Verasonics®
The leader in Research Ultrasound™

Verasonics Vantage™ System Transmit Capabilities

Vantage systems are available in three different transmit power configurations.

Conventional Imaging Pulses

- Extremely high precision high voltage power supply (2 to 190 V p-p)
- Maximum burst length: a few microseconds (see notes)[1,2]

Applications: B-mode, Doppler, conventional and non-conventional imaging

Extended Transmit Option

- Independent Internal Power supply: 0.5 A max (up to 48 W total average power), 2 to 190 V p-p
- Long pulse tolerant circuitry
- Maximum burst length in 0.5 to 4.0 MHz band: ~ 1 ms (see note)[1]

Applications: ARFI, Shear Wave "Push", drug delivery, moderate tissue heating, remote manipulation of tissue

The Vantage **Arbitrary Waveform Package** is a purchasable optional that includes the **Extended Transmit Option**, and provides:

- Arbitrary sequences of tristate pulses
- Amplitude modulation of acoustic signal via pulse-width modulation
- Waveform design software toolkit included

Applications: Coded Excitation, AM, FM, PWM,

HIFU Configuration — High Energy Delivery for Ablative Modalities or long-duration pulses

- 1200 W Programmable External Supply standard (2400 W Dual Supply option)
- Extended Transmit Option included
- Enhanced circuitry for high currents and very long pulses
- Maximum burst length: 10 Megacycles (10^7 cycles)
- Per-channel limit of 8 W average into 50 Ohms, in the 0.5 to 4.0 MHz band
- Total Average RF output power: 1000 W (with 1200 W supply)

Applications: HIFU, FUS, Histotripsy, Drug Delivery, BBB opening, Sonoporation

High Energy Transmit Features

Verasonics' "**Extended Transmit Option**" (also called "extended burst" or "push") provides an internal power supply with nearly 50 Watt capacity to sustain extended transmit bursts. A large energy storage capacitor provided within the system enables very high energy bursts, provided that enough time is allowed between transmissions to recharge the capacitor from the internal supply. This mode can damage transducers due to overheating, and can raise tissue temperatures above FDA safety limits. The Extended Transmit Option is available on the Vantage 256, Vantage 128, and the Vantage 64*LE*.

Vantage 256™ system with external transmit power supply

The Verasonics Vantage research system, **when configured to support HIFU** or other high power transmit applications, can provide continuous output power levels of 8 Watts per channel into 50 Ohms (16 W into 100 Ohms) at transmit frequencies in the range from 0.5 to 4.0 MHz. The total system power output depends on other limits, such as the 1200 W capacity of the standard external power supply included with the HIFU configuration.

With the "**HIFU Configuration**", circuit board provisions for additional thermal dissipation and connection of an external transmit power supply are added, and continuous transmit output power levels of up to 1000 W (2000 W with 2400 W supply) can be supported for a wide range of burst durations and repetition intervals, at any frequency in the 0.5 to 4.0 MHz range. Outside the fully supported frequency band, HIFU operation is possible but with reduced performance. The HIFU configuration permits all forms of imaging supported by the standard system using conventional imaging arrays, including radiation force methods. The HIFU Configuration (with external power supply) is available on the Vantage 256, Vantage 128, and Vantage 64*LE* models.

[1] Maximum achievable pulse length and pulse power depend on a number of factors, including operating voltage, effective frequency, number of active channels, acceptable voltage droop, transducer element impedance, etc. Software limit testing permits derated operation outside stated specifications.

[2] Maximum allowable burst length without Extended Transmit option is a few microseconds. Excessive voltage droop may prevent bursts longer than about 10 cycles, under some conditions.

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With the introduction of HIFUPlex™, the Vantage software includes interleaving scripts plus a graphical user interface (GUI), that facilitates control of the major parameters of focused ultrasound and imaging. The Vantage USgFUS GUI is included with all HIFU systems and features a high-level selection of modular operating modes for typical USgFUS experimental workflow.

Automatic Limit Checking: Operating states destructive to the system can be programmed by the user given the very high transmit energy levels available with the extended transmit option. An automatic operating limit-checking algorithm is included with the system that prevents system operation at potentially damaging levels, overriding the user's program. This limit test function can be extended by the user to protect the transducer from damage, or to impose acoustic output power limits during imaging or therapy events.

Conventional imaging modes can be interleaved as desired between extended transmit or HIFU sequences, using different transmit voltage levels, and utilizing the full range of features and performance provided by the Verasonics systems for echo imaging and Doppler modalities. This enables the user to employ image guidance and monitoring of interventional and therapeutic techniques in real time.

HIFUPlex Portfolio

Verasonics HIFU systems for research in Focused Ultrasound (FUS) techniques are available without transducers, or can be purchased with high performance FUS and imaging transducers from Sonic Concepts as part of the HIFUPlex Portfolio.

Vantage Transmit Power Configurations

	Conventional Imaging Pulses	**Extended Transmit**	**External Power Supply (HIFU)**
Transmitter circuit			
Vantage Transmit Power Configurations	2 to 190 V p-p	2 to 190 V p-p	2 to 190 V p-p
Max Pulse Current *(per channel)*	2.0 A	2.0 A	2.0 A
Power Supply Capabilities			
Maximum Average Power[3,4]	Up to 10 W	Up to 50 W	1200 W
Maximum Sustained Average Current	0.1 A	0.5 A	60 A
Pulse Length Range *(order of magnitude)*	up to a few microseconds (µs)	up to a few milliseconds (ms)	up to a few seconds (s)
Maximum Sustained Power *(during the pulse)*	over 10 kW	a few kW	~ 1 kW
Typical Applications	Basic Imaging B-Mode Doppler Ultrafast (Plane Wave) NDT / NDE	Coded Excitation Shear Wave Elastography ARFI Moderate Heating Drug Delivery Guided Wave NDT BBB Opening Histotripsy Boiling Cavitation Neuromodulation	Ablative Heating
Examples			
10 MHz, 4 cycles, 3000 Hz PRF (Doppler)	✔	✔	✔
5 MHz, 2000 cycles, 250 Hz PRF (Shear Wave "push")	✖	✔	✔
3 MHz, 1,000,000 cycles, 3 Hz PRF (HIFU ablation)	✖	✖	✔

[3] 1200 Watts for the standard QPX600DP power supply provided. Maximum power may be greater using a different external power supply. Contact Verasonics for details.

[4] For cavitation methods requiring high PRF and long bursts, the HIFU configuration/external power supply is needed

Notes

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