



Broadcast Electronics

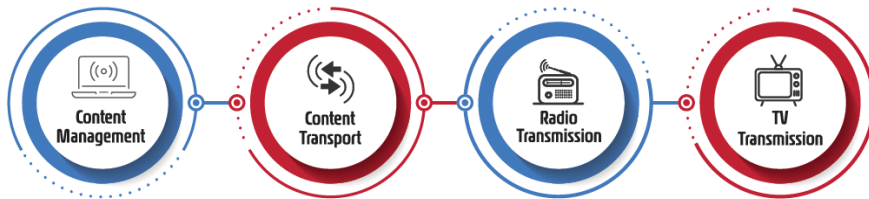


TTX Series Compact High Efficiency Digital Television Transmitters

Overview

Broadcast Electronics has an over 65-year legacy of providing innovative technology to enable radio and TV broadcasters to deliver compelling content to their audiences and create revenue-generating business opportunities. Supporting global innovation and next generation content delivery, Broadcast Electronics embodies a customer first approach to the market from the company's headquarters in Quincy, Illinois in the United States.

Customer focused solutions from Broadcast Electronics are built on four technology areas:

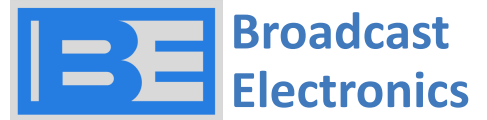


AudioVault is BE's award-winning suite of Content Management software enabling live and automated program creation and playout, news solutions and digital logging as well as data management.

The Marti range enables content Transportation, powering audio contribution and distribution for point-to-point (STL) wireless connectivity.

Radio Transmission is the heart of Broadcast Electronics with multiple product lines to support AM and FM transmission. The BE STX line of HD Radio® ready FM transmitters provides superior sonic quality and low operating cost. BE ETX analog FM transmitters deliver compact, energy efficiency in a cost-effective package. The BE AM line of transmitters provides for rugged, reliable, energy efficient peace of mind for your AM radio station.

Broadcast Electronics complete line of **low and high-power TV transmitters** are designed around a software defined core exciter that can cover all the global analog and digital TV standards. With solutions covering UHF and VHF frequency bands and air-cooling configurations, BE can craft the right solution to meet your technical, budgetary and operating requirements.



Broadcast Electronics is a global technology company dedicated to driving innovation in broadcast technology providing market leading solutions for software-based content management, Radio & Television transmission, and scientific applications of radio frequency devices.

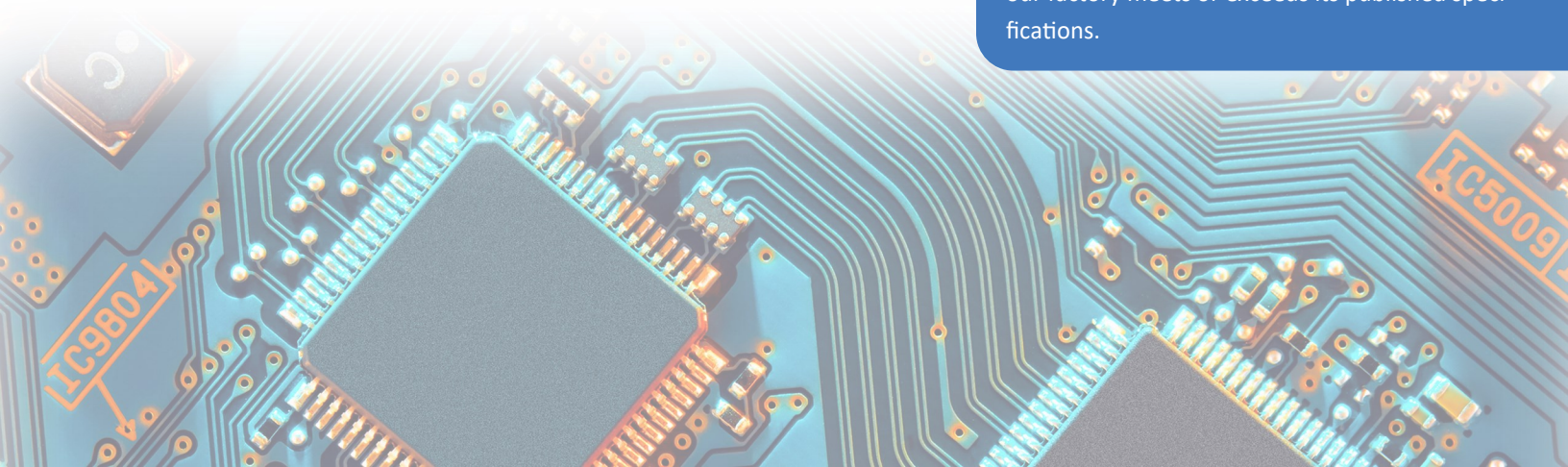
Broadcast Electronics, has been providing high-tech solutions for broadcasters for more than 65 years in over 170 countries. All of our products and services come from a heritage of creativity and innovation unmatched in the industry, focused on developing innovative solutions for customers problems.



Every major innovation that shaped modern radio originated in Quincy, and it is here that BE products are designed, supported and manufactured today.

Our facility in Quincy employs the latest instruments for research, new product design, prototype fabrication and testing.

We take advantage of the best practices of automated production, adding human attention to detail to ensure every product that leaves our factory meets or exceeds its published specifications.



TTX Compact Transmitter Series

The TTX is the latest in a long timeline of reliable, efficient, and performance-leading TV transmitters from Broadcast Electronics. TTX has been designed for high energy efficiency to lower operating costs, world-class digital performance, maximum reliability and uptime, simplified and fast field repair, built-in redundancy, and the flexibility to support continued technological updates over time.

Combining the best of both world

Broadcast Electronics TTX series combines the best characteristics from the BE Alpan family and the BE ETX line of transmitters to deliver a high-performance, cost-effective solution with models from 100 W to 16,600W. Leveraging the highly efficient and compact RF technology with the latest ruggedized LDMOS RF devices in a broadband Doherty configuration the TTX provides the efficiency, compactness, and reliability you have come to expect.

We didn't stop there, drawing from BE's legacy of software defined exciters, we incorporated a digital direct-to-channel software defined modulator with powerful adaptive correction and ultra-reliable highly efficient hot-pluggable power supplies to deliver the maintainability and robustness our customers expect with a new level of performance and reliability at an exceptional price.

TTX's simple yet powerful control system provides extensive monitoring, logging, and control capabilities with fast-acting protection for maximum reliability. A front panel LCD screen, navigation buttons and bright LED indicators allow easy review, setup, and diagnostics. The RJ-45 port allows you to connect to the intuitive and powerful GUI and SNMP from anywhere in the world. The programmable parallel GPI/O interface provides connectivity to a traditional remote-control system.

Flexible options — software enabled

BE knows that in the fast-paced and evolving world of broadcasting, the old adage—the only constant is change—holds. You need to invest in cost-effective tools for today, but maintain the flexibility to expand your system when things change tomorrow—all without ripping things out and starting over. The software defined modulator with dualcast allows you to switch modulations by simply clicking a button. The TTX comes standard with extensive capabilities to address almost all situations, but also we offer a wide selection of cost-effective options to protect your original investment and extend the usability of the transmitter to deliver your content to your audience.

Eliminate multiple outboard boxes when you use cost-effective options like – Off Air re broadcast receiver —ideal for a translator or transposer, skip the STL or outboard device—ASI/EDI over IP solutions inside the TTX, you can even add single or dual satellite receivers, and more.... all integrated into our simple easy to use web GUI.

You bring the content; we will help you deliver it to your audience cost-effectively!

Put these powerful capabilities to work for you

- Models from 100 W to 16600 W
- Ultra compact size and low weight
- Software Defined Mult standard Multimode modulator allow dualcast operation (analog and digital mult standard)
- T.S. over IP able to receive MPEG Transport Streams (encapsulation ProMpeg COP#3 rel.2)
- GNSS GPS-GLONASS receiver for SFN applications
- Linear and non-linear precorrection with option for adaptive
- Power Amplifier Modules with gain and phase adjustment to obtain perfect matching when coupling more units
- Power amplifiers use Doherty broadband configurations featuring very high efficiency.
- Hot-Pluggable / Front Access Power Supplies - Redundant 5RU & above
- Seamless operations over a wide range of voltages and power stability
- Run at maximum power up to 1.5:1 VSWR w/proportional foldback
- IP Connectivity with HTML5 GUI for anytime, anywhere access
- Flexible alerts, monitor and control with SMTP email, SNMP, and SMS
- Comprehensive event log stores 5000 events—simplifies troubleshooting
- Multifunction USB port
- Removable front panel grill and washable filter for clean operation
- Single or dual satellite and terrestrial receiver Available standards: DVB-S/S2, DVB-T/T2, ISDB-T/Tb

Software Defined Modulator—The Heart of the Transmitter

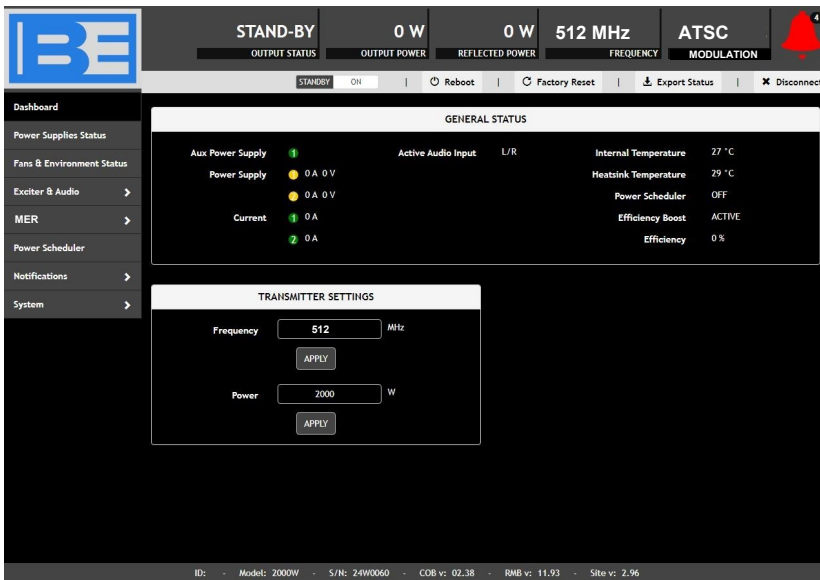
The TTX Software Defined Multistandard Multimode modulator allow dualcast operation (analog and digital multistandard DVB-T/H; DVB-T2; ISDB-T/Tb; ATSC; other on request) and can be supplied with wide choice of input interfaces, linear and non-linear precorrection with option for adaptive.

The built in GNSS receiver option, specifically developed for the timing function, provides time and frequency signals (1pps and 10MHz) necessary for the synchronization of the transmitter when operating in SFN Mode.



Advanced Monitor and Control Capability

Every TTX includes a powerful yet simple-to-use browser-based HTML-5 graphical user interface for control and monitoring of the transmitter anywhere in the world. Extensive TCP/IP network connectivity via integrated RJ-45 connection allows the transmitter to be securely connected to any IP network. The optional 3g/4g model provides for simple connectivity in even the most remote places. Integrated multiuser multilevel password protection ensures only authorized operation on your network.



TTX also supports a robust SNMP – (Simple Network Management Protocol) interface for easy connection with a wide array of powerful software network manager systems and popular transmitter remote controls. The entire transmission system can be controlled and monitored using the standard published MIB protocols.

TTX provides a comprehensive event log that captures all transmitter-related activities, operations, and faults storing the 5000 most recent activities. This allows for detailed diagnostics and simplified routine maintenance.

Remote Monitor and Control interfaces supported include:

- Popular parallel interface to panels and legacy remote-control systems
- Automated Alarms and notifications via Email or SMS text
- SNMP connectivity for alerts, monitoring, and control
- Web GUI via ethernet network connection RJ-45 (10/100Base-T) with TCP/IP protocol

Innovative RF System Delivers Lowest Cost of Ownership

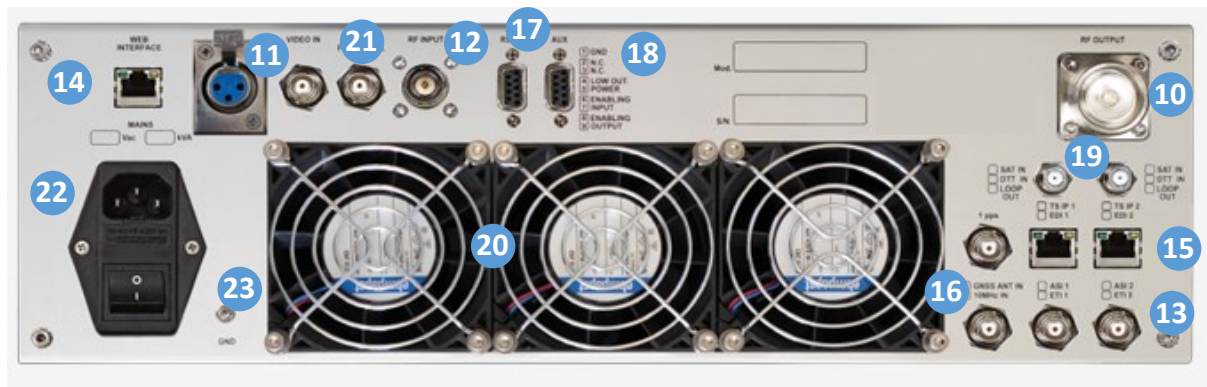
Featuring the latest LDMOS- Broadband Doherty power amplifier device technology coupled with innovative amplifier design TTX delivers significant increase in power density and efficiency.

Redundant rugged amplifiers and low-loss combiners protect against lightning, antenna system short—and open circuits and high VSWR keeps you on the air, reduces operating and maintenance costs, delivering the lowest cost of ownership over the life of the transmitter - maximizing your investment.

TTX Front & Rear Panel

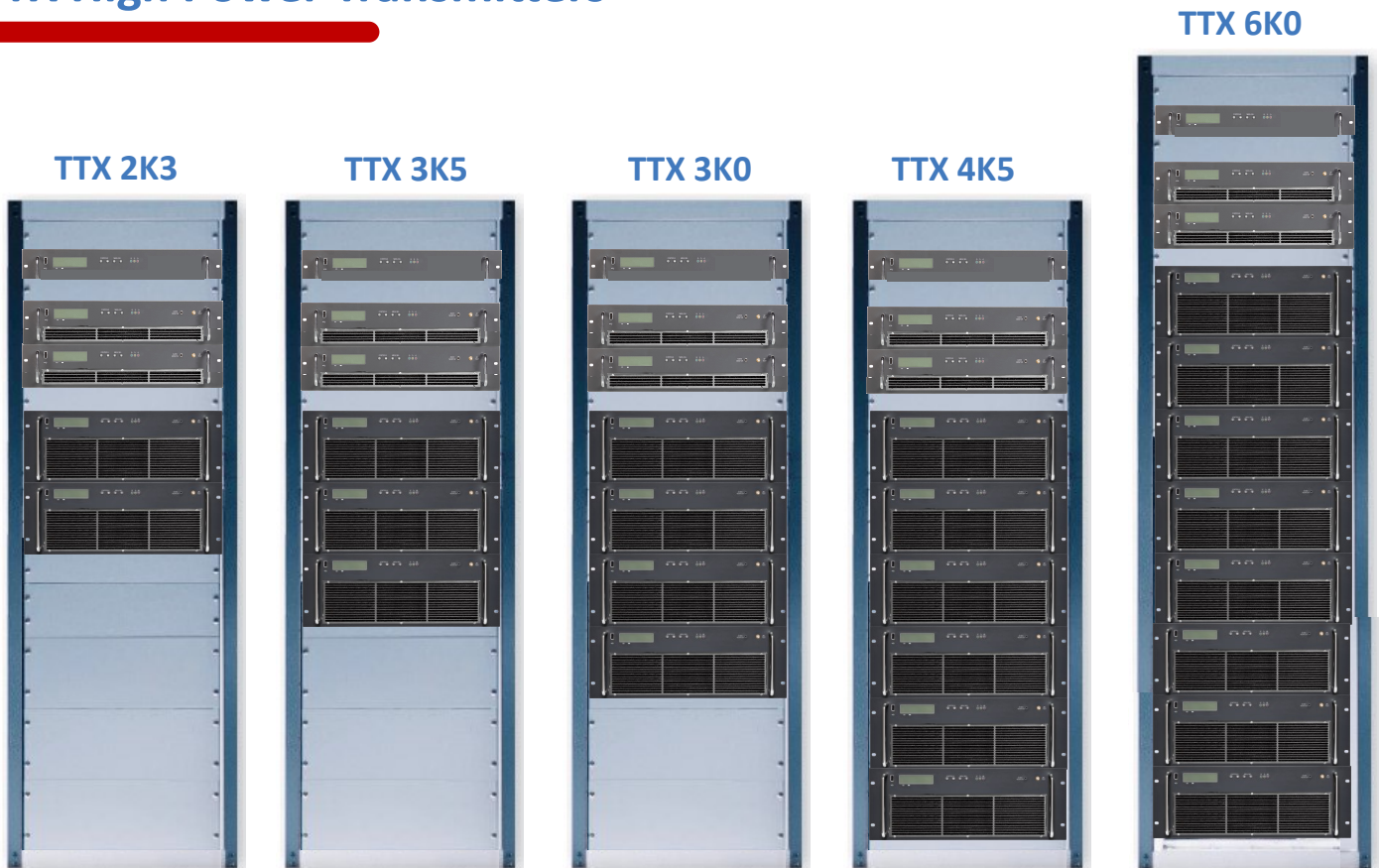


- 1. Removable Air Filter— washable filter
- 2. USB port for system back ups and storing configurations
- 3. Graphic LCD display
- 4. Function keys and menu selectors
- 5. LED indicators: green (ON), yellow (warning), red (alarm)
- 6. LAN (RJ45) for management (Web server, SNMP, etc.)
- 7. Hot Pluggable power supply # 1
- 8. Hot Pluggable power supply # 2
- 9. RF output monitor (SMA female)



- 10. RF output connector (DIN 7-16 female)
- 11. Analog audio input (XLR connector) | BNC female connector for analog video
- 12. "N" connector for receiver VHF/UHF input
- 13. BNC female connector for ASI and ETI
- 14. LAN (RJ45) for management (Web server, SNMP, etc.)
- 15. LAN (RJ45) (2) ASI over IP transport stream input
- 16. Reference: 1pps, 10MHz external reference or GPS/GLONASS antenna input
- 17. DB9 connector for RS232
- 18. Remote Control—GPIO
- 19. Single or dual Satellite/Terrestrial receiver ("L" Band)
- 20. Main fans (3)
- 21. Adaptive Correction monitor
- 22. AC power supply input and fuse
- 23. Ground screw

TTX High Power Transmitters



TTX Scalable Architecture to Deliver High Power in a Compact Footprint

The Broadcast Electronics TTX family of VHF & UHF TV & DAB transmitters produces a range of outputs with a combination of TTX 3RU & 5RU power amplifiers each delivering hi efficiency RF power, a single TTX or dual set of 2 TTX Exciters and a controller.

The overall RF power of the models in this product series ranges from 100 W to 16600 W and each system can be housed in a single 19" rack.

TTX High Power transmitters represent the most advanced technology in terms of electrical efficiency, compactness, reduced weight, ease of use, and diagnostics. They have been designed to guarantee the maximum performance and operation while lowering operational costs through energy saving technology.

The Broadcast Electronics TTX transmitters provide an extremely high operational performance under extreme environmental conditions (high external temperatures, poorly adjusted antenna, fluctuations in the power source).

Power Supply Redundancy

Each TTX 5RU amplifier contains 3 hot pluggable power supplies that operate in a N+1 mode such that with the loss of any one supply the amplifier can still deliver full output power.

The loss of 2 power supplies still keeps the amplifier operating a 50% or more of power ensuring you can stay on the air at very high power levels with multiple failures.

The TTX 6K0 for example has enough redundancy so that up to 8 power supplies can fail and the transmitter will still make full output power. This level of redundancy and resiliency is unheard of in competitive TV transmitters



Specifications

	TTX 200	TTX 300	TTX 400	TTX 600	TTX 800	TTX 1K2
UHF Power (OFDM/ATSC/analog)	200/300/560	N/A	400/600/1110	600/900/1670	800/1100/2242	1200/1700/3330
VHF Power Band III (OFDM/ATSC/analog)	200/300/560	300/400/830	400/600/1110	600/900/1670	800/1100/2220	1200/1700/3330
VHF Power Band I (OFDM/ATSC/analog)	200/300/560	300/400/830	400/600/1110	600/900/1670	800/1100/2220	1200/1700/3330
# of Power Supplies	1—Option for 2	1—Option for 2	1—Option for 2	2—Option for 3	2—Option for 3	3
# LDMOS in the amplifier stage	1	2	2	3	4	6
Accuracy (Output Power)	2% full scale	2% full scale	2% full scale	1% full scale	1% full scale	1% full scale
Amplification Type	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband
Output Connector	7-16 DIN female	7-16 DIN female	7-16 DIN female	7-16 DIN female	7-16 DIN female	7-16 DIN female
Cooling Method	Forced air-cooled, internal fans, airflow front to	Forced air-cooled, internal fans, airflow front to	Forced air-cooled, internal fans, airflow front to	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear
Operating Temperature	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing
Maximum operating altitude (ft / m)	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000
AC Input Voltage	90-264Vac, 47 to 63Hz single phase	90-264Vac, 47 to 63Hz single phase	90-264Vac, 47 to 63Hz single phase	176-264Vac, 47 to 63Hz single phase (90-176Vac with limited output power)	176-264Vac 230Vac, 47 to 63Hz single phase 400Vac three phase star conn. (w/ neutral) and 230Vac three phase delta conn. (w/o neutral)	
Dimensions (W x H x D, inches / cm)	19 x 3 RU (5.25) x 18 inches 48 x 13 x 46 cm	19 x 3 RU (5.25) x 18 inches 48 x 13 x 46 cm	19 x 3 RU (5.25) x 18 inches 48 x 13 x 46 cm	19 x 3 RU (5.25) x 18 inches 48 x 13 x 46 cm	19 x 3 RU (5.25) x 18 inches 48 x 13 x 46 cm	19 x 5 RU (8.75) x 28 inches 48 x 23 x 70 cm
Weight (LBS / Kgs)	38 / 17	38 / 17	40 / 18	42 / 19	64 / 29	66 / 30

Specifications

	TTX 1K5	TTX 2K3	TTX 3K0	TTX 3K5	TTX 4K5	TTX6K0
UHF Power (OFDM/ATSC/ analog)	1500/2100/4170	2300/3300/6330	3000/4300/8330	3500/5000/9720	4500/6400/12500	6000/8600/16670
VHF Power Band III (OFDM/ATSC/ analog)	NA	2300/3300/6390	NA	3500/5000/9720	4500/6400/12500	NA
VHF Power Band I (OFDM/ATSC/ analog)	On request	On request	On request	On request	On request	On request
# of Power Supplies	4	6 Option for 8	8 Option for 12	9 Option for 12	12 Option for 18	16 Option for 24
# LDMOS in the amplifier stage	8	12	16	18	24	32
Accuracy (Output Power)	1% full scale	1% full scale	1% full scale	1% full scale	1% full scale	1% full scale
Amplification Type	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband	High Efficiency Doherty broadband
Output Connector	7-16 DIN female	EIA 1-5/8" flange, other on request	EIA 1-5/8" flange, other on request	EIA 1-5/8" flange, other on request	EIA 1-5/8" flange, other on request	EIA 1-5/8" flange, other on request
Cooling Method	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear	Forced air-cooled, internal fans, airflow front to rear
Operating Temperature	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing	-5°C to +45°C 95% non-condensing
Maximum operating altitude (ft / m)	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000	10000 / 3000
AC Input Voltage	176-264Vac 230Vac, 47 to 63Hz single phase 400Vac three phase star conn. (with power neutral) and 230Vac three phase delta conn. (without power neutral)					
Dimensions (W x H x D, inches / cm)	19 x 5 RU (8.75) x 28 inches 48 x 23 x 70 cm	Rack 22.5 x 74.8 x 39.4 inches 57 x 190 x 100 cm	Rack 22.5 x 74.8 x 39.4 inches 57 x 190 x 100 cm	Rack 22.5 x 74.8 x 39.4 inches 57 x 190 x 100 cm	Rack 22.5 x 74.8 x 39.4 inches 57 x 190 x 100 cm	Rack 22.5 x 74.8 x 39.4 inches 57 x 190 x 100 cm
Weight (LBS / Kgs)	66 / 30	639 / 290	771 / 350	925 / 420	985 / 460	1080 / 490

All specifications contained in this document may be changed without prior notice

Digital Specifications	
Transmitter Type	Solid State VHF Band I, Band III, UHF Band IV TV transmitter for analog and digital TV
Output Power	100 W to 16,670W
Spurious, harmonics and out of channel IMD products	Compliant with ETSI and FCC specification $\leq -60\text{dB}$ (with RF output filter)
Frequency stability (-5 to +45°C)	$\geq \pm 250\text{Hz}$; option: GNSS locked reference for better than 1Hz stability
Transmission standard	DVB-T/H; DVB-T2; ISDB-T/Tb; ATSC; other on request
Intermodulation products (shoulders before output filter)	According to the model and output power typ. $\leq 38\text{dB}$ with reference to emission channel centre power density
MER – Modulation Error Ratio	According to the model and output power (typ. 36dB)
Input interface options	ASI - MPEG/DVB and BTS Transport Stream - 75Ω BNC Female Ethernet - MPEG TS over IP (as per Pro-MPEG CoP#3 release 2) DVB-S/S2 receiver - 950-2150MHz, all modulation schemes, code rates and rolloff factors, Multistream, PL scrambling decoding with gold code (CAM option) DVB-T/T2, ISDB-T/Tb receiver - VHF and UHF (CAM option)
Input switching	Automatic near-seamless switching between first and second priority. Option for seamless switching
Analog Specifications	
Output power (after filter)	up to 16.67kWp.s. (tol.+0/-0.5dB) according to the model
Transmission standard	B, G, D, H, I, K, K1, M or N - PAL, Secam and NTSC
In band intermodulation	$\leq -56\text{dB}$ (typ. $\leq -60\text{dB}$ – Test: V.C. -8dB; S.C. -10dB; C.S. -16dB)
Video input	1Vpp (75Ω BNC-f) – video processing include ALC and signal reconstruction
Transmitted Video quality parameters	Differential gain: within $\pm 5\%$ (typ. $\leq \pm 2\%$); Differential phase: $\leq \pm 3^\circ$ (typ. $\leq \pm 1.5^\circ$) 2T K rating: $\leq 2\%$ (typ. $\leq 1\%$); Random noise (weighted typical): $\leq -60\text{dB}$; Group delay response (V.C. to C.S.): Within $\pm 40\text{nS}$ (typ. $\leq \pm 20\text{nS}$) Amplitude / frequency response: (V.C. to C.S.): Within $\pm 1\text{dB}$ (typ. $\leq \pm 0.2\text{dB}$)
Audio input	0dBm (adjustable) 600 Ω bal. / unbal. Stereo / dual sound IRT; BTSC and other on request
Audio quality parameters	Amplitude / frequency response: $\pm 1\text{dB}$ (typ. $\pm 0.5\text{dB}$); Harmonic distortion: $\leq 0.4\%$

Service and Support

We know that having the right support behind a product is every bit as important as the features and capabilities it delivers. At Broadcast Electronics we are committed to provide you with not only great products and software, but a dedicated team of service experts to help you keep your station running smoothly for years to come.

Training

Broadcast Electronics has long provided training programs for our products to educate and prepare users to operate and maintain them in the most effective possible manner. Training is offered for all styles of transmitters and Audio Vault systems, featuring a mix of instruction with hands-on operation and troubleshooting. Training programs can be crafted to meet your local needs, offered in our facility, at your location or online. Our programs provide SBE educational credits.

Warranty

You can rest assured that Broadcast Electronics stands behind

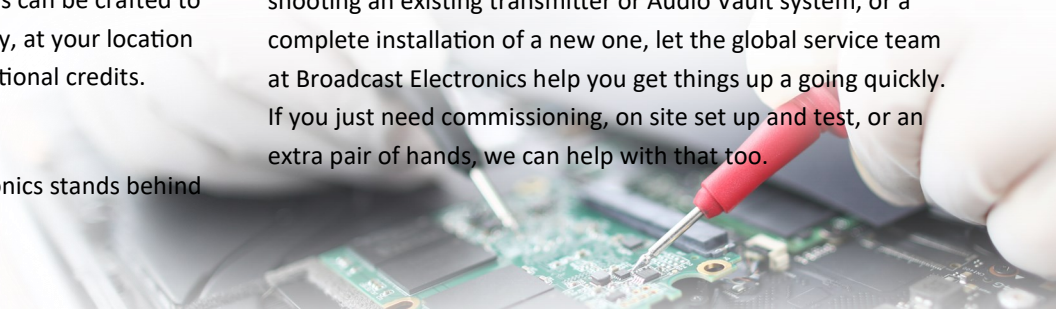
its products and services to provide complete satisfaction. Our products offer a standard set of warranty services that exceed others in the industry.

Repair Service

As a leader in providing innovative products and solutions to broadcasters around the globe, Broadcast Electronics understands the needs for long life and years of trouble-free service. You can feel secure that if disaster strikes and your products need service, we offer complete repair and refurbishment service to get you back on the air delivering your high-quality programming quickly.

On-Site Service and Installation

Regardless if you simply need some additional help troubleshooting an existing transmitter or Audio Vault system, or a complete installation of a new one, let the global service team at Broadcast Electronics help you get things up a going quickly. If you just need commissioning, on site set up and test, or an extra pair of hands, we can help with that too.





Broadcast Electronics

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