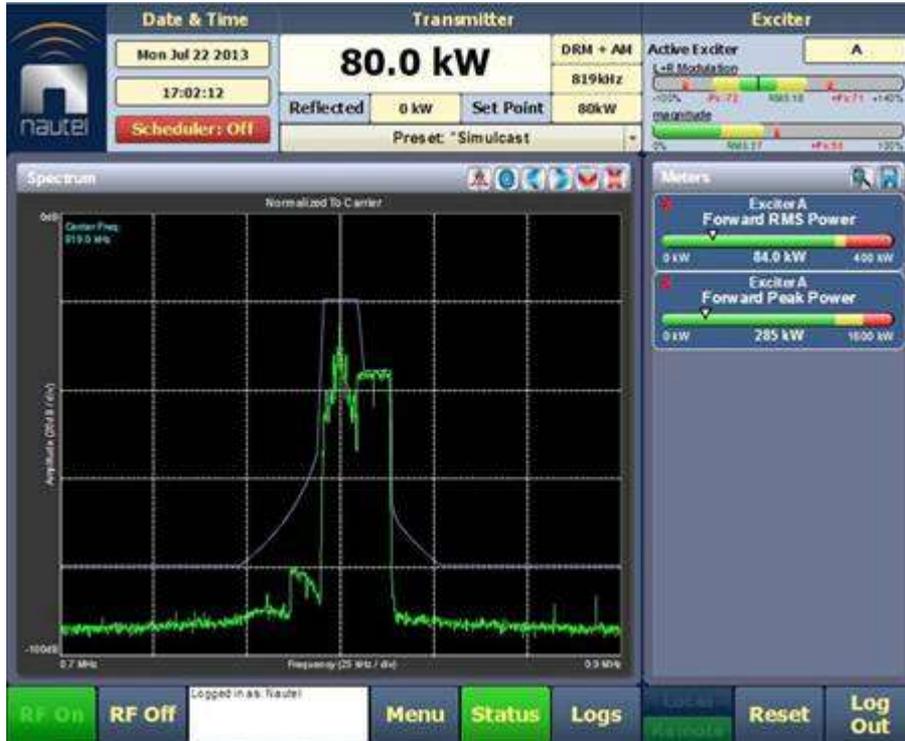
NXSeries Digital Radio leadership

The Nautel NX series leads the industry in Digital Radio development

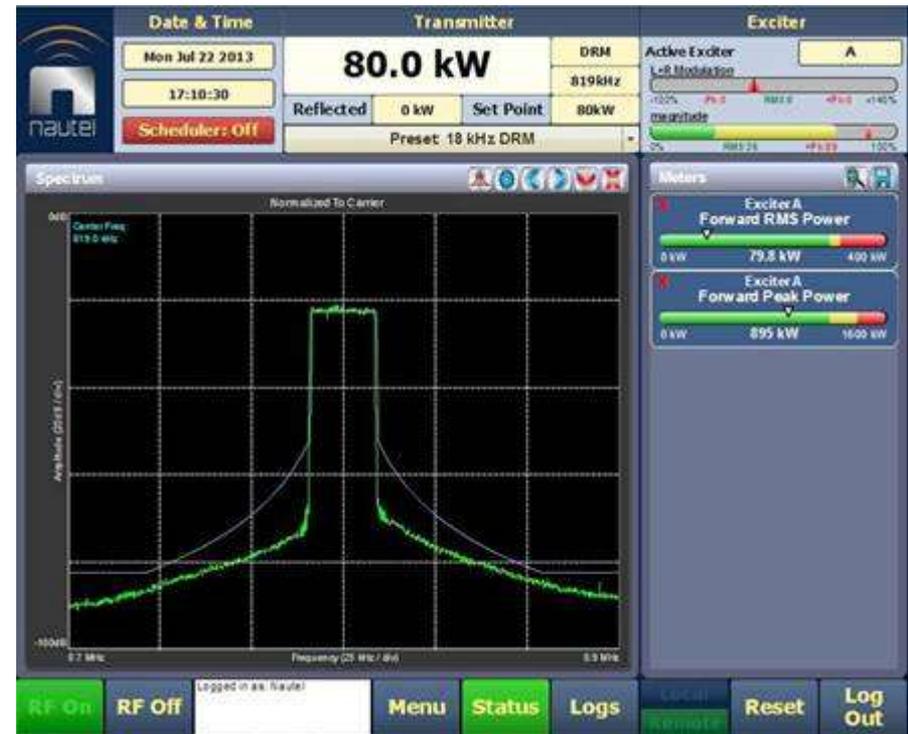
- Whether it's for DRM or HD Radio, Nautel has pushed the performance limits.
- Advanced PAPR and linearization algorithms provide more RMS power from a given power transmitter with better MER.
- Continuing development has further improved all-digital performance. See Brian Walker's paper at NAB 2014.
- Feeds the transmitter with true digital I/Q signals for best performance.
- All modes and bandwidths supported.



Advanced DRM modes

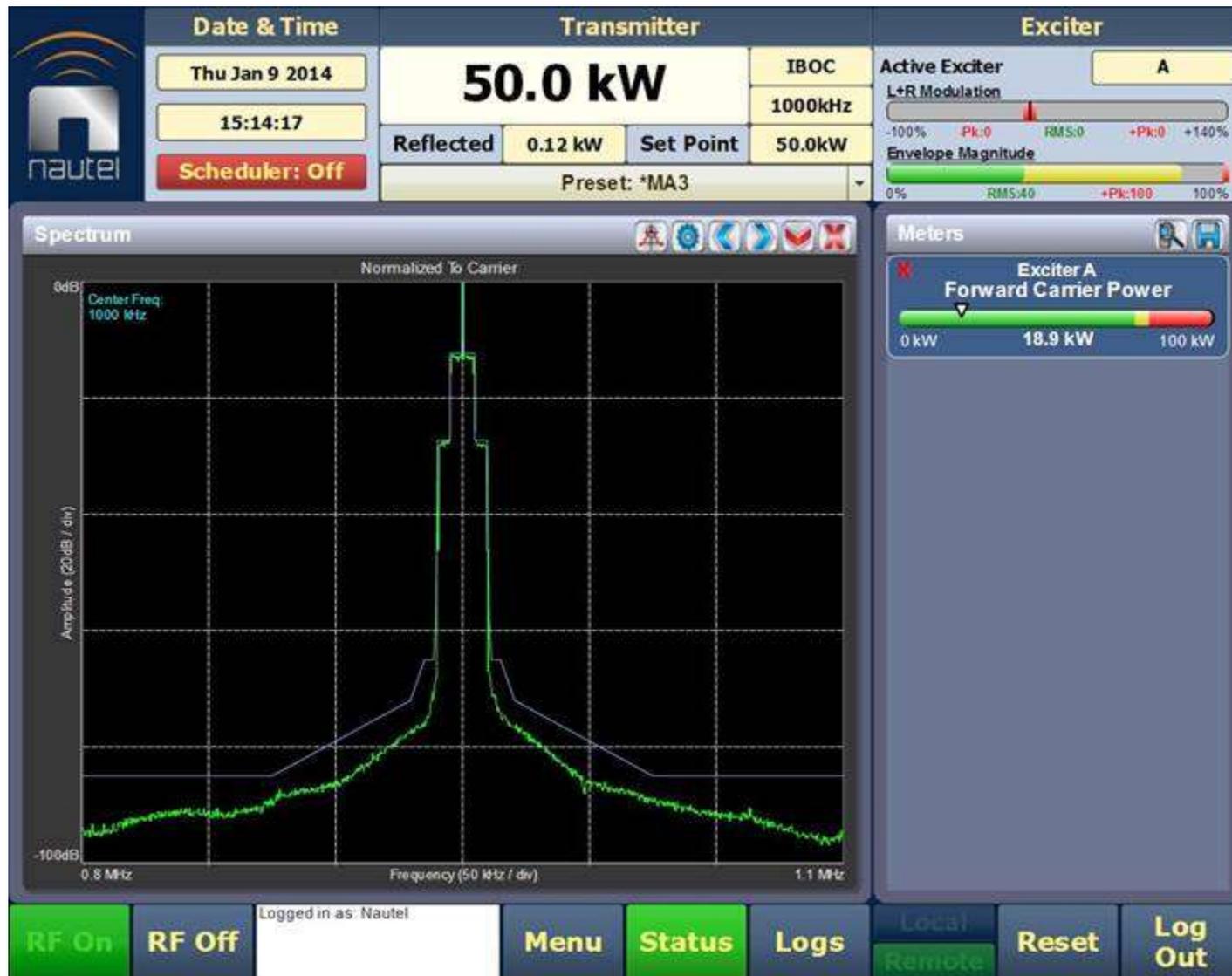


Simulcast



20 kHz DRM

NXSeries: All digital HD Radio



NX Efficiency

The Nautel NX is the world leader in high efficiency AM transmission

Highest efficiency:

86% for NX5 and NX10

88% for 25kW and 50kW

90% for NX 100kW and higher

90%
EFFICIENCY



Even more power savings:

Modulation Dependant Carrier Level (MDCL)
standard

all 5 popular algorithms are included

up to an additional **30%** savings in electrical costs

no discernable coverage or performance reduction.

“With reduced electrical costs the purchase price of an NX can often be paid off in just a few years when compared to older tube and solid state designs.”

NX Firmware Release 4

Nautel offers continuous development and improvement to its products

- *the result of over a year of development*
- *includes both feature enhancements and bug-fixes*
- *creates common code + feature set for all Nautel AUI based products*
 - *including NV, NVLT, NX, and VS.*



New features include:

- MER metering
- Support for TLS secured SMTP servers
- Port forwarding
- Ability to save user selected AUI meters
- Ability to save critical parameters remotely
- SNMP traps
- Remote AUI timeout
- Customizable user account capabilities
- Redesigned scheduler
- Network Time Protocol
- Unique OS password enabled
- Ability to add Call Sign to AUI banner
- Multi phase PDM cancellation routine resulting in improved RF spectrum
- Summary alarms for remote interfacing
- 'take action' on audio loss
- USB Audio (Nautel USB adapter required)
- Icecast/Shoutcast capable

NXSeries: Scalable to 2MW

- High power building blocks:
 - 100, 200, 300 or 400kW systems
- Combiners: 2, 3, 4 or 5 port
- Even greater redundancy
- Nautel Dummy Loads
- 2MW: 5 port combined NX400



800kW



1200kW

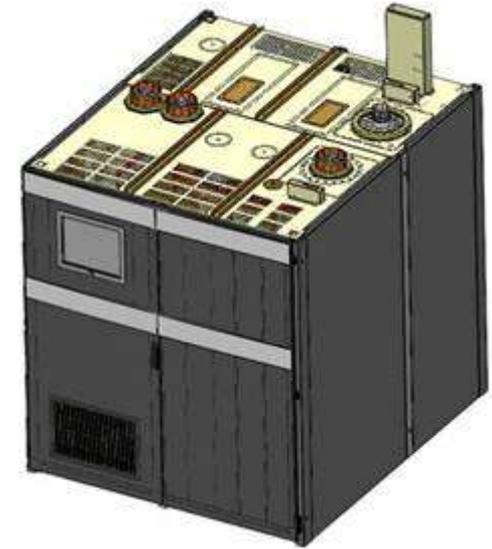
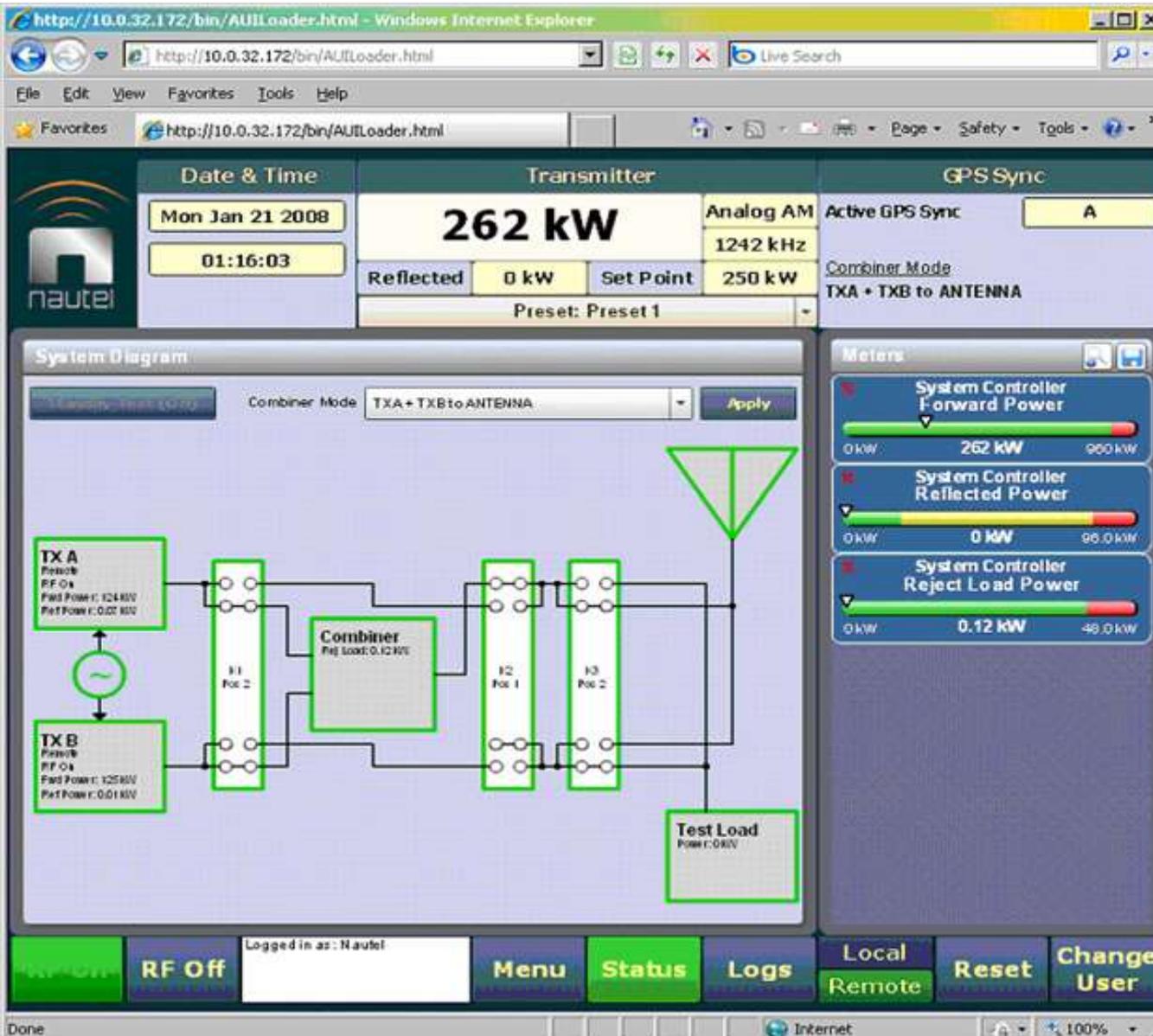


1600kW



2000kW

NXC Combiner Control



NXC 800



Date & Time

Mon Jan 21 2008

01:17:06

Transmitter

0 W

Analog AM

1242 kHz

Reflected

0 kW

Set Point

250 kW

Preset: Preset 1

GPS Sync

Active GPS Sync

A

Combiner Mode

TXA + TXB to ANTENNA

Reject Controller 2



Firmware Version

Loading

Meters

Fan Supply A	0 V	Ambient Temperature 1	19 °C	Fan 3 Speed	0 rpm
Fan Supply B	0 V	Ambient Temperature 2	17 °C	Fan 4 Speed	0 rpm
Fan Supply C	0 V	+15V	14.9 V	Fan 5 Speed	0 rpm
+5V	4.97 V	Fan Supply	0 V	Fan 6 Speed	0 rpm
Infrared Temperature 1	28 °C	Fan 1 Speed	0 rpm	Fan 7 Speed	0 rpm
Infrared Temperature 2	23 °C	Fan 2 Speed	0 rpm	Fan 8 Speed	0 rpm

Alarms



RF On

RF Off

Logged in as: Nautel

Menu

Status

Logs

Local

Remote

Reset

Change User

Change User



Date & Time

Mon Jan 21 2008

01:17:36

Transmitter

0 W

Analog AM

1242 kHz

Reflected

0 kW

Set Point

250 kW

Preset: Preset 1

GPS Sync

Active GPS Sync

A

Combiner Mode

TXA + TXB to ANTENNA

Changeovers



Active GPS Sync:

Main GPS Sync

Auto Sync Changeover

Select a Preset to Activate

Preset 1

Mode: Analog AM
Index: 1

DCC Mode: No DCC

Preset 2

Mode: Analog AM
Index: 2

DCC Mode: No DCC

Preset 3

Mode: Analog AM
Index: 3

DCC Mode: No DCC

Preset 4

Mode: DRM
Index: 4

DCC Mode: No DCC

Yes

No

Load

Cancel

RF On

RF Off

Logged in as: Nautel

Menu

Status

Logs

Local
Remote

Reset

Change
User



Date & Time

Mon Jan 21 2008

01:17:53

Transmitter

0 W

Analog AM

1242 kHz

Reflected

0 kW

Set Point

250 kW

Preset: Preset 1

GPS Sync

Active GPS Sync

A

Combiner Mode

TXA + TXB to ANTENNA

User Settings



Network Setup

Email Configuration

Notifications

Upload Files

SNMP Configuration

Network Setup

MAC Address

00:18:7D:1C:08:40

DHCP

Static IP

IP Address

10.0.32.172

Subnet Mask

255.255.255.0

Default Gateway

10.0.32.254

Default Nameserver

10.0.1.239

Alternate Nameserver

10.0.1.238

Port Number

3501

Status

Running

Apply

RF On

RF Off

Logged in as: Nautel

Menu

Status

Logs

Local
Remote

Reset

Change
User



Date & Time

Mon Jan 21 2008

01:19:55

Transmitter

0 W

Analog AM

1242 kHz

Reflected

0 kW

Set Point

250 kW

Preset: Preset 1

GPS Sync

Active GPS Sync

A

Combiner Mode

TXA + TXB to ANTENNA

System Settings



Reset

Screen Configuration

Upgrade Software

RF Monitor Gain

GPS Alarms Enable

Audio Loss Shutdown

Time Setup

NTP Servers

Audio Loss Shutdown

Enable Audio Loss Shutdown

No

Yes

Shutdown Delay

10

Seconds

Recovery Delay

10

Seconds

Apply

Cancel

RF On

RF Off

Logged in as: Nautel

Menu

Status

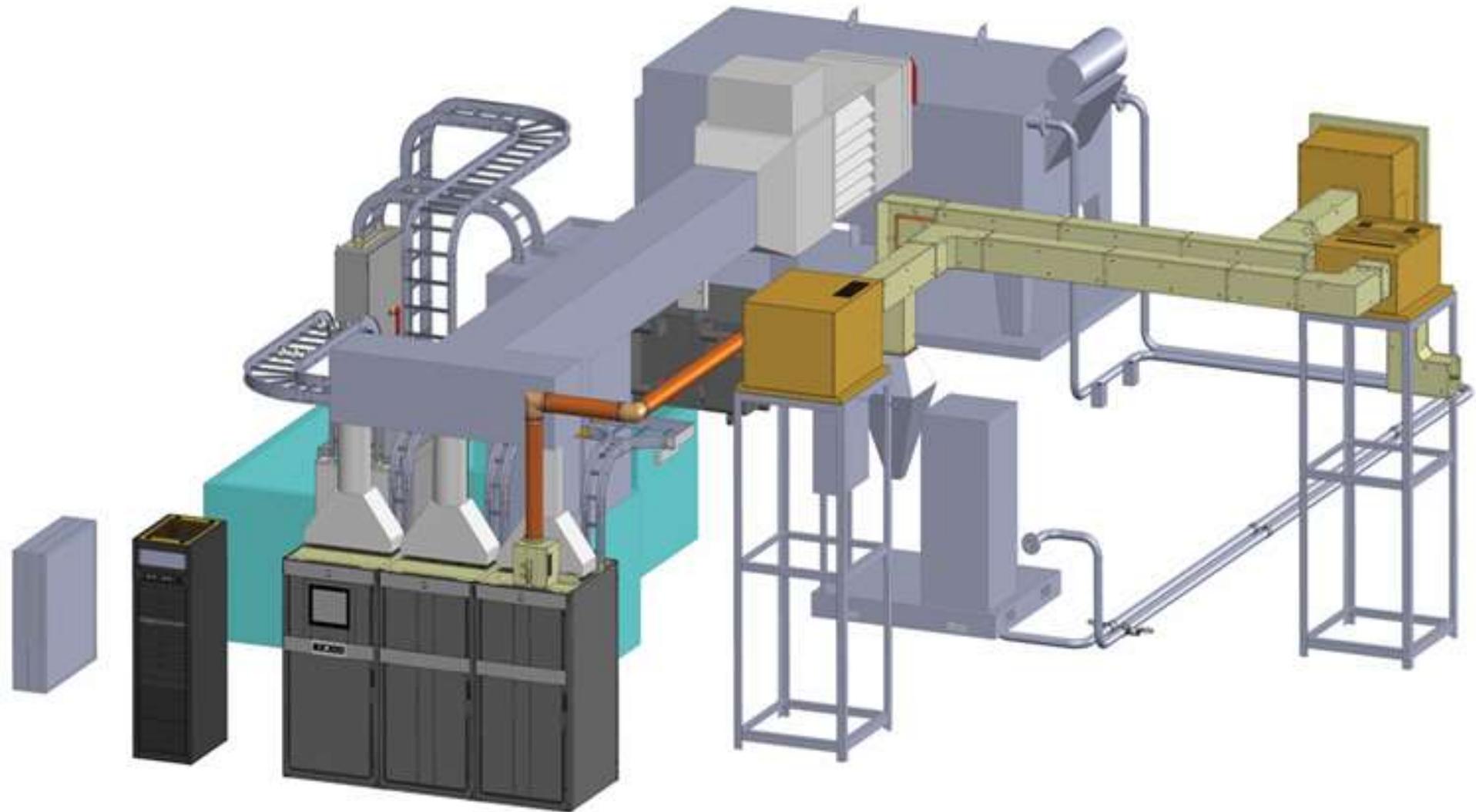
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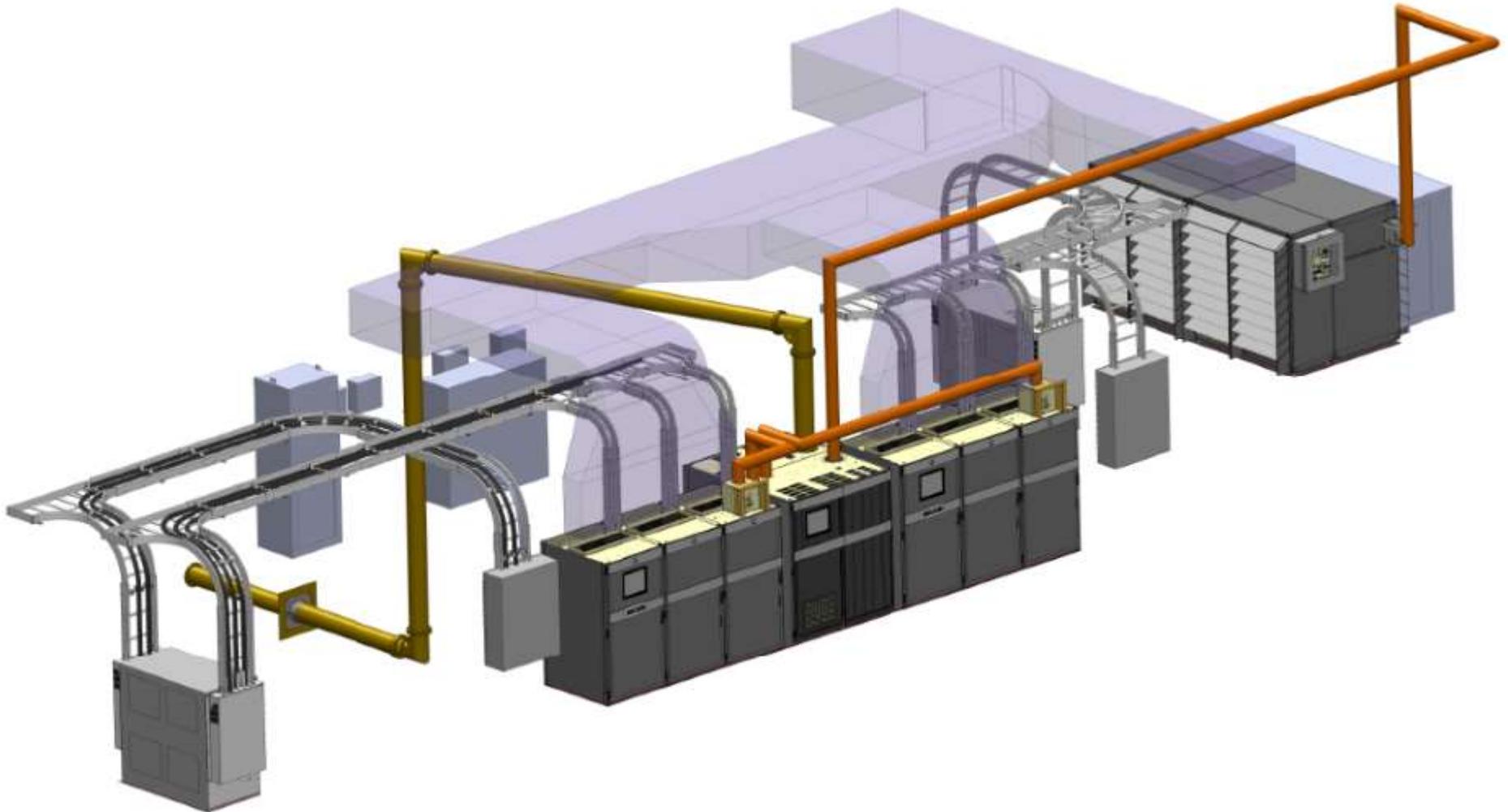
Reset

Change
User

NX High Power: Typical Installation



NX High Power: Combined Installation



Nautel Dummy Loads

- Suitable for indoor or outdoor use
- Fully sealed and slanted top to prevent water penetration
- Louvered front and back panels
- Rated for 50% above label power
- Frequency Range:
 - 530 – 1,700kHz operation
- VSWR: 1.05:1 maximum
- Available in many power levels



NXL200 Medium Wave Load

Nautel Specialized Integration



Nautel Support/Services

- **Three support offices:**
 - Quincy, Bangor, Halifax
- **Parts depots:**
 - Quincy, Bangor, Halifax, Memphis
 - Memphis quick-ship depot 
 - Order by 7:30 EST for overnight delivery
- **24/7 live support**
- **Live chat**
- **Commitment**
 - Support for every Nautel product ever made... no matter when it was manufactured.



NXSeries: **Long Wave Band**

- Frequency Range: 129 to 283.5
- 90%+ efficiency
- 135% positive peak modulation
- 1.5:1 VSWR
- Other features are identical to the NX MW models



Nautel Installed Transmitters









300KW

300KW



NX Series Summary

- The NX Series is the most advanced MW transmitter series available today
- Available from 5kW to 2MW with unparalleled efficiency
- Ready for all forms of digital radio
- Complete with powerful test equipment
- Nautel Continuous Improvement



Learn More / Stay in touch

- Nautel Waves Newsletter
<http://www.nautel.com/newsletter/>
- Webinars
<http://www.nautel.com/webinars/>
- YouTube
<http://www.youtube.com/user/NautelLtd>
- Nautel Store
<http://store.nautel.com/>



Questions? We're ready to help.

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Wendell Lonergan	Head of Broadcast Sales & Europe & Russia
Gary Manteuffel	US Corporate Accts & Canada
Ellis Terry	Western US
Jeff Welton	Central US
Gary Liebisch	Eastern US
Ken Ruzicka	Sales Engineer
John Abdour	Asia / Pacific
Gerardo Vargas	Latin America / Caribbean
John Macdonald	Middle East / Africa
Christy White	VS and LPFM Specialist



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