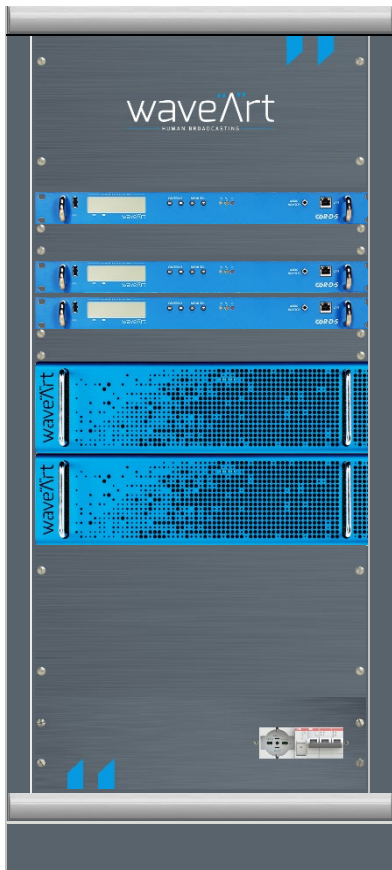# WAVE4000-DA - 4kW FM TRANSMITTER

SINGLE/DUAL DRIVER, DOUBLE AMPLIFIER

Advanced Efficiency Boost

Efficiency over 75% with adaptive optimization

Prognostics

Analysis for predictive maintenance

Easy Care

Hot pluggable PSU
Easy to replace fans

Digital Processing

Unique performances thanks to DDS digital modulator

Controls

LCD display, Web server and SNMP

Stereo & Soft clipper

Always included

Integrated unique features

Micro SD card slot
FM, Satellite and Terrestrial receiver
Audio processor
Full telemetry with 3G/4G connection

GENERAL SPECIFICATION

Output frequency range	87.5 to 108MHz in 1Hz steps
Output Power	4kW (tol. +0/-0.5dB)
Output connector	EIA 7/8" flange, other on request
Spurious and harmonic suppression	Compliant with ETSI and FCC specification
Analog input	2x XLR female (Balanced; impedance 600Ω/10KΩ selectable)
MPX/SCA/RDS input	2x BNC female (Unbalanced; impedance 50Ω/10KΩ selectable)
Soft Clipper with band limitation	Included
Power consumption	Typ. 5,4kVA - Max. <6kVA
AEB - Advanced Efficiency Boost	Included
AC Input voltage and frequency	176-264Vac, 47 to 63Hz single phase (90-176Vac limited output power)
AC/DC Power Supplies	N.2 power supplies hot pluggable from the front panel (each amplifier)
Operative temperature & fans	-5°C to +45°C @MSL. N.4 fans on the rear panel (each amplifier)
Maximum operative altitude	3000m ASL. For higher altitudes please contact our sales dept.
Maximum operative humidity	95% non-condensing
Housing	Option Rack Cabinet 19" 15U or 25U dimensions: 570 x 830 x 870 mm or 570 x 1250 x 1000 mm (W x H x D)
Weight	<140Kg

SOFTWARE OPTIONS		
S-AM-UN	Audio monitor for input or on-air signal + test tone generator	
S-SD-UN	Micro SD card slot	
S-AES-UN	Digital AES/EBU & AES192 (MPX over AES) inputs	Included in **S-FULL-UN**
S-FMRX-UN	FM receiver input (for regenerative FM repeater/ translator)	
S-SWI-UN	Automatic input switching (n.3 MPX profiles – audio/ RDS)	
S-RDS-UN	Static RDS coder	
S-IP-UN	IP input (Icecast2 streaming & AES67)	
S-DMPX-UN	Digital MPX over TS & Digital MPX over IP in/out	
S-RDS+-UN	Dynamic RDS	
S-ISO-UN	SFN/ Isofrequency operation	
S-AP-DEL	Delossifier	Only with **H-AP**
S-AP-ARDS	Advanced RDS	

HARDWARE OPTIONS	
H-SAT	Embedded Satellite receiver demodulator. DVB-S/S2 (L-band input) Low Symbol Rate with loop
H-SATDTT	Embedded Satellite and Terrestrial receiver demodulator. DVB-S/S2 (L-band input) and DVB-T/T2 and ISDB-T (VHF/UHF band input)
H-3G; H-4G	2G/3G or 3G/4G modem router for remote connection/telemetry and SMS
H-I/O	GPIO interface with n.3 isolated clean contact out, n.4 optoisolated in, n.4 analog out (0 to 5V), mini UPS for remote control, RF filter for router
H-AP-PRO	Integrated audio processor card with professional software license
H-SATDTT2	Second Redundant Embedded Satellite and/or Terrestrial receiver demodulator with seamless switching
H-CAM	CAM Slot (Common Interface Module)
H-ASI	ASI T.S. input (or output) interface
H-REF	10MHz and 1pps inputs
H-GNS	High stability reference oscillator GNSS (GPS + GLONASS) locked, oven clock 10MHz + 1pps outputs
H-AGNS	GPS/GLONASS receiving antenna (gain 26dB typ.) + 15 meters cable

The software-based audio processor can be integrated in any Wave Transmitter, from low and medium compact versions to high power line. **H-AP-PRO Audio Processor** offers outstanding audio quality and comes with many unique features.

FM Composite Clipper

Up to 140% audio level at 100% modulation gives 2-3 dB extra headroom for highs. Improve your audio, being the loudest and cleanest station on the dial!

Stereo & RDS Coder

Built-in stereo and RDS encoder
RT+

Advanced Dynamics & EQ

Increases the dynamics for music that lacks dynamics. Adjusts the spectrum without compression, making it possible to generate a very consistent sound without sounding compressed

Dehummer

Improves the sound of MPEG2/MP3 style lossy compressed files, removing unwanted constant sounds, such as a 50/60 Hz hum from bad cables

Better FM reception

Improves stereo reception area up to 30Km

Declipper & Natural Dynamics

Repairs clipped audio, removes distortion
Restores Natural Dynamics

Delossifier

Improves the sound quality of MPEG2/MP3 style lossy compressed files

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RF OUTPUT

Output frequency range	87.5 to 108MHz (Output frequency adjustable in 1Hz steps)
Class of emission	F3E – Standard: ± 75kHz peak deviation – Max: ± 200kHz peak deviation
Frequency stability	In the temperature range -5 to +45°C: ≥ ±1ppm; in one year (aging): ≥ ±1ppm Option: GNSS synchronizer (GPS + GLONASS) with oven oscillator for better than 0.1Hz precision and stability
Output power range	Output power is adjustable from nominal value up to -10dB
Output power stability	±0.2dB (with ALC inserted – Automatic Level Control)
Load (Antenna) VSWR	Normal operation up to 1.5:1 (4% reflected power – 14dB return loss). Fold-back and Fast Protection functions operate (see description under "Embedded Features")
Spurious emissions (including harmonics)	Compliant with ETSI and FCC specification
RF Monitor output	SMA Female on the front panel (coupled to the RF output @ -50dB typ.)

INPUT INTERFACES

Analog Audio	L; R or L+R: N°2 XLR female (Balanced; impedance 600Ω/10KΩ jumper selectable). Nominal input level: +15dBu to -15dBu (software adjustable). MPX / SCA / RDS: N°2 BNC female (Unbalanced; impedance 50Ω/10KΩ jumper selectable). Nominal input level: +12.5dBu to -12.5dBu (software adjustable)
Digital Audio	AES/EBU: XLR female (Balanced; impedance 110Ω). Nominal input level: -24dBfs to 0dBfs (software adjustable); automatic sample rate selection up to 192kHz for AES192 (MPX over AES). Ethernet 10/100 base T (Icecast 2 streaming and MPX over IP): RJ45. ASI: BNC (female) 75Ω
Micro SD Card slot	Cards up to 32GB; Supported format: MP3; AAC-LC; AAC-HE; MPEG1 L2; WMA; FLAC; Ogg Vorbis Card reader for emergency content transmission (in case other input sources are not available)
Analog receiving interfaces	FM receiver (for regenerative transposer application or for audio monitoring) Input connector (for transposer application): N female 50Ω Note: for regenerative transposer application it is also required an input filter
Digital receiving interfaces	DVB-S/S2 receiver: input "L" band, "F" female connector 75 Ω; LNB power supply and control; low symbol rate from 128kS/s - single or redundant configuration. DVB-T/T2 (Base and Lite) and ISDB-T/Tb receiver: input 42 to 1002MHz, "F" female connector 75 Ω - single or redundant configuration

Digital receivers have the possibility to select and decode the wanted audio service (PID). Supported formats: MP3; AAC-LC; AAC-HE; MPEG1 L2; WMA; FLAC; Ogg Vorbis. Additional option: CAM slot for encrypted services

Input Interface selection   Manual or Automatic with priority levels user selectable

AUDIO PERFORMANCES

Pre-emphasis	0, 50 or 75µs selectable
Mono / Stereo Audio bandwidth	20Hz to 15kHz
Audio amplitude/freq. response flatness	≥ ±0.15dB (30Hz to 15 kHz - including pre-emphasis)
MPX bandwidth	Up to 100kHz (according to the filter selected)
FM S/N ratio	80dB (typ. below 100% deviation at 400Hz)
Distortion (THD)	≤ 0.05% (typ. 0.012%)
Stereo crosstalk attenuation (30Hz to 15 kHz)	≥ 50dB (typ. 70dB)
Asynchronous AM S/N ratio	≥ 55dB below equivalent 100% AM @ 400Hz measured with 75 S de-emphasis (no FM modulation)
Synchronous AM S/N ratio	≥ 50dB below equivalent 100% AM @ 400Hz measured with 75 S de-emphasis (FM ±75kHz peak deviation with 1kHz tone)

EMBEDDED FEATURES & FUNCTIONS

Encoders	Stereo MPX (ITU-R Recommendation 450). RDS/RBDS (static and dynamic). Dynamic data through RS232 port and other options for dynamic data on custom basis, on request
Digital Audio processing	Soft Clipper with band limitation. This function allows modulation peaks limitation (within certain limits) without perceiving the annoying distortion effect, without affecting the mono or stereo transmission bandwidth, without overmodulating but maintaining a high emission volume. This function is made inside a FPGA (Field Programmable Gate Array) with a high oversampling real time processing. Full multi-band hi-performance embedded audio processor as option
Isofrequency option (IsoWave)	Exceptionally accurate Isomodulation/Isofrequency generation with timestamp and network delay synchronization. Adjustable additional latency

in 0.1 s steps. Require GNSS (GPS + GLONASS) synchronizer and oven oscillator options

Audio test mono/stereo generator	From 20Hz to 15kHz
MPX output/19 kHz for external RDS	BNC female 50Ω connector
Fold-back function	In case of high value of VSWR (exceeding the specified tolerance) or power amplifier high heatsink temperature, the Fold-back function operates to reduce the RF output power, before tripping off
Fast Protection function	In case of instantaneous very high VSWR (e.g.: RF output disconnection or short circuit), the Fast Protection function operates to cut-off output power in few microseconds
Environmental sensors	Temperature, Humidity, Dust, Corrosion (for alarms, protections and predictive analysis)
Audio monitoring	Stereo jack 3.5 mm for headphones on the front panel to monitor input signals and the RF output signal (using the embedded FM receiver/demodulator)
"Wave Plan" Output Power Scheduler	Reduce the output power at specific times and days, thus further reducing operational costs (OPEX)

LOCAL & REMOTE CONTROLS

Controlled parameters	All main parameters of the transmitter are constantly controlled by the embedded MCU and available on the local display as well as through the remote control (Web Server, SNMP, etc.). Parameters include: transmitter and interfaces settings, output frequency and power (forward and reflected), voltages and currents, temperatures, input levels, optional devices (e.g.: GPS/GLONASS synchronizer, DVB-S/S2 receiver, etc.)
Web Server	Manage all the main equipment parameters. Access is protected by username/password
SNMP Agent	Version 2. Send alarms, read and set parameters. MIB file is downloadable from the web server
Clonation	Store the complete transmitter configuration on a USB key and load it in other units
Event Logger	Stores over 5.000 events (with time, date and description). The event Log can be downloaded through the web server

Remote control interface	RJ45 connector - Ethernet 10/100 Base-T (SNMP - web server). 2G/3G modem/router with SMS notifications (up to 7 phone numbers) and VPN support. Mini UPS for remote control, for router and telemetry interface + RF filter for router
Firmware upgrade	Remote and local upgrade supported
Control Contacts	One free contact available as general alarm; one contact (to be shorted) for transmission enabling. Option: housekeeping interface (user configurable) with n.3 isolated clean contact outputs (max 100V 100mA), n.4 optoisolated inputs (5V 2mA pull-up) and n.4 analog outputs (0 to 5V - no isolation)

GENERAL SPECIFICATIONS

Power factor	≥ 0,96 (typ. 0,99 - @ nominal output power) Main power supplies have High Efficiency (typ. 95%) and are equipped with PFC (Power Factor Corrector)
Operating temperature range and max. altitude	-5 to +45°C @ MSL. Maximum operating temperature decreases by 6,5°C / 1.000m altitude (as per the international ICAO Standard Atmosphere) up to the maximum allowed operating altitude of 3.000m AMSL. Fold-back function operates (see description under "Embedded Features")
Maximum operative humidity	95% non condensing
Fans	Fans are high quality, long life, ball bearings units, easily replaceable from the rear panel with automatic variable speed (according to the internal temperatures) to reduce dust and power consumption. Fold-back function operates (see description under "Embedded Features")

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