



July 18, 2022

GE Medical Systems Ultrasound and Primary Care Diagnostics, LLC
% Lee Bush
Regulatory Affairs Director
9900 W. Innovation Drive
WAUWATOSA WI 53226

Re: K221147

Trade/Device Name: Vivid T8, Vivid T9
Regulation Number: 21 CFR 892.1550
Regulation Name: Ultrasonic pulsed doppler imaging system
Regulatory Class: Class II
Product Code: IYN, IYO, ITX
Dated: July 1, 2022
Received: July 5, 2022

Dear Lee Bush:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at <https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm> identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for

devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see <https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products>); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to <https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems>.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (<https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance>) and CDRH Learn (<https://www.fda.gov/training-and-continuing-education/cdrh-learn>). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (<https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice>) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

For

Michael D. O'Hara, Ph.D.
Deputy Director
DHT 8C: Division of Radiological Imaging
and Radiation Therapy Devices
OHT 8: Office of Radiological Health
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure



GE Healthcare
510(k) Premarket Notification Submission

DEPARTMENT OF HEALTH AND HUMAN SERVICES Food and Drug Administration Indications for Use	Form Approved: OMB No. 0910-0120 Expiration Date: 08/30/2023 See PRA Statement below.
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510(k) Number (if known)

K221147

Device Name

Vivid T8, Vivid T9

Indications for Use (Describe)

The Vivid T8/Vivid T9 is a general-purpose ultrasound system, specialized for use in cardiac imaging. It is intended for use by qualified and trained Healthcare professionals for ultrasound imaging, measurement, display and analysis of the human body and fluid. The device is intended for use in a hospital environment including echo lab, other hospital settings, operating room, Cath lab, and in private medical offices. The systems support the following clinical applications: Fetal/Obstetrics, Abdominal (includes GYN), Pediatric, Small Organ (includes breast, testes, thyroid), Neonatal Cephalic, Adult Cephalic, Cardiac (includes Adult and Pediatric), Peripheral Vascular, Musculoskeletal Conventional, Musculoskeletal Superficial, Urology (including prostate), Transcranial, Transesophageal, Transrectal, Transvaginal, Interventional guidance (including Biopsy, Fluid Drainage), Thoracic/Pleural, Intraoperative(Vascular). Modes of operation include: B, M, PW Doppler, CW Doppler, Color Doppler, Color M, Power Doppler, Harmonic Imaging, Coded Pulse and Combined modes: B/M, B/PWD, B/Color/PWD, B/Power/PWD.

Type of Use (Select one or both, as applicable)

- Prescription Use (Part 21 CFR 801 Subpart D) Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

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510(k) Premarket Notification Submission
510(k) Summary K221147

In accordance with 21 CFR 807.92 the following summary of information is provided:

Date: July 12, 2022

Submitter: GE Medical Systems Ultrasound and Primary Care Diagnostics 9900
Innovation Drive
Wauwatosa, WI 53226

Primary Contact Person: Lee Bush
Regulatory Affairs Director GE Healthcare
T: (262)309-9429

Secondary Contact Person: Yuan Wang
Regulatory Affairs Leader
GE Healthcare

Device Trade Name: Vivid T8/Vivid T9

Common/Usual Name: Diagnostic Ultrasound System

Classification Names: Class II

Product Code(s): Ultrasonic Pulsed Doppler Imaging System, 21CFR 892.1550, 90-IYN;
Ultrasonic Pulsed Echo Imaging System, 21CFR 892.1560, 90-IYO;
Diagnostic Ultrasound Transducer, 21 CFR 892.1570, 90-ITX

Predicate Device: Vivid T8/Vivid T9 (K200851), Diagnostic Ultrasound System

Classification Names: Class II

Product Code(s): Ultrasonic Pulsed Doppler Imaging System, 21CFR 892.1550, 90-IYN;
Ultrasonic Pulsed Echo Imaging System, 21CFR 892.1560, 90-IYO;
Diagnostic Ultrasound Transducer, 21 CFR 892.1570, 90-ITX



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Reference Device: Vivid iq (K161706), Diagnostic Ultrasound System
Classification Names: Class II
Product Code(s): Ultrasonic Pulsed Doppler Imaging System, 21CFR 892.1550, 90-IYN;
Ultrasonic Pulsed Echo Imaging System, 21CFR 892.1560, 90-IYO;
Diagnostic Ultrasound Transducer, 21 CFR 892.1570, 90-ITX

Reference Device: Venue Go (K202233), Diagnostic Ultrasound System
Classification Names: Class II
Product Code(s): Ultrasonic Pulsed Doppler Imaging System, 21CFR 892.1550, 90-IYN;
Ultrasonic Pulsed Echo Imaging System, 21CFR 892.1560, 90-IYO;
Diagnostic Ultrasound Transducer, 21 CFR 892.1570, 90-ITX

Reference Device: Versana Premier (K210438), Diagnostic Ultrasound System
Classification Names: Class II
Product Code(s): Ultrasonic Pulsed Doppler Imaging System, 21CFR 892.1550, 90-IYN;
Ultrasonic Pulsed Echo Imaging System, 21CFR 892.1560, 90-IYO;
Diagnostic Ultrasound Transducer, 21 CFR 892.1570, 90-ITX

Device Description:

Vivid T9/Vivid T8 is a Track 3, diagnostic ultrasound system, which is primarily intended for cardiac imaging and analysis but also includes vascular and general radiology applications. It is a full featured diagnostic ultrasound system that provides digital acquisition, processing, analysis and display capability.

The Vivid T9/Vivid T8 consists of a mobile console with control panel color LCD touch panel, LCD display monitor and optional image storage and printing devices. It includes a variety of electronic array transducers operating in linear, curved, sector/phased array, matrix array, and dual array including dedicated CW transducers.

The user-interface includes an operator control panel, a 21.5-inch-wide screen LCD monitor (mounted on an arm for rotation and/or adjustment of height), a 10.1-inch touch panel with multi-touch capabilities and alpha-numeric keyboard.

The smart standby battery is an option to allow the system to not have to be powered down when moving from room to room. Imaging is not allowed when it is not plugged in.

The system includes electronics for transmit and receive of ultrasound data, ultrasound signal processing, software computing, hardware for image storage, hard copy printing, and network access to the facility through both LAN and wireless (supported by use of a wireless LAN USB-adaptor) connection.

Vivid T8 and Vivid T9 are based on the same SW platform and similar HW design. Each system may have different configurations available. The configurations may differ by available SW-options and transducers provided commercially. Vivid T9 has height-adjustable control panel, while Vivid T8's control panel can't



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be adjustable. Vivid T9 has monitor flexible arm, while Vivid T8 has a monitor fixed arm and monitor flexible arm as an option.

The product named Vivid T9 represents the system that has the full functionality and is offered with full support for transducers.

Intended Use/Indication For Use:

The Vivid T9/Vivid T8 is a general-purpose ultrasound system, specialized for use in cardiac imaging. It is intended for use by qualified and trained Healthcare professionals for ultrasound imaging, measurement, display and analysis of the human body and fluid. The device is intended for use in a hospital environment including echo lab, other hospital settings, operating room, Cath lab, and in private medical offices. The systems support the following clinical applications: Fetal/Obstetrics, Abdominal (includes GYN), Pediatric, Small Organ (includes breast, testes, thyroid), Neonatal Cephalic, Adult Cephalic, Cardiac (includes Adult and Pediatric), Peripheral Vascular, Musculoskeletal Conventional, Musculoskeletal Superficial, Urology (Including prostate), Transcranial, Transesophageal, Transrectal, Transvaginal, Interventional guidance (including Biopsy, Fluid Drainage), Thoracic/Pleural, Intraoperative(Vascular). Modes of operation include: B, M, PW Doppler, CW Doppler, Color Doppler, Color M, Power Doppler, Harmonic Imaging, Coded Pulse and Combined modes: B/M, B/PWD, B/Color/PWD, B/Power/PWD.

Technology:

The Vivid T8/Vivid T9 employs the same fundamental scientific technology as its predicate device.

Determination of Substantial Equivalence:

The proposed Vivid T8/Vivid T9 system is substantially equivalent to the predicate device Vivid T8/Vivid T9 and reference devices with regards to intended use, imaging capabilities, technological characteristics and safety and effectiveness.

The following is an overview of the differences between the proposed Vivid T8/Vivid T9 and its predicate device.

Indications for use:

The proposed Vivid T8/Vivid T9 and predicate Vivid T8/Vivid T9 (K200851) have similar clinical indications for use, except for:

- Added Thoracic/Pleural application, which was cleared on reference device Venue Go (K202233).
- Urology (Including prostate) is listed independently instead of within Abdominal as it was in the predicate Vivid T8/Vivid T9 (K200851). There is no change in imaging or the product. No impact to safe or effective use.



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Transducer and modes:

- The proposed Vivid T8/Vivid T9 and predicate Vivid T8/Vivid T9 (K200851) have identical imaging modes.
- The proposed Vivid T8/Vivid T9 and predicate Vivid T8/Vivid T9 (K200851) transducers are similar, except for:
 - Addition of M5Sc-RS on Vivid T8 and Vivid T9, which was first cleared on Vivid iq (K161706). The clinical applications and imaging modes of M5Sc-RS are similar on the proposed Vivid T8/Vivid T9 as they are on the reference device Vivid iq (K161706).
 - Addition of L4-20t-RS on Vivid T9, which was first cleared on Venue Go (K202233). The clinical applications and imaging modes of L4-20t-RS are similar on the proposed Vivid T8/Vivid T9 as they are on the reference device Venue Go (K202233).
 - Addition of C1-5-RS on Vivid T8, which was cleared on predicate device Vivid T9 (K200851). The clinical applications and imaging modes of C1-5-RS are similar on the proposed Vivid T8 as they are on Vivid T9 (K200851).
- The Thoracic/Pleural application is added to the transducers:
 - 3Sc-RS, 6S-RS, 9L-RS, 12L-RS, ML6-15-RS, L8-18i-RS, C1-5-RS, 8C-RS, and L4-20t-RS based on the clearance of reference device Venue Go (K202233).
 - 4C-RS based on the clearance of reference device Versana Premier (K210438).
 - 12S-RS is a similar transducer to 6S-RS cleared with reference device Venue Go (K202233)
 - M5Sc-RS is a similar transducer to 3Sc-RS cleared with reference device Venue Go (K202233)

Software:

- Added workflow enhancements tools: Pre-Post Compare, Image Spooler
- Updates made to: 2D Color Flow, Launchpad
- Added Easy Auto EF -based on Auto EF 3.0 (includes AI Auto ROI algorithm)
- Added Easy AFI LV -based on AFI 3.0 (includes AI Auto ROI algorithm)
- Added Spline Tool - area, circumference, and volume measurement method
- Added Strain Elastography feature added, cleared in Versana Premier (K210438)
- Added Imaging Insights Data Collection Support – provides device usage information
- Added Probe check (Transducer Element Check)

Accessories:

- Added compatible OEM biopsy guide accessory compatibility for the L4-20t-RS and M5Sc-RS transducer



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Summary of Non-Clinical Tests:

Vivid T8/Vivid T9 is evaluated for acoustic output, biocompatibility, cleaning and disinfection effectiveness as well as thermal, electrical, electromagnetic, and mechanical safety, and have been found to comply with applicable medical device safety standards. The Vivid T8/Vivid T9 complies with voluntary standards:

- AAMI/ANSI ES60601-1, Medical Electrical Equipment – Part 1: General Requirements for Safety and Essential Performance, 2005/ A2:2012
- IEC 60601-1-2, Medical Electrical Equipment – Part 1-2: General Requirements for Basic Safety and Essential Performance – Collateral Standard: Electromagnetic Disturbance – Requirements and Tests, 2014
- IEC 60601-2-37, Medical Electrical Equipment – Part 2-37: Particular Requirements for the Safety of Ultrasonic Medical Diagnostic and Monitoring Equipment, Ed. 2.1, 2015
- ISO 10993-1, Biological Evaluation of Medical Devices- Part 1: Evaluation and Testing Within A Risk Management Process, 2009
- IEC 62359, Ultrasonics – Field characterization – Test methods for the determination of thermal and mechanical indices related to medical diagnostic ultrasonic fields, 2017
- ISO 14971, Application of risk management to medical devices, 2019
- NEMA PS 3.1 – 3.20, Digital Imaging and Communications in Medicine (DICOM) Set. (Radiology), 2016

The following quality assurance measures are applied to the development of the system:

- Risk Analysis
- Requirements Reviews
- Design Reviews
- Testing on unit level (Module verification)
- Integration testing (System verification)
- Performance testing (Verification)
- Safety testing (Verification)

Transducer materials and other patient contact materials are biocompatible.

AI Summary of Testing: Easy Auto EF and Easy AFI LV

Summary test statistics or other test results including acceptance criteria or other information supporting the appropriateness of the characterized performance

- The accuracy of the AI algorithm (average dice score) as tested on datasets from different countries, is 92% or higher; as tested on datasets from different scanning views, is 91% or higher; as tested on dataset from different left ventricle volumes, is 92% or higher.
- The number of individual patients' images were collected from: 45 exams from assumed 45 patients (exact number of patients unknown due to anonymization of dataset).
- The number of samples, if different from above, and the relationship between the two: 135 images extracted from the 45 exams



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Demographic distribution including:

- Gender: Unknown, due to data anonymization during data collection
- Age: Adult, specific age unknown
- Ethnicity/Country: Europe, Asia, US

Information about clinical subgroups and confounders present in the dataset:

- During testing of the AI algorithm, we have included images from different countries, from different scanning views, and a range of different LV Volumes

Information about equipment and protocols used to collect images:

- Mix of data from across 5 different probes and 4 different Console variants. The data collection protocol was standardized across all data collection sites.

Information about how the reference standard was derived from the dataset (i.e., the “truthing” process)

- For all datasets, two certified cardiologists performed manual delineation, then reviewed the annotations for each other. A consensus reading was first done whereby the two cardiologists discussed if they agreed on or not. A panel of experienced experts further reviewed annotations that the two cardiologists could not agree on.
- Hence, the ground truth used are the annotations that the two cardiologists agreed with each other, and the consensus annotations achieved in the review meeting by a panel of experienced experts.

Description of how independence of test data from training data was ensured.

- To ensure that the testing dataset is not mixed with the training data, we used datasets from different clinical sites for testing as compared to the clinical sites for training.

Summary of Clinical Tests:

The subject of this premarket submission, Vivid T8/Vivid T9, did not require clinical studies to support substantial equivalence.

Conclusion:

GE Healthcare considers the Vivid T8/Vivid T9 to be as safe, as effective, and performance is substantially equivalent to the predicate and reference devices.