

Q Series -10kW, 20kW, 30kW, and 40kW FM

Nautel Limited 10 kW, 20 kW, 30 kW and 40 kW Totally Solid State FM Broadcast Transmitters

A Quantum Leap for High Power FM Transmission

MORE POWER

- Q10, 10 kW
- Q20, 20 kW
- Q30 (20+10), 30 kW
- Q40 (20+20), 40 kW

MORE REDUNDANCY

- Broadband Power Modules – on-air serviceable
- Switching Power Supply Modules – on-air serviceable
- Parallel Redundant Rectifiers
- Distributed DC Ventilation Fans

MORE DUPLICATION

- Dual Digital Exciters
- Dual IPA
- Dual IPA Power Supply
- Dual Low Voltage Power Supply



A Powerful Combination

Customize your power requirements with Nautel Q series transmitters.

Not everyone has the same needs. That's why Nautel engineers developed the Q series of transmitters. Each of our solid state 10 and 20 kW transmitters is designed to integrate seamlessly with another member of the Q family. That means you can have 10, 20, 30 or 40 kW of power through simple combinations of units. Now you have the power to choose.

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**Q10 Solid State 10 kW FM
Q20 Solid State 20 kW FM
Standalone Transmitters**



Q20

RF Output

The Combiner / Filter assembly is tunable over the entire FM band from 88 MHz to 108 MHz to provide the correct impedance matching and harmonic rejection.

Nautel's approach to solid state FM combining allows extremely high power single ended

transmitters by avoiding cascaded levels of Hybrid networks with associated imbalance loads. The design avoids complexity and waste heat dissipation within the transmitter cabinet, contributing to system reliability.

RF output power up to 22,000 Watts is derived from 64 independent power amplifiers (PAs) in the Q20 and up to 11,000W from 32 Pas in the Q10. Each PA is connected via a short fixed length (13 inch) co-axial cable to the Nautel patented 60° single stage Combiner. The high integrity coaxial connection is visually verifiable and easily accessible.

In the unlikely event of amplifier malfunction, no stress is imposed on the other amplifiers. The remaining amplifiers experience only a slight increase in load impedance. No power is wasted and no heat is produced.

Nautel's combining scheme is simple, efficient and has proven to be very reliable. The technique provides superior failure isolation.

No damage to the Combiner can be caused by failure of a module in either short or open circuit mode. Any Power Module can be removed from the transmitter while the remaining modules continue to operate. Service may be carried out during normal hours without a broadcast interruption.

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Redundant Power Modules



On-Air Serviceable

Power Modules each provide mounting for four independent single stage RF power amplifiers. Each PA consists of one MRF151G (Gemini Series) device operating in a push-

pull configuration. The Gemini MOSFET is a dual package with inherent device matching. This permits field replacement with standard non-selected devices available from local component distributors. No tuning or other adjustment is required. The high efficiency broadband Power Module is identical and fully interchangeable in any Nautel Q series solid state FM transmitter.

The amplifier is fundamentally identical to that employed in the many Nautel solid state FM series transmitters successfully put into service around the world during the past decade. Field experience has demonstrated exceptional reliability with Mean Time Between Failure statistics exceeding 2.5 million hours.

Should one of the PAs malfunction, transmitter operation continues with only minor power reduction. Whenever convenient the affected Power Module may safely be removed for service, without any interruption in broadcasting.

Redundant Switching PS Modules

On-Air Serviceable

Each Power Module and IPA module receives its regulated +50 V DC supply from its own dedicated Switching Power Supply Module.



Nautel engineers have developed a switching power supply optimized for efficiency, safety and ease of use.

The Power Supply operates as a fixed frequency phase modulated PDM system utilizing a full bridge composed of two FETs and two IGBTs.

The unique design provides new levels of reliability for switching power supplies. Each PS Module is individually fused and protected by four MOVs across a common Bus input. Power Supply control electronics are referenced to normal output ground to allow safe, easy service with only low DC voltage applied. Power components can be verified at the workbench with only an ohmmeter without need for a three-phase supply.

There is minimal effect, should a Switching PS malfunction. Only one RF Power Module is disabled. Safe, on-air serviceability permits simple exchange or repair without any transmitter down time.

Dual IPA Modules

The Q20 Intermediate Power Amplifier (IPA) Module comprises four RF amplifiers and is identical and interchangeable with any of the Power Modules.

The Q10 IPA uses only two RF Amplifiers and may economically be duplicated.

The IPA is designed for maximum reliability. Each amplifier in the IPA Module operates at only 240 watts while conservatively rated for up to 370 watts when employed in a Power Module.

IPA input from the Digital FM Exciter is matched to 50 ohms. Output impedance matching takes place in the IPA Combiner / Splitter which provides single point input tuning to all the power amplifiers to achieve maximum efficiency.

Facilities are provided for Main and Standby IPA Modules with automatic changeover.

Dual Digital Exciters



The Q series transmitter systems provide control and

mounting for two Nautel Digital FM Exciters in main

and standby mode with automatic changeover.

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The Exciter utilizes Direct Digital Synthesis technology, which provides 32 bit signal processing to digitally construct the carrier signal with a numerically controlled oscillator. Modulation in the digital domain provides a perfectly linear system with superior audio fidelity sustained over time.

Direct digital audio input in AES/EBU format is facilitated via electrical or optical connection. The optical TOSLINK® connection has the added advantage of EMI isolation. Should the AES/EBU signal be interrupted, a separate emergency analog input connection is available as a backup. There are three unbalanced BNC connections for SCA/RDS input. A Digital Signal Processor monitors, filters and interpolates the digital audio and generates a digital stereo composite signal, which is applied to the FM Modulator.

Broadcasters utilizing analog systems today can still take advantage of the enhanced performance of the digital technology. The exciter is available for use with conventional composite (analog) input and is field upgradeable to full digital at a later date.

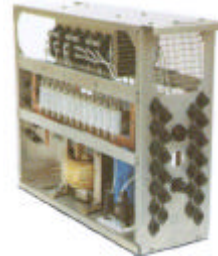
Dual LV PS Modules

The standard Q series transmitter includes Dual Low Voltage DC Power Supply Modules. These employ the same topology as the B+ Switching PS Modules and use an identical input circuit board.

The LVPS is a switching supply with multiple outputs for control and logic, Switching PS operation and ventilation fans.

The two LVPS Modules are arranged so only one supply is on at one time. Automatic Main / Standby switchover is provided.

Four Redundant Rectifiers



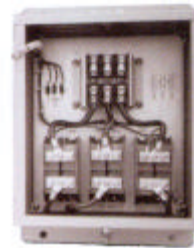
The AC/DC Power Supply is the transmitter's interface to the AC mains. The complete unit is housed in a lightweight, wheeled roll-out assembly for ease of service.

A common three-phase Rectifier Stack and Low Pass Filter develops a 300 V DC Bus for the Switching Power Supply Modules.

The Rectifier consists of four parallel diode pairs per AC supply phase, with each diode individually fused with a semiconductor fuse.

The Rectifier will start and run with only two of the four parallel diode pairs per phase intact to enable full power transmitter operation.

Five Stage Transient Protection



Nautel has more than 30 years successful experience in design and manufacture of exclusively solid state radio transmitters. This has resulted in a clear understanding of transient protection principles necessary to achieve the potential reliability inherent to solid state equipment.

The Q series transmitter includes an AC Line Protection Unit designed for strategic installation at the service entrance. This provides first level phase-to-ground protection for site, equipment and personnel.

The Q series transmitter AC input terminal incorporates second level phase-to-phase MOV protection devices.

Six MOVs are installed across each Rectifier, giving a total of 24 devices at the third level of protection.

After the Rectifiers, the Low Pass Filter of the AC/DC Power Supply adds a fourth level of

transient protection.

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Finally, the DC Bus distribution to each individual Switching PS Module includes four MOVs to protect the FET/IGBT Bridge.

Redundant Ventilation

Low velocity parallel air flow ensures cool reliable operation. Modules have individual thermal protection. Redundant brushless DC ventilation fans avoid thermal stress independent of AC supply frequency.

Separate fans are provided for each pair of Power Modules and each pair of Switching PS Modules. The IPA Modules and Power Supplies have independent ventilation. Redundant fans ventilate the AC/DC Power Supply and Combiner/Filter sections.

The Q10 and Q20 will accommodate various ventilation configurations, including open ambient room air cooling as well as fully closed ducted systems. Room air intake requires minimum floor space with disposable filters installed in the rear doors. Fully ducted systems are accommodated with the addition of a 12-inch sealed air intake plenum installed at the rear of the transmitter.

Compact Construction

The Nautel transmitter is constructed in a rugged aluminum rack with advantages of corrosion resistance, light weight, and small footprint.

Dimensions of the Q20 are 46.5 inches wide x 46.5 inches deep (open air ventilation) x 72.4 inches high. The top of the RF output flange occupies an additional 6.8 inches of height.

Size and floor loading are often critical issues for FM transmitter facilities located in high rise buildings. The front 12-inch section of the rack is designed for easy removal, reducing depth to less than 33 inches. This permits entry through standard width residential entrances.

Operating Convenience

The transmitter control panel allows simple push button selection of operating modes. Two power level selections are continuously adjustable using raise/lower commands. High resolution meters provide measurement of critical parameters. A LED diagnostic flow diagram assists service personnel to easily identify problems.

Automatic main and standby controls are built in for the exciter, IPA and IPA Power Supply. A basic configuration transmitter may be purchased to minimize initial cost and duplication.

The transmitter is ideally suited to unattended automatic or remote controlled operation. RF output is stabilized against moderate VSWR up to 1.1:1. When VSWR exceeds 1.5:1, power output is automatically reduced to a safe level.



Simply the best engineered transmitters

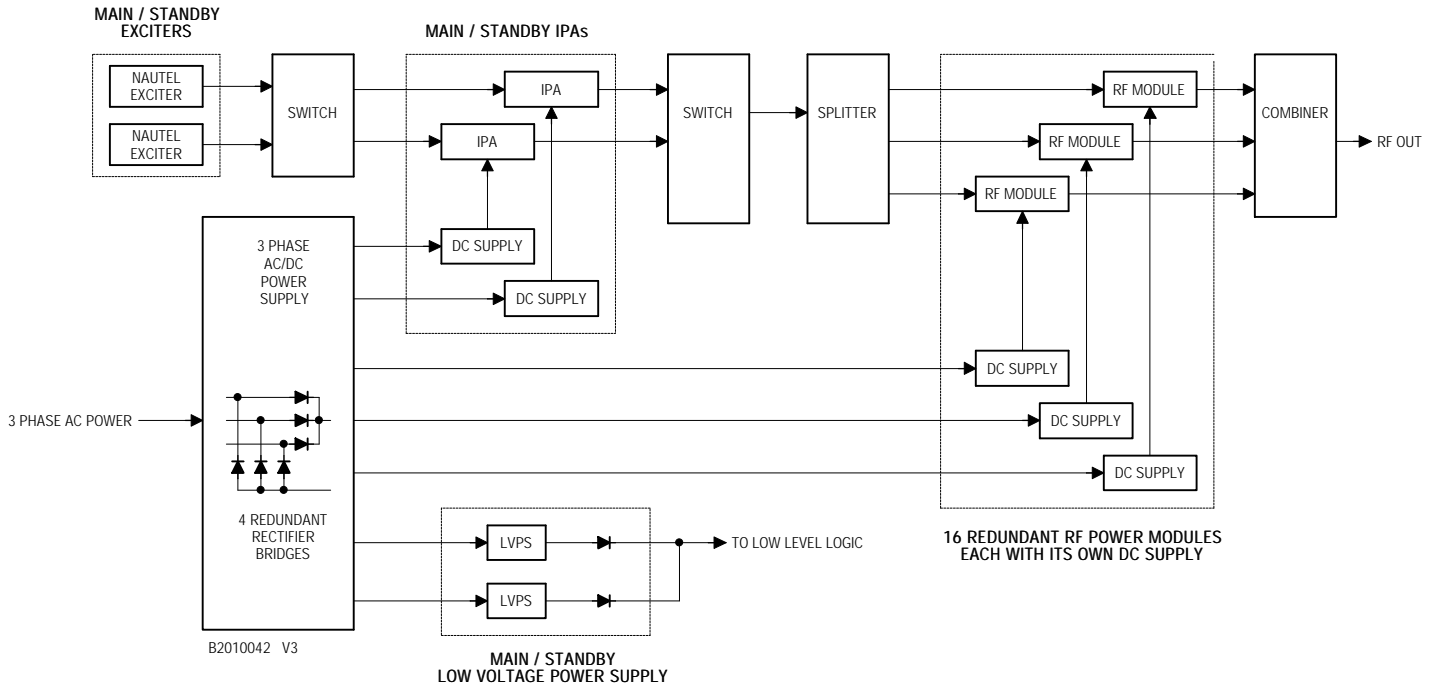
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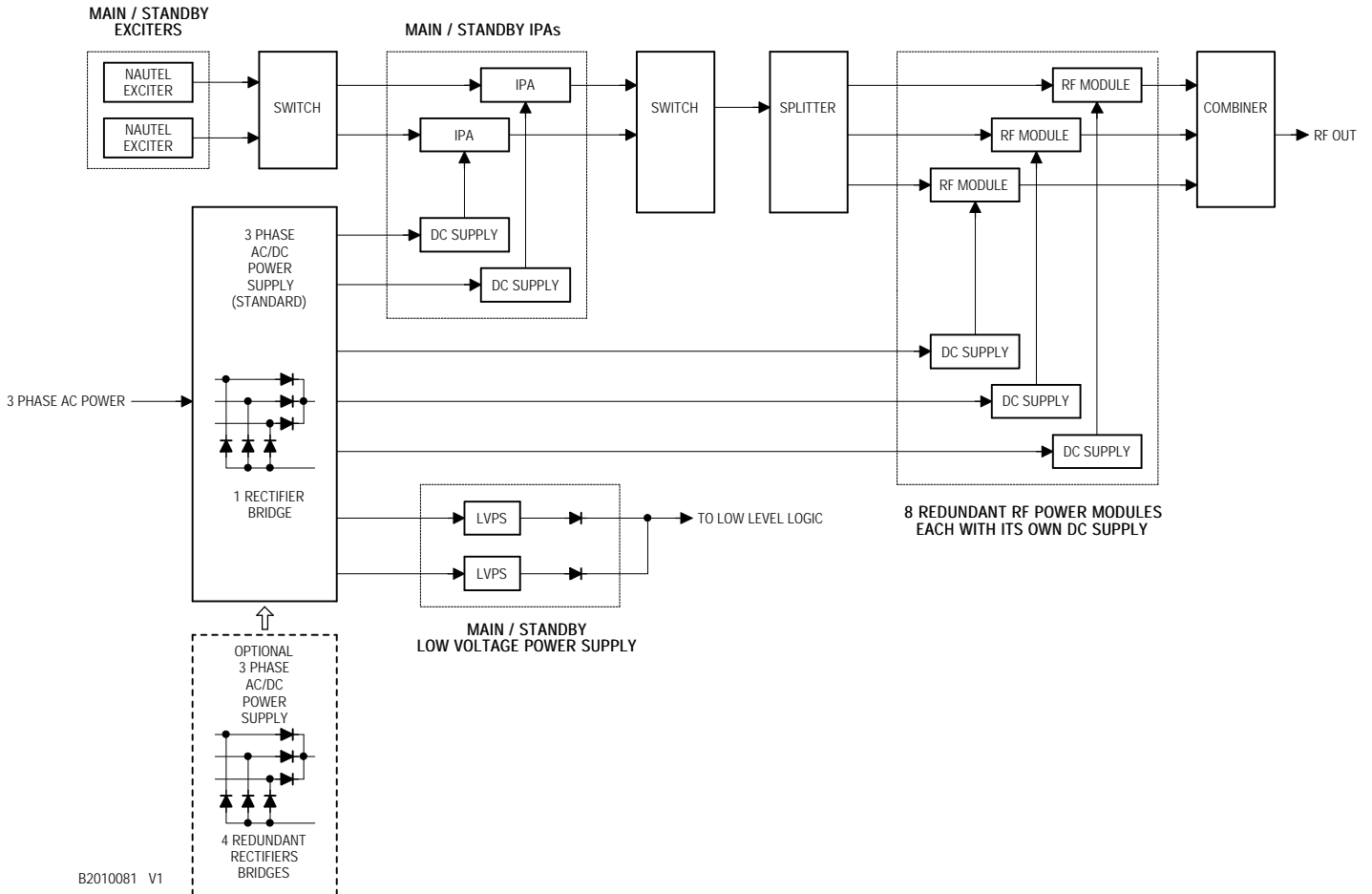
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Q20 BLOCK DIAGRAM



Q10 BLOCK DIAGRAM



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Q40 40 kW FM Q30, 30 kW FM Transmitter Systems

The Q40 is comprised of two 20 kW standalone FM transmitters fully integrated to operate as a 40 kW active reserve transmitter system. Single or dual Digital Exciters with coherent drive components are included. System controls, metering and diagnostics for 40 kW operation are incorporated within the dual Q20 cabinets.

Similarly the Q30 comprises a 20kW and a 10kW transmitter in combined mode operation.

Three standard configurations are offered to satisfy individual site requirements and balance cost and space considerations with maximum on-air confidence and system flexibility.

The Basic Combiner configuration is the simplest, the least costly and requires minimum

floor space. The many duplication and redundancy features, with on-air serviceability, of the Q Series transmitters make this an attractive solution for many installations.

The Automatic Switcher / Combiner configuration provides maximum flexibility. Motorized RF switching makes it possible to bypass the combiner with a single Q series transmitter directly to the antenna. The idle Q series transmitter is isolated and terminated to the station Dummy Load and accessible for safe maintenance or off-air performance testing.

The Automatic Contactless Switcher / Combiner configuration provides motorized 0°-90°-180° phase adjustment to direct full power from a single Q series transmitter to the antenna without interruption in broadcasting. This ability to maintain programming continuity in the event of problems with one transmitter section is particularly attractive for aggressively competitive radio stations.

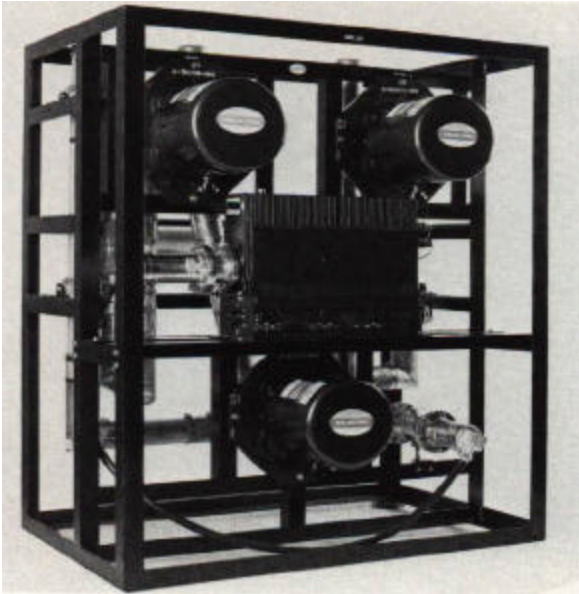
Q30 and Q40 COMBINER CONFIGURATIONS



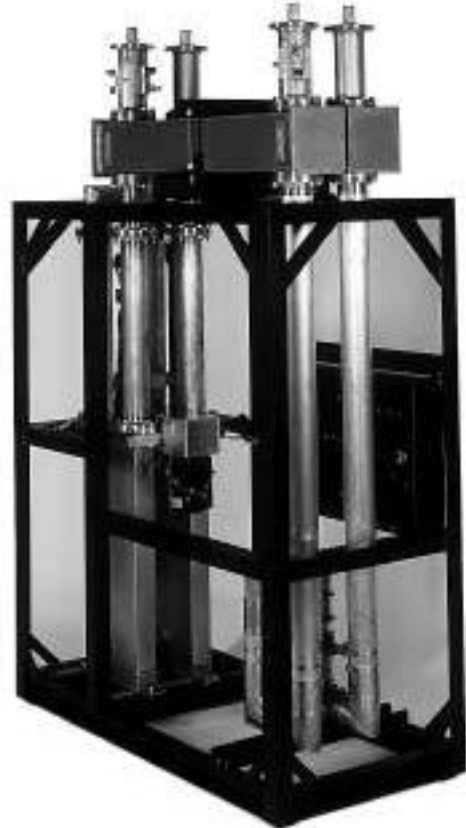
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**AUTOMATIC
SWITCHER/COMBINER**



**AUTOMATIC
CONTACTLESS
SWITCHER/COMBINER**



CONFIGURATIONS	SYSTEM DESCRIPTION	OPERATING MODES
BASIC COMBINER	<ul style="list-style-type: none"> • Two Q transmitters incl. combined system metering and controls • 3dB Hybrid Coupler • 15kW Reject Load 	TxA + TxB to Antenna
AUTOMATIC SWITCHER/COMBINER	<ul style="list-style-type: none"> • Two Q transmitters incl. combined system metering and system controls • Switcher/Combiner Frame housing 3dB Coupler, Three Motorized Co-axial Switches and 15kW Reject Load • 40kW System Test Load (Optional) 	TxA + TxB to Antenna TxA to Antenna, TxB to Dummy Load TxB to Antenna, TxA to Dummy Load TxA + TxB to Dummy Load Local/Remote Mode Selection Automatic Operation
AUTOMATIC CONTACTLESS SWITCHER/COMBINER	<ul style="list-style-type: none"> • Two Q transmitters incl. combined system metering and controls • Phase Shifter/Combiner Frame housing two 3dB Couplers and Motorized Co-axial Phase Shifter. • 25kW Reject Load/Single Transmitter Test Load 	TxA + TxB to Antenna TxA to Antenna, TxB to Dummy Load TxB to Antenna, TxA to Dummy Load Local/Remote Mode Selection Automatic Operation