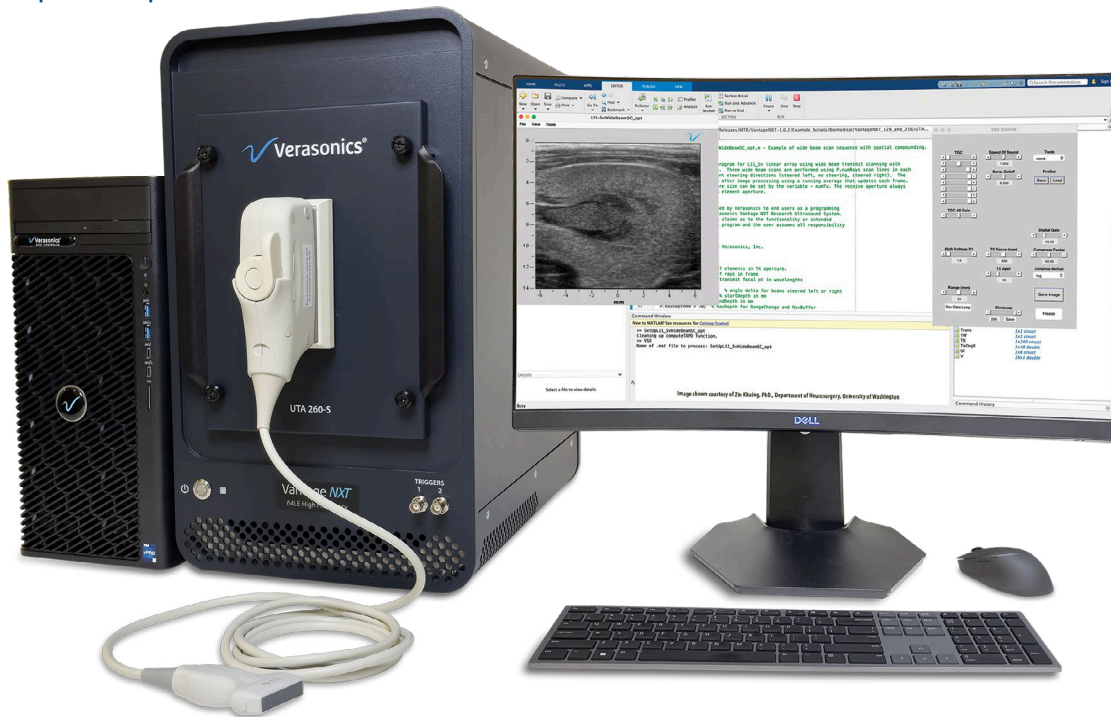


Vantage *NXT*'s patented transceiver delivers unsurpassed transmit signal fidelity. Its tri-state drive architecture enables per-channel programmability, per-channel transmit apodization using pulse-width modulation, and multiple output power options.



## Vantage *NXT* Systems are Available in Three Output Power Options

### A. Imaging Pulses Configuration (Default)

- Precision High Voltage Power Supply: 3.0 to 192 V p-p
- Frequency Operating Range: 250 kHz - 24 MHz (Mid Frequency)  
1 MHz - 60 MHz<sup>3</sup> (High Frequency)
- Maximum Burst duration in Operating Range: ~a few microseconds<sup>1,2</sup>
- Compatibility: All Vantage *NXT* Systems

### B. Extended Transmit Configuration (Radiation Force)

- Internal Power Supply with Push Capacitor: 3.0 to 192 V p-p
- Extended Transmit Frequency Operating Range: 250 kHz - 18 MHz<sup>3,5</sup> (Mid Frequency)  
1 MHz - 18 MHz<sup>3,5</sup> (High Frequency)
- Maximum Burst in Operating Range: ~a few milliseconds<sup>1,3</sup>
- Compatibility: All Vantage *NXT* Systems

### C. HIFU Configuration (Focused Ultrasound, or Therapeutic Energy Levels)

- Additional External 1200 W<sup>4</sup> Programmable Power Supply
- HIFU Frequency Operating Range: 250 kHz to 8.0 MHz<sup>5</sup> (Mid Frequency)
- Maximum Burst Operating Range: ~a few seconds<sup>1</sup>
- Extended Transmit license included
- Compatibility: Vantage *NXT* 256, Vantage *NXT* 128 and Vantage *NXT* 64LE Mid Frequency configurations

\*Footnotes are provided on page 4

## Output Power Options & Features

The **Extended Transmit Option** (also called “extended burst” or “push”) provides an independently regulated power supply and energy-storage capacitor to sustain extended transmit bursts provided that enough time is allowed between transmissions to recharge the capacitor from the internal supply. This mode allows the system to transmit thousands of cycles for up to a few milliseconds. In the Vantage *NXT* mid-frequency configuration, Extended Transmit is available from 250 kHz up to 18 MHz, while in the Vantage *NXT* high frequency configuration this feature can be used from 1 MHz to 18 MHz<sup>3</sup>. Extended Transmit power levels in both Vantage *NXT* mid-frequency and high frequency system configurations has the potential to damage transducers due to overheating and can raise tissue temperatures above FDA safety limits.

The **HIFU Configuration** provides continuous output power at transmit frequencies in the range from 250 kHz to 8.0 MHz. In this configuration, internal modifications within the Vantage *NXT* mid-frequency configuration are made for additional thermal dissipation, and an external 1200 W power supply is connected. Continuous transmit output power levels of up to 1000 W can be supported for a wide range of burst durations and repetition intervals, at any frequency in the 250 kHz to 8.0 MHz range. The HIFU Configuration still permits all forms of imaging supported by the system using conventional imaging arrays, including radiation force methods. The HIFU Configuration is only available in Vantage *NXT* mid-frequency configuration.

### Additional Features:

**Automatic Limit Checking:** An automatic operating-limit-checking algorithm is included that prevents the Vantage *NXT* System from operating at potentially damaging levels. This feature will even override the user’s chosen parameters if the total current is potentially harmful to a specific channel or PCB. The user can also set safety limits within the MATLAB® environment to protect the transducer from damage, or to impose acoustic output power limits during imaging or therapy events to meet regulatory or safety considerations.

**Interleaving Imaging Modes:** Conventional imaging modes (e.g. Doppler and B-mode) can be interleaved as desired between Extended Transmit or HIFU sequences, even allowing for different transmit voltage levels and utilizing the full range of features and performance provided by Verasonics Systems. This enables the user to employ ultrasound image guidance and monitoring of interventional and therapeutic techniques in real time.

**GUI Control & Custom GUIs:** Vantage *NXT* software provides a default GUI that allows the customer to add controls (buttons and fields) that interact with the sequence defined in MATLAB®. For example, the user can modify the transmit voltage, the number of cycles of the transmitted waveform, the number of elements transmitting, among others. The software also allows customers to create their own custom GUIs, providing access to modify several parameters such as waveform length, PRF, duty cycle, voltage, and other parameters during the running of the application.

**Arbitrary Waveform Package:** This purchasable software package includes the Extended Transmit option and provides the user the ability to create arbitrary waveforms of extremely long durations. Utilizing knowledge of the impulse response of the transducer, the software provides an algorithm accessed via a GUI or from the MATLAB® command line to generate custom waveforms by encoding the tri-level pulses within the bandwidth of the transducer. This programming results in the desired waveform once transmitted by the transducer. A waveform design software toolkit with GUI is included and provides impulse responses of all Verasonics supported transducers. Applications of the package include coded excitation and pulse compression imaging including Amplitude Modulation (AM), Frequency Modulation (FM), and Pulse Width Modulation (PWM).

**FUS Transducer Compatibility:** Systems for research in Focused Ultrasound (FUS) techniques can support a selection of transducers pairings which have been integrated into our software. These transducers come in different frequencies (both for therapy and imaging) depending on the application. The system can also support custom transducers.

## Transmit Configuration FAQs

### 1. If I have purchased one transmit configuration, can I upgrade to another?

Yes, if a customer has purchased a system with the Imaging Pulses configuration, they can acquire the software and license for Extended Transmit or upgrade to the HIFU hardware configuration. If a customer has purchased Extended Transmit configuration, they can also upgrade to the HIFU configuration. *Note: If a customer has purchased HIFU the functionality of the Extended Transmit configuration is already included.*

### 2. If I wish to upgrade to another transmit configuration, can this be done remotely via a license upgrade?

Upgrading from Imaging Pulses to Extended Transmit configuration requires only a license update to activate the feature. Upgrading from either Imaging Pulses or Extended Transmit configuration to HIFU requires a return of the system to Verasonics to make internal changes to the hardware to allow for the high energy transmit and temperature dissipation requirements.

### 3. Is HIFU compatible with the Vantage NXT high frequency configuration?

No, HIFU is only available on the Vantage NXT mid-frequency configuration in 64LE, 128 and 256 channel options.

### 4. Is Extended Transmit compatible with the Vantage NXT high frequency configuration?

Yes, Extended Transmit is available both on the Vantage NXT mid-frequency and high frequency configurations.

### 5. Can I use HIFU and Extended Transmit pulsing on all channels of a Vantage NXT system?

Yes, in both the HIFU and Extended Transmit configurations, the customer is allowed to utilize all channels of their Vantage NXT System. The user can even program custom waveforms for each of the channels.

# Vantage NXT Transmit Power Options

	Imaging Pulses	Extended Transmit	HIFU
<b>Transmitter Circuit</b>			
Transmit Amplitude	3.0 to 192 V p-p	3.0 to 192 V p-p	3.0 to 192 V p-p
Frequency Operating Range	MF: 250 kHz - 24 MHz HF: 1 MHz - 60 MHz <sup>3</sup>	MF: 250 kHz - 18 MHz <sup>3,5</sup> HF: 1 MHz - 18 MHz <sup>3,5</sup>	MF: 250 kHz - 8 MHz <sup>5</sup>
<b>Power Supply Capabilities</b>			
Maximum Average Power <sup>1</sup>	90 W @ 60 Vp (Any Load) 45 W @ 20 Vp (Any Load) 36 W @ 96 Vp (Any Load)	90 W @ 60 Vp (Any Load) 45 W @ 20 Vp (Any Load) 36 W @ 96 Vp (Any Load)	1000 W <sup>4</sup>
Typical Pulse Duration <sup>1</sup>	up to a few us	few us up to few ms	ms to seconds
Typical Applications	Basic Imaging B-Mode, Doppler Ultrafast (Plane Wave) NDT / NDE		Thermal Ablation BBB Opening Neuromodulation Cavitation
			ARFI Coded Excitation Shear Wave Elastography Moderate Hyperthermia Drug Delivery Guided Wave NDT Particle Manipulation
<b>Examples</b>			
10 MHz, 4 cycles, 3000 Hz PRF (Doppler)	✓	✓	✓
5 MHz, 2000 cycles, 25 Hz PRF (Shear Wave “push”)	✗	✓	✓
3 MHz, 1,000,000 cycles, ~1 Hz PRF (HIFU ablation)	✗	✗	✓

- <sup>1</sup> Maximum achievable pulse length and pulse power depend on several factors, including operating voltage, effective frequency, number of active channels, acceptable voltage droop, transducer element impedance, etc. Software imposed transmit limits permits derated operation outside stated specifications.
- <sup>2</sup> Maximum allowable burst length without the Extended Transmit configuration is a few microseconds. Excessive voltage droop may prevent bursts longer than about 10 cycles, under some conditions.
- <sup>3</sup> Transmit performance is limited near frequency extremes.
- <sup>4</sup> Standard QPX6OODP power supply provided. For cavitation methods requiring high PRF and long bursts, the Vantage NXT HIFU configuration with external power supply is required.
- <sup>5</sup> Note that frequency operating range specifies the reduced range of Extended Transmit or HIFU pulses only, while conventional imaging pulses over full Vantage NXT mid-frequency and high-frequency operating ranges are also possible in these configurations.

*Note: Vantage NXT and Vantage Research Ultrasound Systems are laboratory research and/or development platforms; they are intended to be used to acquire, store, display, and analyze ultrasound data; they are not approved for clinical use. Users must perform additional testing to comply with local regulatory requirements for clinical use.*

