

Continental's  
816R-5B, 35 kW  
Single Tube  
Broadcast Transmitter

*fm*



Includes the 802A solid-state exciter

## Features

- SCR Power Control
- Automatic RF Power Output Control
- Automatic SWR Circuit Protection
- SWR Output Power Foldback
- Remote Control Interface
- True RMS Filament Power Regulation/Metering
- AC Power Failure Recycle
- Two/Four Shot Automatic Overload Recycle
- Grounded Screen Amplifier
- Internal Diagnostics

## Top Performance and Proven Design in High Power FM

Continental's 816R-5B 35 kW FM transmitter is a high performance, state-of-the-art transmitter that uses the 802A exciter to deliver a crisp, clean signal.

The transmitter is solid-state except for one 9019/YC130 tetrode power amplifier operating at Class C.

The 9019/YC130 tetrode was specially designed by EIMAC for Continental, to meet stringent FM service requirements at 35 kW.

The 816R-5B is the latest addition to Continental's popular 816R Series of 11, 21.5, 25 and 27.5 kW transmitters, but employs a newly designed cavity for the 9019/YC130 tetrode.

The harmonic filter is internally mounted, providing a 3-1/8" EIA flange for direct mounting to the transmission line.

Transmitter power may be adjusted to any level between 0 and 100% with minimal retuning, by using front panel controls.

If momentary power outages or overloads occur, special circuits protect the transmitter and will automatically restore it to operational status.

Two independent VSWR protection circuits automatically reduce transmitter power to a safe operating level whenever abnormal antenna mismatches occur. One circuit handles severe mismatches such as lightning strikes by interrupting the RF when reflected power reaches 10%. The other circuit holds reflected power to a preset level during icing conditions, allowing power to be maintained at the highest safe level.

An exclusive "soft-start" circuit and low voltage controls are easy on the total system and limit current surges through the power supply components; this helps to minimize parts replacement.

Twenty-three different circuits or indicators are used to protect the transmitter and the control circuits are of the conventional 28 VDC design.

The meters and controls are strategically placed at or near eye level for easy reading and accurate adjustment. All components are easily accessible.

The wide, flat bandwidth is a result of the wideband quarter-wave cavity design which optimizes performance.

If a problem should occur, 27 LED indicators, 14 indicating fuseholders and six front panel circuit breakers assist in quickly isolating it.

The 816R-5B's control options offer operating flexibility. Its compact size and simple installation will get you air-ready with minimum time and cost.

The harmonic filter is contained within the transmitter cabinet.

The 816R-5B is self-contained in one cabinet except for the high voltage power supply which may be placed up to 20 feet away from the transmitter.

In keeping with the tradition of other Continental transmitters, the 816R-5B uses ruggedized components and is built to give many years of reliable service.

## Solid-State Driver

Featured in this transmitter is a solid-state driver which increases reliability and decreases maintenance and complexity. This driver also offers greater bandwidth and self-protecting RF modules.

## The FM Exciter

Continental's 802A solid-state FM exciter offers broadcasters unmatched performance.

## State-of-the-Art Design

Modular subassemblies are easily reached from the front of the exciter. The 802A will accept a composite baseband signal from a stereo generator, STL system or monaural audio and SCA programming.

## Refined Linearity

Exciter modulation performance surpasses the measurement capability of the most advanced test equipment.

## Digital Frequency Selection

Exciter generates its operating frequency with a digitally programmed, dual speed, phase-locked frequency synthesis system.

## 50 Watts Output Broadband Amplifier

The 802A is completely solid-state and needs no tuning adjustments other than selection of operating frequency. Power output is 50 watts into a 50 ohm load at all frequencies in the FM band.

## Automatic Power Level Control

Special circuit protects amplifier from any mismatched load, including open or short circuits. Automatic power control maintains output at any preset level from 5 to 50 watts.

## Sophisticated Styling

Front panel readouts present clear and accurate indication of system performance. Digital LED display indicates true peak level of modulating signal in 5% increments with an accuracy of better than  $\pm 2\%$ .

## Modular Construction

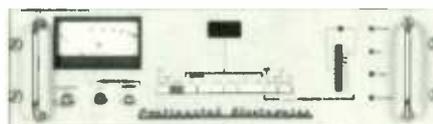
Any subassembly within the exciter can be removed without removing the exciter from the transmitter, and without disturbing other exciter assemblies or components. The exciter is mounted on slides for easy access.



LED status indicators



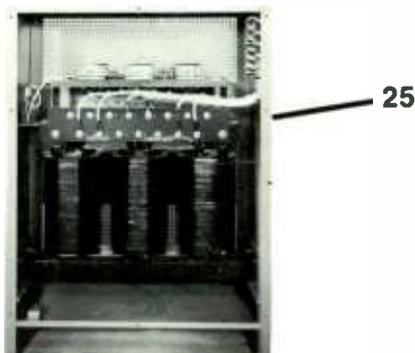
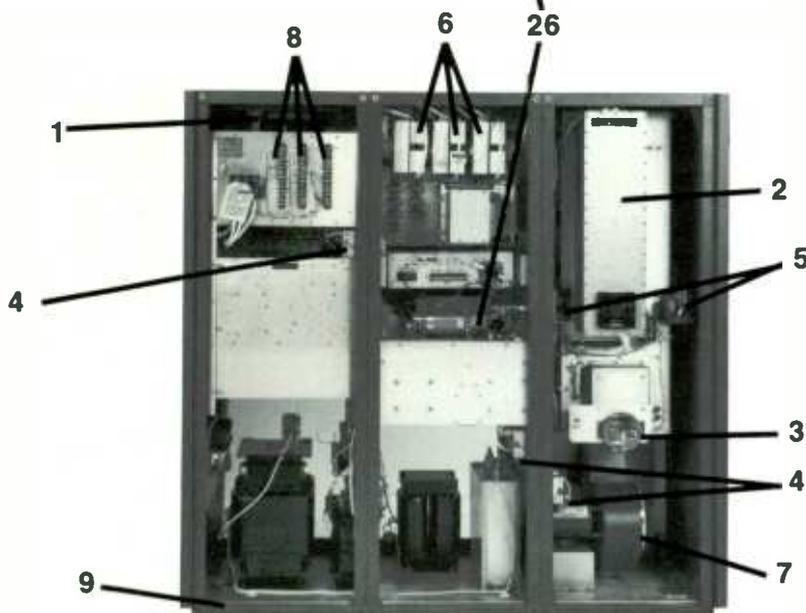
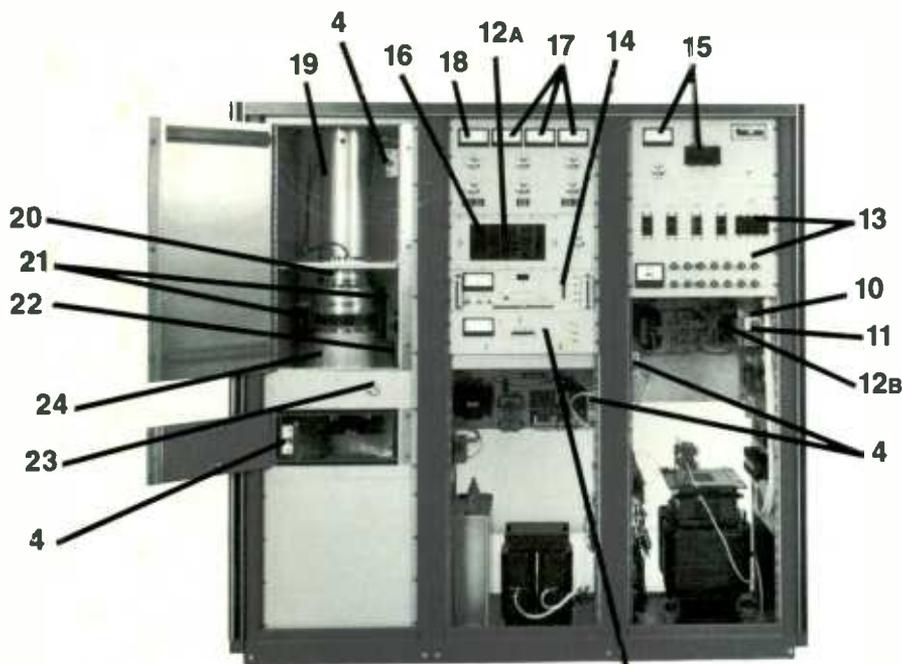
All exciter components are easily reached from the front of the transmitter. Exciter moves on tracks for easy access; shown here with top cover removed.



802A FM exciter, front view



802A FM exciter, rear view



### The Inside Story

1. **Cabinet flushing blower.** This powerful fan with washable air filter delivers approximately 850 cfm with interlocks to maintain positive cabinet air pressure.
2. **Harmonic filter.** Fully contained inside cabinet for easy installation while reducing overall space requirements.
3. **Air switch.** Positioned for easy access.
4. **Interlocks.** Located at doors and access panels, interlocks automatically short out high voltage when opened.
5. **Tuning & loading motors.** These motors and connecting capacitor plates are the only moving parts in the PA.
6. **SCR control.** Three-phase control of the plate supply primary voltage with feedback that maintains constant forward power output with line voltage variations.
7. **PA blower.** 1 hp PA exhaust blower moves 525 cfm of cooling air through PA tube to help extend tube life and reduce heat accumulation.
8. **Remote control connectors.** Conveniently located for simple set-up of system.
9. **Power wire.** Either top or bottom entry is available; bottom entry shown here.
10. **Tube cool-down timer.** Continuous blower operation for up to 3 minutes after filaments are turned off.
11. **Phase monitor.** Detects phase loss, phase rotation, and low voltage. Provides protective shutdown of transmitter in event of ac mains problems.
12. **Filament voltage regulator.** Keeps constant filament voltage to PA tube to maximize tube life.  
A = Control card  
B = Control drive assembly
13. **Indicator fuses & circuit breakers.** Indicators glow brightly for fast troubleshooting.
14. **802A exciter.**
15. **True RMS iron vane meter & 200 amp ac mains circuit breaker.** Meter gives readings on filament voltage and three ac voltage phases.
16. **LED-equipped card cage.** Twenty-seven LEDs give a quick status readout of protection circuits and control modes.
17. **Continuous readout meters.** Shows plate current and voltage, output power.
18. **DC multimeter.** Eleven operating parameters at the turn of a dial.
19. **PA exhaust stack temperature sensor.** Redundant backup to airflow switch protects final stage if cooling air is lost or if over-dissipation occurs.
20. **Wideband quarter-wave cavity.** A proven design for maximum reliability.
21. **Tuning & loading controls.** Exclusive motorized system for easy adjustments.
22. **Static drain choke.** Bleeds off static buildup in transmission lines or antennas.
23. **Driver plate adjustment.** A single control tunes the driver plate.
24. **Final amplifier.** The 9019/YC130 tube uses lower filament power to save money. The grounded screen tetrode eliminates screen bypass capacitors and enhances stability.
25. **Power supply.** Plate transformer and rectifier are mounted in external cabinet which may be placed up to 20 feet away from transmitter.
26. **Solid-state driver.**

## SPECIFICATIONS using 802A solid-state exciter

### GENERAL

#### Rated Power Output:

35 kW

#### Power Consumption:

54 kW, nominal

#### Frequency Range:

88 to 108 MHz, in 10 kHz steps

#### Frequency Control:

Phase-locked loop frequency synthesis from high stability master oscillator

#### Frequency Stability:

±250 Hz

#### Output Impedance:

50 ohms

#### Output Connector:

3 $\frac{1}{8}$ " EIA flange

#### VSWR:

2:1, maximum

#### Modulation Type:

Direct carrier frequency modulation

#### Modulation Capability:

±150 kHz deviation

#### Modulation Indication:

Digital LED display shows true peak level of modulated signal in 5% increments with accuracy better than ±2%

#### Exciter:

Solid-state unit with variable output of 5 to 50 watts; self-contained harmonic filter

#### RF Harmonic Attenuation:

-80 dB, minimum

#### Power Supply Rectifiers:

Silicon

### MONAURAL OPERATION

#### Audio Input Impedance:

600 ohms, balanced

#### Audio Input Return Loss:

30 dB or better

#### Audio Input Level:

+ 10 dBm (6.93 V peak-to-peak) at 600 ohms for ±75 kHz deviation

#### Audio Frequency Response:

±0.5 dB; flat, 25, 50 or 75 microsecond pre-emphasis, 20 Hz to 15 kHz

#### Total Harmonic Distortion:

0.08% maximum; 20 Hz to 15 kHz (Measured with spectrum analyzer)

#### Intermodulation Distortion:

0.08% or less, 60 Hz to 7 kHz, 4:1 ratio

#### FM S/N Ratio (FM Noise):

75 dB minimum, below ±75 kHz deviation at 400 Hz, measured within a 20 Hz to 15 kHz bandwidth with 75 microsecond de-emphasis

#### Asynchronous AM S/N Ratio (AM Noise):

55 dB RMS below carrier; reference 100% AM modulation, full power, with 75 microsecond de-emphasis, no FM modulation

#### Synchronous AM S/N Ratio (Incidental AM Noise):

50 dB below carrier; reference: 100% AM modulation, full power, with 75 microsecond de-emphasis, FM modulation ±75 kHz at 400 Hz

### WIDEBAND OPERATION

#### Composite Inputs:

Balanced, unbalanced, test

#### Composite Input Impedance:

5,000 ohms, nominal

#### Composite Input Level:

1.25 V RMS (3.54 V peak-to-peak) for ±75 kHz deviation

#### Composite Amplitude Response:

±0.1 dB, 20 Hz to 100 kHz

#### Composite Total Harmonic Distortion:

0.08% maximum

#### Composite Intermodulation Distortion:

0.08% or less, 60 Hz to 7 kHz, 4:1 ratio

#### Two SCA Inputs:

Balanced or unbalanced

#### SCA Input Impedance:

15,000 ohms, nominal

#### SCA Input Level:

1.25 V RMS for ±75 kHz deviation

#### SCA Amplitude Response:

±0.3 dB, 40 kHz to 100 kHz

### STEREO OPERATION

Most stereo performance parameters are determined primarily by the stereo generator used. The following parameters are influenced by the RF system, and assume that a state-of-the-art stereo generator is used.

#### Stereo Separation:

50 dB minimum; 50 Hz to 15 kHz (60 dB or better, 400 Hz to 7.5 kHz typical)

#### Total Harmonic Distortion:

0.08% maximum; 50 Hz to 15 kHz (Measured with spectrum analyzer)

#### Intermodulation Distortion:

0.08% maximum; 60 Hz to 7 kHz, 4:1 ratio

#### FM Noise:

-72 dB minimum, below ±75 kHz deviation at 400 Hz, measured within a 20 Hz to 15 kHz bandwidth with 75 microsecond de-emphasis

#### Linear Crosstalk:

-55 dB

### SCA OPERATION

Most SCA performance parameters are determined primarily by the SCA generator used. The following parameters are influenced by the RF system, and assume that a state-of-the-art SCA generator is used.

#### Crosstalk, SCA to Main and Stereo (67 kHz and/or 92 kHz):

-60 dB, SCA deviation 5 kHz; main 75 microsecond de-emphasis

#### Crosstalk, Main and Stereo to SCA (67 kHz and/or 92 kHz):

-50 dB, main and stereo 75 kHz deviation; SCA reference deviation, 5 kHz and 200 Hz modulation; SCA de-emphasis, 150 microsecond

#### Crosstalk, SCA to SCA (67 kHz and/or 92 kHz):

-50 dB, SCA reference deviation; 5 kHz and 200 Hz modulation, 150 microsecond de-emphasis

### ELECTRICAL

#### Power Source:

200 to 250 VAC; 60 Hz, three-phase; available transformer taps are 200, 210, 220, 230, 240, 250 VAC; 50 Hz available on request

#### Permissible Line Voltage Variation:

±5% (each phase voltage variation; within 5% of the average of all three phases)

#### Filament Regulator:

±1% of optimum

### OPERATING ENVIRONMENT

#### Altitude:

7,500 ft (2,286 m) standard; optional to 10,000 ft (3,048 m) with modification kit

#### Ambient Temperature Range:

-20°C to +50°C (-4°F to +122°F)

#### Relative Humidity:

0 to 95%

### MECHANICAL

#### Transmitter:

69" (175 cm) H  
72" (183 cm) W  
28" (71 cm) D

#### Weight:

1,657 lbs (752 kg) nominal

#### External Plate Transformer:

46" (117 cm) H  
35" (89 cm) W  
24" (61 cm) D

#### Weight:

901 lbs (409 kg) nominal

#### Note:

External plate transformer can be located up to 20 ft (6.10 m) away from the transmitter

All specifications are subject to change without notice.

Printed in USA 2M 1188

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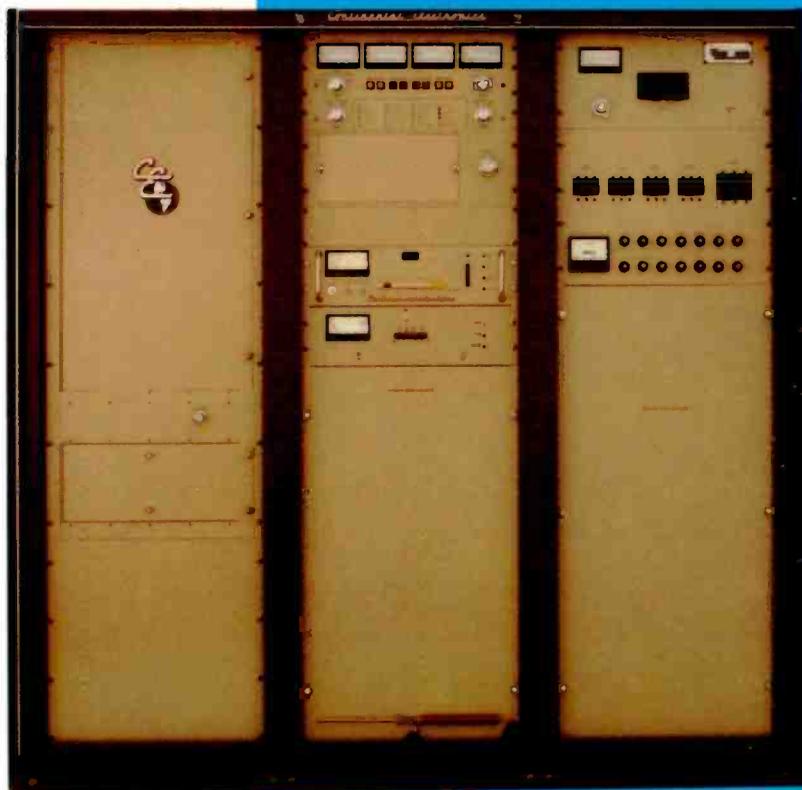
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**Continental's  
816R Series 21.5, 25 & 27.5 kW  
Broadcast Transmitters**



**Includes the 802A solid-state exciter**

## Top Performance and Proven Design in High Power FM

Continental's 21.5, 25 and 27.5 kW FM transmitters offer you high fidelity, low power consumption, low noise or distortion and excellent stereo separation.

Transmitter power may be adjusted to any level between 0 and 100%, with minimal retuning, using front panel controls.

If momentary power outages or overloads occur, special circuits protect the transmitter and will automatically restore it to operational status.

Two independent VSWR protection circuits automatically reduce transmitter power to a safe operating level whenever abnormal antenna mismatches occur. One circuit handles severe mismatches such as lightning strikes by interrupting the RF when reflected power reaches 10%. The other circuit holds reflected power to a preset level during severe icing conditions, allowing power to be maintained at the highest "safe" level.

An exclusive "soft-start" circuit and low voltage controls are easy on the total system and limit current surges through the power supply components; this helps to minimize parts replacement.

Twenty-three different circuits or indicators are used to protect the transmitter and the control circuits are of the conventional 28 VDC design.

The meters and controls are strategically placed at or near eye level for easy reading and accurate adjustment. All components are easily accessible.

The wide, flat bandwidth is a result of the wideband quarter-wave cavity design which optimizes performance.

If a problem should occur, 27 LED indicators, 14 indicating fuseholders

and six front panel circuit breakers assist in quickly isolating it.

The 816R Series' control options offer operating flexibility. Its compact size and simple installation will get you air-ready with minimum time and cost.

## Solid-State Driver

Featured in this transmitter is a solid-state driver which increases reliability and decreases maintenance and complexity. This driver also offers greater bandwidth and self-protecting RF modules.

## The FM Exciter

Continental's 802A solid-state FM exciter offers broadcasters unmatched performance.

## State-of-the-Art Design

Modular subassemblies are easily reached from front of exciter. The 802A will accept a composite baseband signal from a stereo generator, STL system or monaural audio and SCA programming.

## Refined Linearity

Exciter modulation performance surpasses the measurement capability of the most advanced test equipment.

## Digital Frequency Selection

Exciter generates its operating frequency with a digitally programmed, dual speed, phase-locked frequency synthesis system.

## 50 Watt Output Broadband Amplifier

The 802A is completely solid-state and needs no tuning adjustments other than selection of operating frequency. Power output is 50 watts into a 50 ohm load at all frequencies in the FM band.

## Automatic Power Level Control

A special circuit protects the amplifier from any mismatched load, including open or short circuits. Automatic power control maintains output at any preset level from 5 to 50 watts.

## Sophisticated Styling

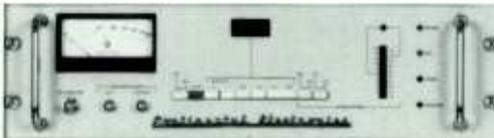
Front panel readouts present clear and accurate indication of system performance. Digital LED display indicates true peak level of modulating signal in 5% increments with an accuracy of better than  $\pm 2\%$ .

## Modular Construction

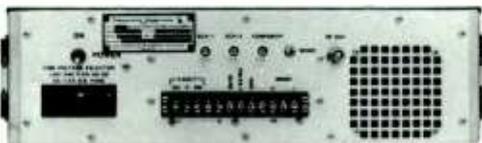
Any subassembly within the exciter can be removed without removing the exciter from the transmitter, and without disturbing other exciter assemblies or components. The exciter is mounted on slides for easy access.



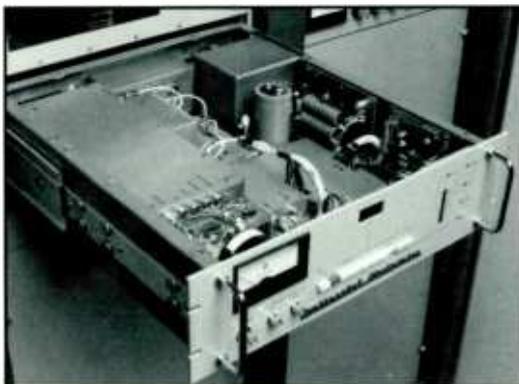
LED status indicators



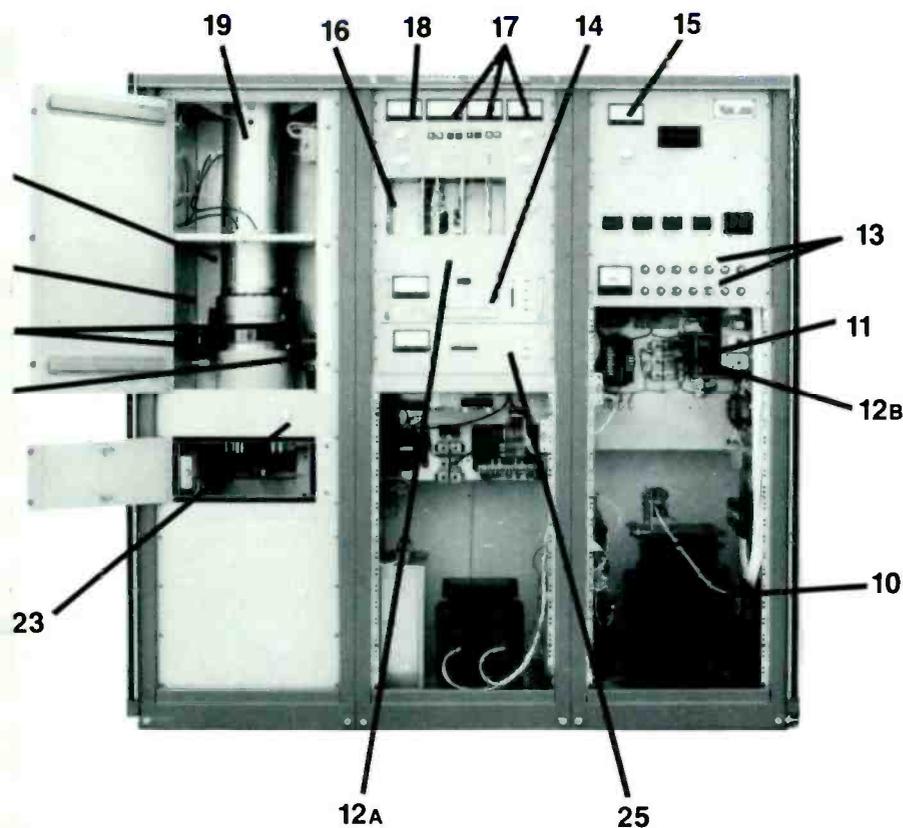
802A FM exciter, front view



802A FM exciter, rear view



All exciter components are easily reached from the front of the transmitter. Exciter moves on tracks for easy access; shown here with top cover removed.



## The Inside Story

**1. Cabinet flushing blower.** This powerful fan with washable air filter delivers approximately 850 cfm to maintain positive cabinet air pressure.

**2. Harmonic filter.** Fully contained inside cabinet for easy installation while reducing overall space requirements.

**3. Air switch.** Positioned for easy access.

**4. Interlocks.** Located at doors and access panels, interlocks automatically short out high voltage when opened.

**5. Tuning & loading motors.** These motors and connecting capacitor plates are the only moving parts in the PA. They eliminate complicated chains and gears.

**6. SCR control.** Three-phase control of the plate supply primary voltage with feedback that maintains constant forward power output with line voltage variations.

Exclusive "soft start", which initially brings up the transmitter gently.

**7. PA blower.** 1 hp PA exhaust blower moves 525 cfm of cooling air through the PA tube. This helps extend tube life and reduces heat accumulation.

**8. Remote control connectors.**

Conveniently located for simple set up.

**9. Power wire.** Either bottom or top entry is available; bottom entry shown here.

**10. Power supply.** A self-contained integral part of the transmitter.

**11. Phase monitor.** Detects phase loss, phase rotation, and low voltage. Provides protective shutdown of transmitter in event of ac mains problems.

**12. Filament voltage regulator.** Keeps constant filament voltage to the PA tube to maximize tube life.

A. Control card

B. Control drive assembly

**13. Indicator fuses & circuit breakers.** Indicators glow brightly for fast troubleshooting.

**14. 802A exciter.**

**15. True RMS iron vane meter & 150 amp ac mains circuit breaker.** Meter gives readings on each of the three ac voltage phases, as well as filament voltage.

**16. LED-equipped card cage.** Twenty-seven LEDs give a quick status readout of the protection circuits and control modes. Remote control relays are also here for easy access.

**17. Continuous readout meters.** At a glance you'll know plate current, plate voltage and output power.

**18. DC multimeter.** Eleven operating parameters at the turn of a dial.

**19. PA exhaust stack temperature sensor.** Redundant backup to the air flow switch protects the final stage if cooling air is lost or over-dissipation occurs.

**20. Wideband quarter-wave cavity.** A proven design for greater reliability.

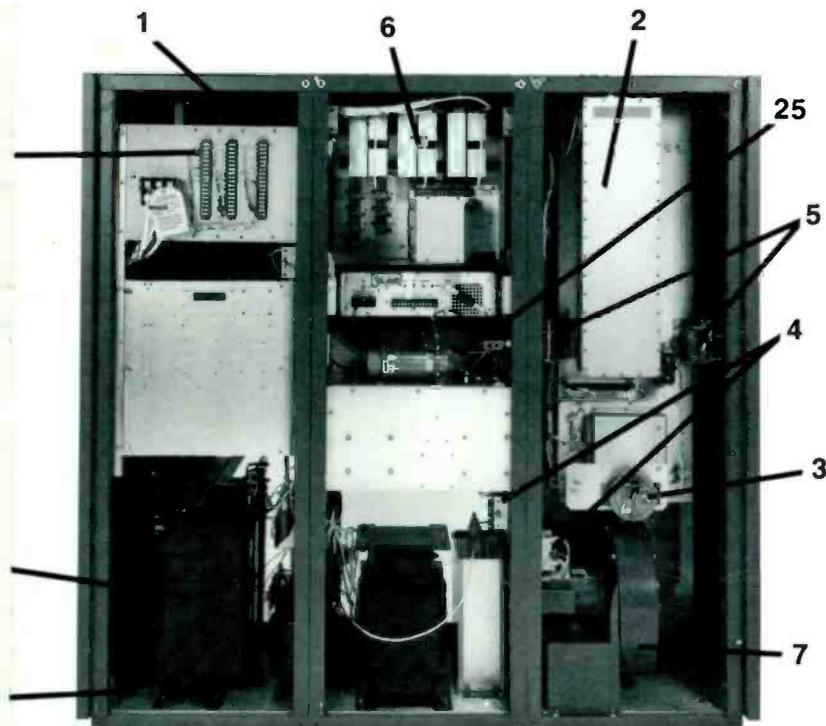
**21. Tuning & loading controls.** Exclusive motorized system for easy adjustments.

**22. Static drain choke.** Bleeds off static build-up in transmission lines or antennas.

**23. Driver plate adjustment.** A single control tunes the driver plate.

**24. Final amplifier.** The 4CX15,000A tube uses lower filament power to save money. The high plate dissipation rating and proven design give long life performance. A unique grounded screen tetrode design eliminates screen bypass capacitors and greatly enhances stability.

**25. Solid-state driver.**



## SPECIFICATIONS using 802A solid-state exciter

### GENERAL

#### Rated Power Output:

816R-2B: 21.5 kW  
816R-3B: 25 kW  
816R-4B: 27.5 kW

#### Power Consumption:

816R-2B: 33 kW nominal  
816R-3B: 40 kW nominal  
816R-4B: 42 kW nominal

#### Frequency Range:

88 to 108 MHz, in 10 kHz steps

#### Frequency Control:

Phase-locked loop frequency synthesis from high stability master oscillator

#### Frequency Stability:

±250 Hz

#### Output Impedance:

50 ohms

#### Output Connector:

3/8" EIA flange

#### VSWR:

2:1, maximum

#### Modulation Type:

Direct carrier frequency modulation

#### Modulation Capability:

±150 kHz deviation

#### Modulation Indication:

Digital LED display shows true peak level of modulating signal in 5% increments with accuracy better than ±2%

#### Exciter:

Solid-state unit with variable output of 5 to 50 watts; self-contained harmonic filter

#### RF Harmonic Attenuation:

-80 dB, minimum

#### Power Supply Rectifiers:

Silicon

### MONAURAL OPERATION

#### Audio Input Impedance:

600 ohms, balanced

#### Audio Input Return Loss:

30 dB or better

#### Audio Input Level:

+10 dBm (6.93 V peak-to-peak) at 600 ohms for ±75 kHz deviation

#### Audio Frequency Response:

±0.5 dB; flat, 25, 50 or 75 microsecond pre-emphasis, 20 Hz to 15 kHz

#### Total Harmonic Distortion:

0.08% maximum; 20 Hz to 15 kHz (Measured with spectrum analyzer)

#### Intermodulation Distortion:

0.08% or less, 60 Hz/7 kHz, 4:1 ratio

#### FM S/N Ratio (FM Noise):

75 dB minimum, below ±75 kHz deviation at 400 Hz, measured within a 20 Hz to 15 kHz bandwidth with 75 microsecond de-emphasis

#### Asynchronous AM S/N Ratio

##### (AM Noise):

55 dB RMS below carrier; reference: 100% AM modulation, full power, with 75 microsecond de-emphasis, no FM modulation

#### Synchronous AM S/N Ratio

##### (Incidental AM Noise):

50 dB below carrier; reference: 100% AM modulation, full power, with 75 microsecond de-emphasis, FM modulation ±75 kHz at 400 Hz

### WIDEBAND OPERATION

#### Composite Inputs:

Balanced, unbalanced and test

#### Composite Input Impedance:

5,000 ohms, nominal

#### Composite Input Level:

1.25 V RMS (3.54 V peak-to-peak) for ±75 kHz deviation

#### Composite Amplitude Response:

±0.1 dB, 20 Hz to 100 kHz

#### Composite Total Harmonic Distortion:

0.08% maximum

#### Composite Intermodulation Distortion:

0.08% maximum; 60 Hz to 7 kHz, 4:1 ratio

#### Two SCA Inputs:

Balanced or unbalanced

#### SCA Input Impedance:

15,000 ohms, nominal

#### SCA Input Level:

1.25 V RMS for ±75 kHz deviation

#### SCA Amplitude Response:

±0.3 dB, 40 kHz to 100 kHz

### STEREO OPERATION

Most stereo performance parameters are determined primarily by the stereo generator used. The following parameters are influenced by the RF system. These specifications assume that a state-of-the-art stereo generator is used.

#### Stereo Separation:

50 dB minimum; 50 Hz to 15 kHz (60 dB or better, 400 Hz to 7.5 kHz typical)

#### Total Harmonic Distortion:

0.08% maximum; 50 Hz to 15 kHz (Measured with spectrum analyzer)

#### Intermodulation Distortion:

0.08% maximum; 60 Hz to 7 kHz, 4:1 ratio

#### FM Noise:

-72 dB referenced to 400 Hz, 75 kHz deviation. Measured with 75 microsecond de-emphasis within a 20 Hz to 15 kHz bandwidth

#### Linear Crosstalk:

-55 dB

### SCA OPERATION

Most SCA performance parameters are determined primarily by the SCA generator used. The following parameters are influenced by the RF system. These specifications assume that a state-of-the-art SCA generator is used.

#### Crosstalk, SCA to Main and Stereo

##### (67 kHz and/or 92 kHz):

-60 dB, SCA deviation 5 kHz; main 75 microsecond de-emphasis

#### Crosstalk, Main and Stereo to SCA

##### (67 kHz and/or 92 kHz):

-50 dB, main and stereo 75 kHz deviation; SCA reference deviation, 5 kHz and 200 Hz modulation; SCA de-emphasis, 150 microsecond

#### Crosstalk, SCA to SCA

##### (67 kHz and/or 92 kHz):

-50 dB, SCA reference deviation; 5 kHz and 200 Hz modulation frequency, 150 microsecond de-emphasis

### ELECTRICAL

#### Power Source:

200 to 250 VAC; 60 Hz, three-phase; available transformer taps are 200, 210, 220, 230, 240, 250 VAC; 50 Hz available on request

#### Permissible Line Voltage Variation:

±5% (each phase voltage variation; within 5% of the average of all three phases)

#### Filament Regulator:

±1% of optimum

### OPERATING ENVIRONMENT

#### Operating Altitude:

7,500 ft (2,286 m) standard; optional to 10,000 ft (3,048 m) with modification kit

#### Ambient Temperature Range:

-20°C to +50°C (-4°F to +122°F)

### MECHANICAL

#### Transmitter:

69" (175 cm) H  
72" (183 cm) W  
28" (71 cm) D

#### Weight:

1,962 lbs (890 kg) nominal

All specifications are subject to change without notice.  
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