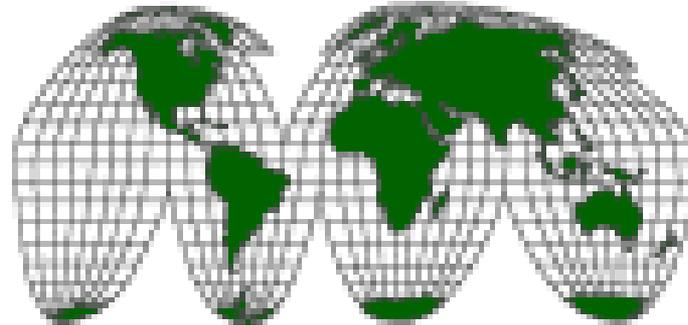


Welcome

HFCC



HFCC

Brisbane, Australia

24-28 August, 2015



Continental Electronics Corporation



Calvin G. Carter

Director of International Sales
Continental Electronics Corporation



- **Dallas-based Continental Electronics is a premier manufacturer of radio frequency (RF) broadcast transmission equipment specializing in the design, development, and manufacture of leading-edge digital and analog fully integrated Transmitter systems for the global market.**
- **Continental Electronics offers a full range of products for LF, VLF, HF, VHF, FM, S and X Band as well as high-power amplifiers for any application.**
- **Continental also specializes in Solid State High-Voltage/ High-Current Power Supplies and Pulse Step Modulator (PSM) products.**

- **Market Expertise**
 - 1000+ customers worldwide
 - Installed transmitter base of several thousand units
 - Industry-leading 24/7 technical, product and logistics support
 - Customer-focused marketing and support group ensures high customer satisfaction
- **Engineering Expertise**
 - Highly specialized and experienced engineering team with strong design capabilities
 - > RF/Power/System/Control/Circuit/Structural/Mechanical
- **Manufacturing Expertise**
 - ISO 9001:2000 certified facility
 - Highly vertically integrated manufacturing approach
 - > Assembly/Wiring/Fabrication/Machining/Metal Finishing/Product Testing
- **Breadth and depth of management team**
 - Highly experienced management staff
 - Roadmap in place for future path

FACILITIES

Continental Electronics Corporation

4212 S. Buckner Blvd.

Dallas, Texas 75227

U.S.A

www.contelec.com





Continental Electronics

Organized in 1946
by J.O. Weldon

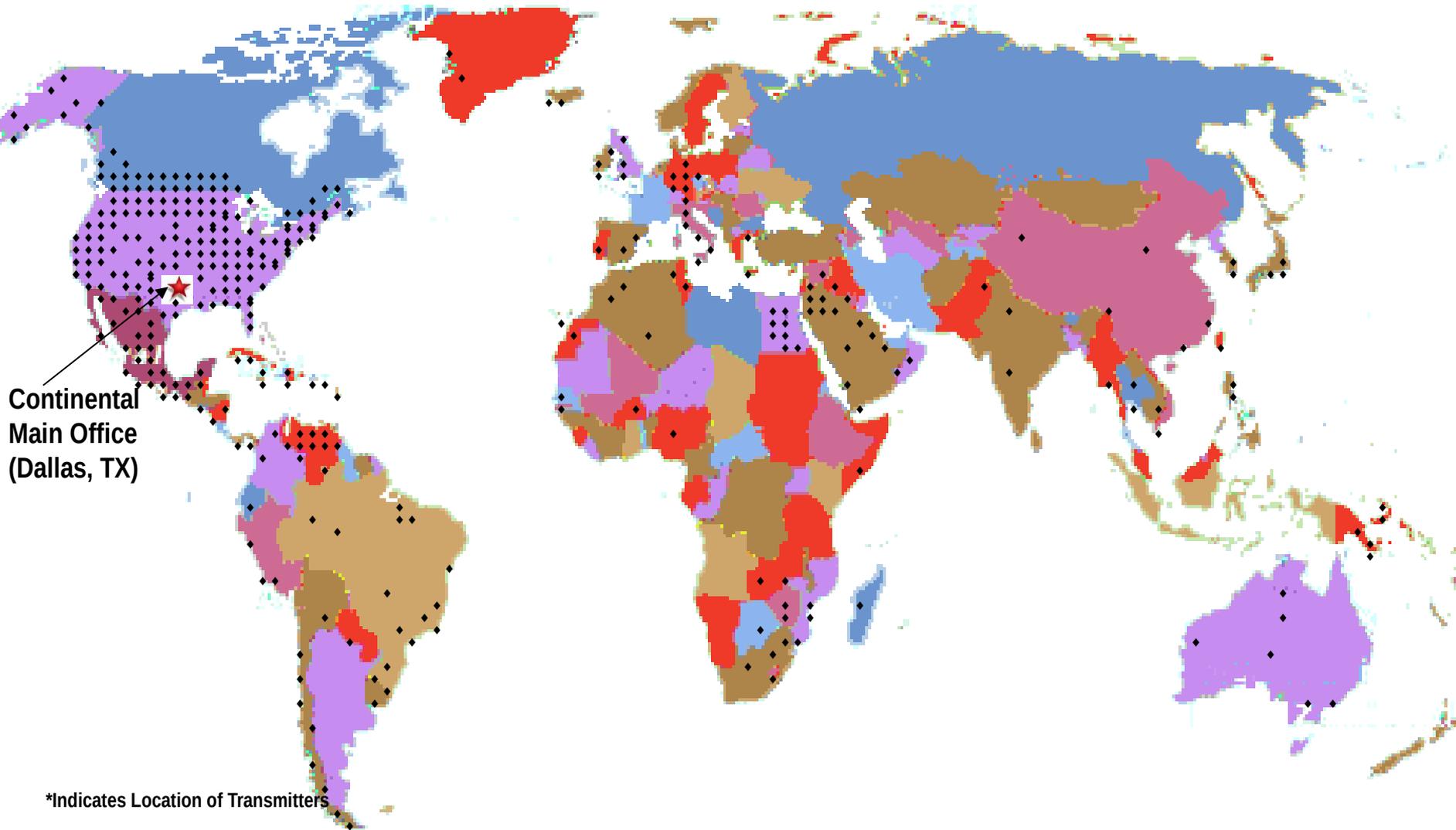
“60+ Years of Continued Excellence!”

HISTORICAL MILESTONES

- World's first 500kW transmitter in 1946
- 1MW Medium Wave Transmitter for Voice of America in 1950's
- 2.5MW transmitter for MIT Lab to bounce signals off Venus in 1958
- World's first VLF site for US Navy in Maine in early 1960's
- Arecibo Observatory transmitter first delivered in 1960's
- Began upgrades to 5 US Navy VLF sites in 1995. Upgrading VLF stations continue around the world today.
- Began delivering HD IBOC FM transmitters in 2006
- 180th dual transmitter delivered to HAARP for Ionosphere Research in 2006
- Spain Nationwide Shortwave Radio Deployment 4 x 300kW completed 2008
- Romania Nationwide Shortwave Radio Deployment 5 x 300kW & 1 x 100kW in 2008
- US Government 5 x 500kW Radar Transmitters in 2009
- Increase power of JPL DSN transmitters in 2011
- NASA uses CEC 80kW X-band Transmitter to for New Horizons Pluto mission in 2015



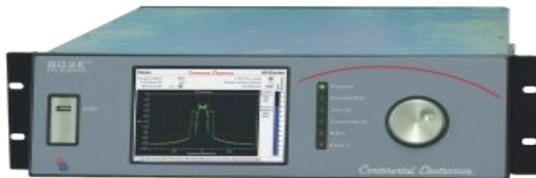
GLOBAL INSTALLATIONS





816 HD FM Transmitter

- Analog and Digital Transmitter Power Levels ranging from 250W to 70kW. CEC specializes in power levels above 10kW
- Complete transmitter designed and built by CEC
- CEC 816HD transmitter allows for analog and digital simulcasting eliminating the need for a second transmitter
- Continental 802EX IBOC Digital Exciter and 800EXP Embedded Exporter provides an overall solution with enhanced functionality



802Ex IBOC Exciter



800Exp Emb Exporter



- Purchased the Crown Weather Radio Division in 2011
- Transmitter power levels from 300W to 1000W
- Updated design to include digital processing and high efficiency amplifiers
- Integral digital exciter
- Modular design for easy repair and maintenance
- TCP/IP Based Remote Control System for unattended operation



Transmitters

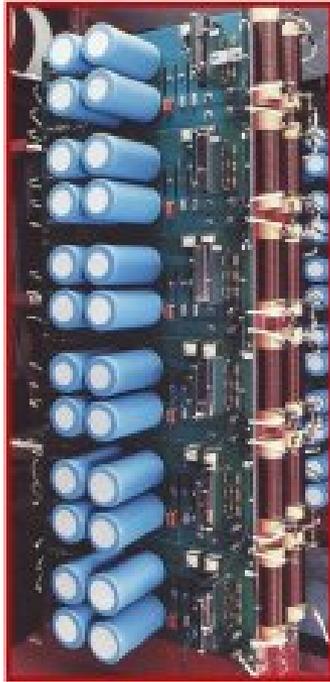


Antenna Tuning Units



Gas Capacitors

- CEC designs and manufactures nearly all major components for VLF/LF applications such as Timing Stations, Submarine Communications, Over-the Horizon and Surface-Wave Radar
- Capable of providing overall system design including coverage analysis
- More experience and deployments than any other supplier
- Transmitter power level ranging from 1MW to 2MW
- State of the art digital signal processing and high efficiency amplifiers
- Antenna Tuning Units, Helix Coils, Variometers, T-Networks designed and manufactured for the application....supplying since 1947!!
- Fixed and variable GAS-CAP Capacitors with ratings up to 400A at 1 MHz, capacitance to 25,000pF, and voltage rating to 85kV..... supplying since 1947!!



Power Supplies



RF Sources

- CEC utilizes commercial products to satisfy the needs of the Scientific and Industrial Community
- “One Off” unique custom solutions are produced upon request for specific applications drawing from our vast engineering experience
- Products provided are RF Power Sources, RF Specialty Components and Power Supplies.
- Products are used for particle accelerators, plasma research, oil recovery, medical research and ceramic sintering

X & S-BAND TRANSMITTERS



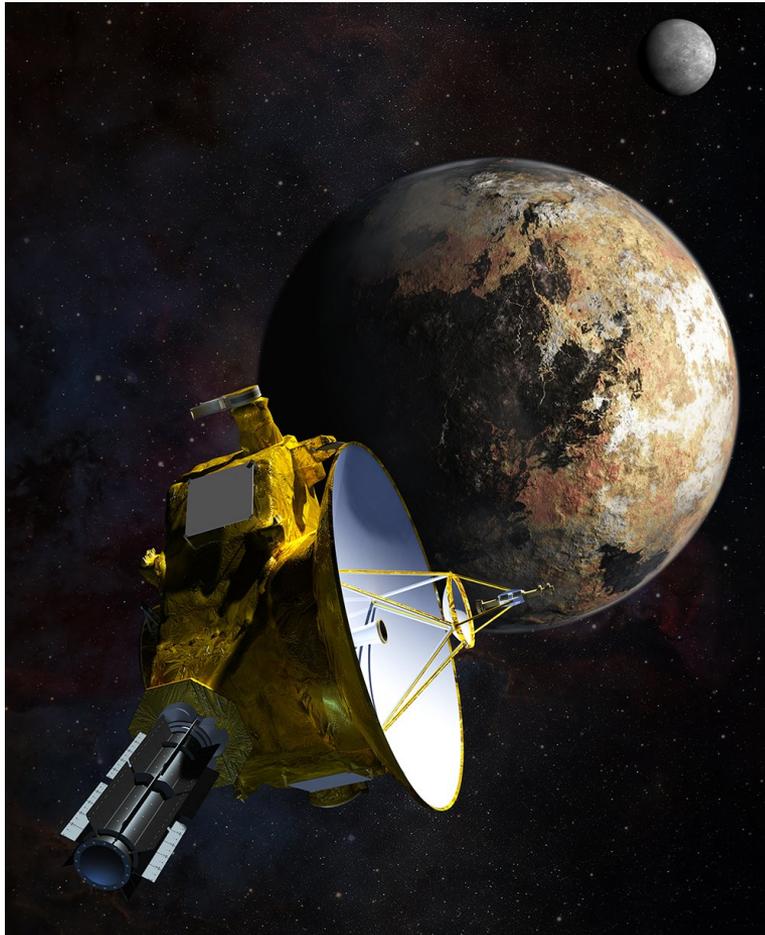
- Transmitter power levels range from 20kW to 80kW.
- Linearized Magnet Power Supply
- No Crowbar System
- Redundant Beam Power Supply Modules
- Air Cooled Beam Power Supply
- Proprietary and Patented Noise Reduction
- Beam Power Supply >95% Efficient
- Products provided are RF Power Sources, RF Components and Power Supplies
- Products are used for particle accelerators, plasma research, oil recovery, medical research and ceramic sintering

- Contracted to supply several X-Band Transmitters for deployment in the Deep Space Network
- One 80kW X-Band Transmitter is currently in final test
- Other transmitters are in various stages of manufacturing



The Deep Space Network, or DSN, is a world wide network of large antennas, transmitters And communication facilities that supports Interplanetary spacecraft missions. It also performs radio and radar observations for the exploration of the solar system and the universe , and supports selected Earth – orbiting missions. DSN is part of the NASA Jet Propulsion Laboratory (JPL).





Deep Space Network (DSN) web site
<http://eyes.nasa.gov/dsn/dsn.html>
<https://youtu.be/EJxwWpaGoJs>

On 13 & 14 July 2015 NASA's New Horizons spacecraft flew by Pluto, which is more than 7.5 billion km (4.6B mi.) from Earth.

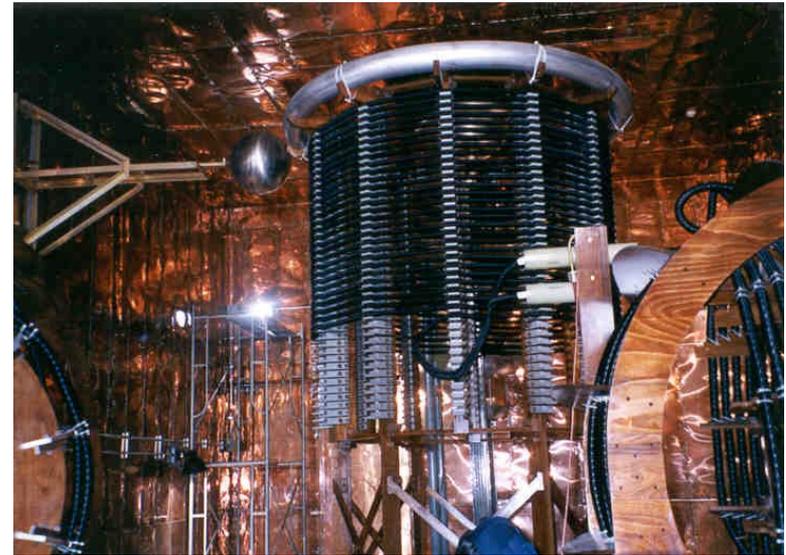
Email to all CEC Employees on 23 July 2015

- *"I am personally very honored that a CEC transmitter was chosen for this historic mission. The 80kW CEC X-band transmitter installed at Goldstone in California will begin transmitting a very high power extremely low noise microwave signal toward Pluto. I have been informed by the DSN team at JPL that the transmitter worked "flawlessly" and the radio experiment uplink was a complete success. But our 80kW transmitters will be used to keep communications going with New Horizons for many more years and maybe even decades to come. You should be very proud of what has been accomplished for this historic mission to Pluto."*

Daniel L. Dickey
President

SPAWAR VLF UPGRADE

- Upgrading NAVY VLF Communication Sites. These sites were originally built by Continental in the 1960's
- Providing equipment and installation services
- Currently finishing an upgrade installation in the Pacific Region



The Space and Naval Warfare Systems Command (SPAWAR) is the Navy's Information Dominance Systems Command. SPAWAR is fully committed to supporting the achievement of the Navy's mission and is dedicated to serving the Fleet. As one of three Department of Navy major acquisition commands, this means acquiring, installing, delivering and maintaining advanced information technology capabilities to the fleet, regardless of platform, to keep war fighters one step ahead of adversaries.

- **Converting Tube Intermediate Power Amplifiers to Solid State Amplifiers**
- **Tube IPAs could no longer be serviced**
- **Provides upgrade path to a new all solid state VLF Transmitter**
- **Providing equipment and installation services**
- **Currently finishing commissioning of upgrade**



Ministero della Difesa (MDD) is the Italian Ministry of Defense. It is responsible for military and civil defense.

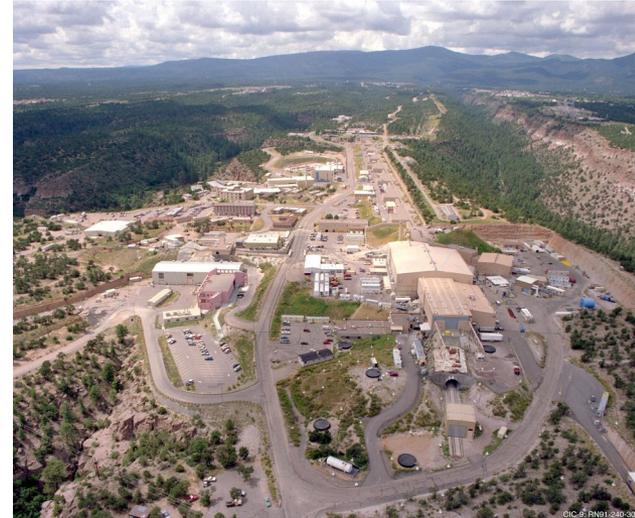
- Contract to build 100 Weather Radio Transmitters
- Developed a rugged high efficiency amplifier and digital integrated modulator
- Transmitters are 300W to 1000W and operate in very harsh environments
- First Production Transmitters are currently in various stages of the manufacturing process



Image Courtesy of George Stojkovic/FreeDigitalPhotos.Net

NOAA Weather Radio All Hazards (NWR) is a nationwide network of radio stations broadcasting continuous weather information directly from the nearest National Weather Service. NWR broadcasts official Weather Service warnings, watches, forecasts and other hazard information 24 hours a day, 7 days a week.

- Under contract to rebuild cavities and other components in operation in the proton accelerator (LINAC) at LANSCE
- This LINAC is our nation's most powerful linear accelerator and was built in 1972 with Continental providing the RF power components
- Various components being manufactured currently
- Unrelated but similar, additional repair components are also currently being manufactured for the Brookhaven and Fermi Labs



LANL's mission is to develop and apply science and technology to ensure the safety, security, and reliability of the U.S. nuclear deterrent; reduce global threats; and solve other emerging National security and energy challenges. LANL prides itself on its continuing record of excellence in the field of accelerator science and technology directed toward both fundamental scientific research and issues of national security and energy security.

MOIC SHORTWAVE PROJECT

- **Manufactured 4 x 300kW Shortwave Transmitters for MOIC**
- **All transmitters are DRM capable and ready for the conversion to digital operation**
- **Commissioning is completed of all four systems in Saudi Arabia.**



*Ministry of Industry and Commerce (MOIC)
Kingdom of Saudi Arabia*

- Under contract to provide 3 x 20kW Liquid Cooled Solid State Transmitters to operate over a wide frequency range
- Transmitter currently in test others being installed



The Naval Surface Warfare Center Dahlgren Division, Dahlgren Laboratory is a premier research and development center that serves as a specialty site for weapon system integration. NSWC has the unique ability to rapidly introduce new technology into complex war fighting systems is based on our longstanding competencies in Science and Technology, Research and Development, and Test and Evaluation.

- **2MW VHF Power Amplifier for Experimental Fusion Reactor**
- **Amplifier will create the energy to start and maintain the Fusion Process**
- **Entering into critical design review phase**

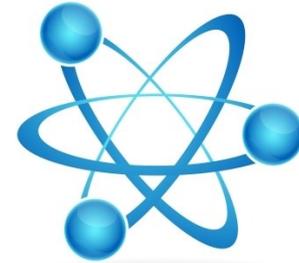


Image Courtesy of
digitalart/FreeDigitalPhotos.Net

ITER, meaning “the way” in Latin, is an experimental Fusion Reactor being constructed presently at Cadarache, in the South of France. ITER is a step towards future production of electricity from fusion energy. Nuclear Fusion is the process in which the Sun and the stars produce the energy by fusing light nuclei of hydrogen. ITER will produce at least ten times more energy than the energy required to operate it. In future demo or commercial reactors based on fusion, this energy can be converted to electricity.

An unprecedented international scientific and technological collaboration representing more than half the worlds human population is presently involved towards construction of ITER. The ITER partners are presently the People's Republic of China, the European Union, India, Japan, the Republic of Korea, the Russian Federation and the United States of America.

SHORTWAVE RADIO TRANSMITTERS



418DRM HF Transmitter



419DRM/420DRM



SSM Series Solid State Modulator

- Analog and Digital Transmitter Power Levels ranging from 100kW to 2000kW.
- Transmitters cover entire frequency band- 3.9MHz to 26.1 MHz
- CEC solid state, high efficiency, modulators
- Capable of operation in Amplitude Modulation (AM), Control Carrier Level Modulation (CCM) or digital streaming in DRM mode
- Complete transmitter designed and built by CEC
- TCP/IP Based Remote Control System for unattended operation

100kW HF Transmitter



CEC Model 418DRM HF Transmitter

Technical Characteristics

100 kW HF Transmitter



SUMMARY OF TECHNICAL CHARACTERISTICS

Carrier Output Power (A3E):

100 kilowatts on all frequencies through the 3.2 to 22 MHz range or optional ranges below.

Types of Emission:

Amplitude Modulation and DRM

RF Output Power:

400 kW PEP DRM and 400 kW Peak program modulation at 100kW RF Carrier Output

Type of Modulator:

Solid state step modulator with CCM

Type of Modulation:

High Level Plate Modulation

Final Power Amplifier:

Class "C" operation in both AM and DRM modes

Frequency Range:

3.2 to 22 MHz (2.3 to 16 MHz or 3.9 to 26.1 MHz optional at extra cost)

Output Impedance:

75 ohms unbalanced, 300 ohms balanced, (or 50 ohms unbalanced, optional). 2:1 max. VSWR

Modulation Capability, Conventional AM:

100%, 50 to 7500 Hz sinusoidal

Controlled Carrier Modulation Capability

(CCM): The Type 418G-DRM Transmitter has the capability of operating in a controlled carrier modulation mode. This is an amplitude modulation technique that scales the amplitude of the carrier to the percentage of modulation.

In typical modulation applications, the carrier can be reduced as much as 6 dB below the rated value. This feature can be a major cost saving to the user.

DRM: DRM operation is provided using external DRM exciter for generating the I and Q signals for amplification. The EER technique used for DRM amplification allow much higher conversion efficiency compared to linear operation of the PA Stage.

Radio Frequency Harmonic:

50 milliwatts, maximum. (Complies with C.C.I.R. recommendations)

Audio Input Impedance:

600/150 ohms, balanced or unbalanced.

Audio Input Levels for 100% Modulation:

+10 dBm at 1000 Hz

Audio Frequency Response (AM): +1 dB from 50 to 5000 Hz at 70% modulation. +1 or -1.5 dB from 5000 to 7500 Hz at 70% modulation

Audio Frequency Distortion:

Less than 3% RMS, 50-5000 Hz @ 90% Modulation

Residual Carrier Noise:

56 dB (unweighted) below 100% modulation level at 1000 Hz

Carrier Shift: Less than 3% at 100% modulation exclusive of power line variations.

Power Consumption:

140kW at carrier

214kW at 100% modulation

Overall Efficiency (Average):

70 - 72% at carrier and any modulation depth

Primary Power Requirements:

380/480 volts, three phase, 50/60 Hz (Other voltages available on special order.)

Power Factor:

Better than 0.95

Ambient Temperature:

+5 to +50 Celsius

Altitude:

Up to 6000 feet above mean sea level

Relative Humidity:

0 to 95% non-condensing

Cooling:

Water and air cooling is employed. All necessary cooling is an integral part of the Type 418G-DRM Transmitter. De-mineralized water requirements are essentially zero.



CEC Model 419DRM/420DRM HF Transmitter

Technical Characteristics

300/500kW HF Transmitter



RF Carrier Output Power (A3E)

420C-500 kW, 419H 300 kW on all frequencies through the 3.9 to 26.1 MHz range.

Reduced RF Carrier Output Power (A3E)

420C - Any power level between 50 kW and 500 kW. 419H - Any power level between 30 kW and 300 kW.

RF Output Power (H3E & R3E)

420C - 1000 kW PEP Two-Tone, 1500 kW PEP Program Modulation; 419H - 600 kW PEP Two Tone, 800 kW PEP Program Modulation.

Frequency Range

3.9 to 26.1.MHz continuous in 100 Hz increments.

Tuning Time

An average of 10 typical frequency changes take less than 25 seconds each.

Standing Wave Ratio

2.0: 1 VSWR at full power.

Output Impedance

75 ohms or 50 ohms unbalanced, 300 ohms balanced.

Modes of Emission

AM (A3E), SSB (H3E & R3E).

DRM (with DRM exciter).

Modulation Method

PA anode modulation using high efficiency solid state modulator.

Modulation Capability

100% sinusoidal modulation at frequencies from 50 to 7,500 Hz, for ten (10) minutes per hour. Up to 70% modulation on a continuous basis.

Controlled Carrier Level Modulation

The Type 419H/420C Transmitter has the capability of operating in a controlled carrier modulation mode (CCM). This is an amplitude modulation technique that scales the amplitude of the carrier to the percentage of modulation. The carrier can be reduced as much as 6 dB below the rated value. This feature can be a major cost saving to the user.

Single Sideband Operation (H3E & R3E)

Single Sideband (SSB) operation is provided using a phase-amplitude method of generating the single sideband signal.

RF Spurious Noise

Less than 50 mW. Out of band emissions are in compliance with CCIR 328-5.

RF Harmonic Outputs

Less than 50 mW.

Audio Response (A3E)

±1 dB from 50 Hz to 7,500 Hz at 70% modulation or any lower modulation level.

Audio Response (H3E & R3E)

±1 dB 100 Hz to 4,500 Hz at any level up to the average power capability.

Audio Harmonic Distortion (A3E)

Less than 3.5% at 90% modulation from 50 to 7,500 Hz.

Audio Harmonic Distortion (H3E & R3E)

Less than 3.5% at full average power capability from 100 to 4,500 Hz.

Intermodulation Distortion (H3E & R3E)

At least -35 dB relative to either tone of a two-tone test signal.

Carrier Reduction (H3E & R3E)

-6 dB to -24 dB relative to two audio tone PEP output, adjustable in 3 dB steps.

Technical Characteristics

300/500kW HF Transmitter (Continued)



Audio Input Requirements

Adjustable from -8 dBm to +10 dBm for 100% modulation.

Audio Input Impedance

600 ohms, or 10K ohms, balanced.

Carrier Level Shift (A3E)

Less than or equal to $\pm 3\%$ shift at 100% tone modulation with 1,000 Hz sine wave
Exclusive of power line variations.

Carrier Noise

-56 dB unweighted referenced to 100% modulation with a 1,000 Hz tone.

Power Source

4,160 Vac, or 11,000 Vac, 3 phase, three wire, 50/60 Hz. Other voltages may be accommodated on special order. Main power requirement is 650/1,200 kW with a 100% tone modulation condition and equal to or greater than 0.95 lagging power factor.

Efficiency

The overall efficiency of the Type 419H/420C Transmitter measured as an average of ten frequencies over the range of 3.9-26.1 MHz at 300/500 kW carrier power level will not be less than 71/73% with any depth of modulation. Overall efficiency of 73/75% is expected during cool weather conditions and at the lower RF frequencies.

Ambient Temperature

+5 to +450 Centigrade, indoors -10 to 450 Centigrade, outdoors. Lower temperatures may be accommodated on special order.

Altitude

Up to 2,000 meters above sea level. Higher altitudes may be accommodated on special order.

Relative Humidity

0 to 95%, non-condensing relative humidity.

Cooling

Water, water-vapor, and air cooling is employed. All necessary cooling is in integral part of the Type 419H/420C Transmitter. Demineralized water requirements are less than or equal to 1 gallon per day. No discrete air ducting is required.

As the premier engineering and manufacturing supplier to the broadcast industry for more than 60 years, Continental continues to excel in state-of-the-art High-Power RF and High-Power Electronics.

Our continuing leadership in commercial products assures all our customers that Continental Electronics represents the value leader in engineered solutions for High-Power Systems.

