April 25, 2023

Bunkerhill, Inc.
% John J. Smith
Partner
Hogan Lovells LLP
555 Thirteenth Street, NW
WASHINGTON DC 20004

Re: K230223
Trade/Device Name: iCAC Device
Regulation Number: 21 CFR 892.1750
Regulation Name: Computed tomography x-ray system
Regulatory Class: Class II
Product Code: JAK
Dated: April 7, 2022
Received: April 7, 2023

Dear John Smith:

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,

Lu Jiang

Lu Jiang, Ph.D.
Assistant Director
Diagnostic X-ray Systems Team
DHT8B: Division of Radiological Imaging
Devices and Electronic Products
OHT8: Office of Radiological Health
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120 Expiration Date: 06/30/2023
See PRA Statement below

510(k) Number *(if known)*
K230223

Device Name

iCAC Device

Indications for Use *(Describe)*

iCAC is a software device intended for use in estimating presence and quantity of coronary artery calcium for patients aged 30 years and above during routine care. The device automatically analyzes non-gated, non-contrast chest computed tomography (CT) images collected during routine care and outputs a visual representation of estimated coronary artery calcium segmentation (intended for informational purposes only) and both exact and four-category quantitative estimates of the patient's coronary artery calcium burden in Agatston units.

The output of the subject device is made available to the physician on-demand as part of his or her standard workflow. The device-generated calcium score or score group can be viewed in the patient report at the discretion of the physician, and the physician also has the option of viewing the device-generated calcium segmentation in a diagnostic image viewer. The subject device output in no way replaces the original patient report or the original chest CT scan; both are still available to be viewed and used at the discretion of the physician.

The device is intended to provide information to the physician to provide assistance during review of the patient's case. Results of the subject device are not intended to be used on a stand-alone basis and are solely intended to aid and provide information to the physician. In all cases, further action taken on a patient should only come at the recommendation of the physician after further reviewing the patient's results.

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

X 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) SUMMARY
Bunkerhill's iCAC Device

K230223

Submitter
Bunkerhill, Inc.

428 El Verano Ave

Palo Alto, CA 94306

Phone: (650) 842-0198
Contact Person: Nishith Khandwala

Date Prepared: February 10, 2023

Proposed Device

Proprietary Name	iCAC Device
Classification Name	Computed tomography x-ray system
Regulation Number	21 CFR 892.1750
Product Code	JAK
Regulatory Class	II

Predicate Device

Proprietary Name	HealthCCSng Manufactured by Zebra Health
Premarket Notification	K210085
Classification Name	Computed tomography x-ray system
Regulation Number	21 CFR 892.1750
Product Code	JAK
Regulatory Class	II

Device Description

The iCAC Device (or the "subject device") is a standalone software as a medical device (SaMD) that provides adjunctive information to a radiologist for an estimate assessment of the presence and quantity of coronary artery calcium (CAC) from routine, non-contrast, non-gated chest computed tomography (CT) scans. The device can be used to leverage the high utilization of non-gated chest CT scans (from lung cancer screening programs, routine exams, etc.) to opportunistically identify and quantify coronary artery calcium in patients.

The iCAC Device takes as an input non-contrast, non-gated chest CT scans via DICOM transfer from the clinicians imaging database such as PACS or DICOM router. The device uses a deep-learning-based computer vision algorithm for its assessment. It estimates the presence and quantity of coronary artery calcium (CAC) from routine, non-contrast, non-gated chest computed

tomography (CT) scans. iCAC Device can be used to leverage the high utilization of non-gated chest CT scans (from lung cancer screening programs, routine exams, etc.) to opportunistically identify and quantify coronary artery calcium in patients.

Intended Use / Indications for Use

iCAC is a software device intended for use in estimating presence and quantity of coronary artery calcium for patients aged 30 years and above during routine care. The device automatically analyzes non-gated, non-contrast chest computed tomography (CT) images collected during routine care and outputs a visual representation of estimated coronary artery calcium segmentation (intended for informational purposes only) and both exact and four-category quantitative estimates of the patient's coronary artery calcium burden in Agatston units.

The output of the subject device is made available to the physician on-demand as part of his or her standard workflow. The device-generated calcium score or score group can be viewed in the patient report at the discretion of the physician, and the physician also has the option of viewing the device-generated calcium segmentation in a diagnostic image viewer. The subject device output in no way replaces the original patient report or the original chest CT scan; both are still available to be viewed and used at the discretion of the physician.

The device is intended to provide information to the physician to provide assistance during review of the patient's case. Results of the subject device are not intended to be used on a stand-alone basis and are solely intended to aid and provide information to the physician. In all cases, further action taken on a patient should only come at the recommendation of the physician after further reviewing the patient's results.

Summary of Technological Characteristics

At a high level, the subject and predicate devices are based on the following same technological elements:

- Both the predicate and the subject device use deep-learning algorithms to identify the presence of coronary artery calcium deposits and quantify calcium burden in individuals of age 30 years and up.
- Both devices analyze non-gated, non-contrast chest computed tomography (CT) images that are sent to the software in DICOM format.
- Both the predicate and the subject device quantify the calcium burden of the coronary arteries.
- Both devices serve as support tools to provide information to the physician. However, they do not replace clinical evaluation and do not alter the standard of care.
- Both devices segment the calcium area on an image and generate a report.

The following technological differences exist between the subject and predicate devices:

- The predicate device defines three (3) detection categories for reporting the calcium score whereas the subject device defines four (4) detection categories. The subject and predicated devices differ in that the subject device reports a detection category for calcium scores of zero, while the predicate device does not explicitly distinguish zero from non-zero calcium scores.
- The predicate device does not output an exact calcium score, whereas the subject device reports an exact calcium score.

A table comparing the key features of the subject and predicate devices is provided below.

Characteristic	**Proposed Device: iCAC**	**Predicate Device: HealthCCSng Manufactured by Zebra Medical** **(K210085)**	**Summary**
Intended Use / Indications for Use	iCAC is a software device intended for use in estimating presence and quantity of coronary artery calcium for patients aged 30 years and above during routine care. The device automatically analyzes non-gated, non-contrast chest computed tomography (CT) images collected during routine care and outputs a visual representation of estimated coronary artery calcium segmentation (intended for informational purposes only) and both exact and four-category quantitative estimates of the patient's coronary artery calcium burden in Agatston units. The output of the subject device is made available	The HealthCCSng device is intended for use as a non-invasive post-processing software to evaluate calcified plaques in the coronary arteries, which present a risk for coronary artery disease. The software generates an estimated coronary artery calcium detection category. The HealthCCSng device analyzes existing non-cardiac-gated CT studies that include the heart of adult patients above the age of 30. The device generates a three-category output representing the estimated quantity of calcium detected together with preview axial images of the detected calcium meant for informational purposes only. The device	Primary difference is in calcium score quantification for each case

Characteristic	Proposed Device: iCAC	Predicate Device: HealthCCSng Manufactured by Zebra Medical (K210085)	Summary
	to the physician on-demand as part of his or her standard workflow. The device-generated calcium score or score group can be viewed in the patient report at the discretion of the physician, and the physician also has the option of viewing the device-generated calcium segmentation in a diagnostic image viewer. The subject device output in no way replaces the original patient report or the original chest CT scan; both are still available to be viewed and used at the discretion of the physician. The device is intended to provide information to the physician to provide assistance during review of the patient's case. Results of the subject device are not intended to be used on a stand-alone basis and are solely intended to aid and provide information to the physician. In all cases, further action taken on a patient should only come at the recommendation of the physician after further	output will be available to the physician as part of their standard workflow. The HealthCCSng results are not intended to be used on a stand-alone basis for risk attribution, clinical decision-making or otherwise preclude clinical assessment of CT studies.	

Characteristic	Proposed Device: iCAC	Predicate Device: HealthCCSng Manufactured by Zebra Medical (K210085)	Summary
	reviewing the patient's results.		
Type of Interpretation	Adjunctive information	Adjunctive information	Same
Intended User	Interpreting physicians	Interpreting physicians	Same
Patient population	Patients aged 30 years and above	Patients above the age of 30	Similar
Anatomical location	Chest	Chest	Same
Intended location	Medical facility	Medical facility	Same
Rx or OTC	Rx	Rx	Same
Measurement scale	Agatston units	Agatston units	Same
Product code	JAK	JAK	Same
Regulation number	21 CFR §892.1750	21 CFR §892.1750	Same
Modality	Computed tomography (CT)	Computed tomography (CT)	Same
Image format	DICOM	DICOM	Same
Contrast	Non-contrast	Non-contrast	Same
Supported CT scan	Non-cardiac-gated CT scan	Non-cardiac-gated CT scan	Same
Slice thickness	Up to 5mm	Up to 3mm	Similar, iCAC can support a wider variety of scans
Calcification detection	Automatic	Automatic	Same

Characteristic	Proposed Device: iCAC	Predicate Device: HealthCCSng Manufactured by Zebra Medical (K210085)	Summary
Default threshold of calcium	130 HU (Hounsfield Units)	130 HU (Hounsfield Units)	Same
Coronary artery calcification quantification method	CAC detection category (based on Agatston score), exact Agatston score	CAC detection category (based on Agatston score)	Similar, iCAC provides a more precise representation of coronary calcium burden
Main image quality	DICOM	DICOM	Same
Annotation of detected calcium	Yes	Yes	Same
Generate patient report	Optional to copy result to clipboard, insert in report, DICOM Secondary Capture	Optional to copy result to clipboard, insert in report, DICOM Secondary Capture	Same
Report of the calcium score	Yes, Coronary Calcium Detection Category and exact Agatston score 4 categories (for detection category): • 0 • 1-99 • 100-399 • ≥400	Yes, Coronary Calcium Detection Category 3 categories: • 0-99 • 10-399 • >400	Similar, iCAC provides a more precise representation of coronary calcium burden by separating the category 0 from the other categories.

Performance Data

Safety and performance of the iCAC Device has been evaluated and verified in accordance with software specifications and applicable performance standards through Software Development and Validation & Verification Process to ensure performance according to specifications, User

Requirements and Federal Regulations and Guidance documents, “Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices”.

The iCAC Device performance was validated in a stand-alone retrospective study for overall agreement of the device output compared to the established ground truth. The pivotal testing dataset consisted of 762 paired CT studies (one non-gated, non-contrast chest CT and one gated coronary CT in each pair) from nine (9) geographically diverse sites. The sample included adequate representation from each coronary calcium detection category. The iCAC Device’s overall agreement was determined by comparing the device output coronary calcium detection category to the ground truth coronary calcium detection category.

Primary acceptance criteria for the pivotal testing study were defined as 73% overall alignment between device output calcium score groups and ground truth calcium score groups and at least 65% positive predictive value (PPV) for each of the four possible calcium score groupings. The iCAC device demonstrated an overall alignment rate of 79.7% and calcium-score-group level positive predictive values of 68.1% to 90.1%, thus satisfying both the primary acceptance criteria for the pivotal testing study.

Conclusions

The iCAC Device is as safe and effective as the predicate HealthCCSng device (K210085). The iCAC Device has the same intended uses and similar indications, technological characteristics, and principles of operation as its predicate device. The minor differences in indications do not alter the intended diagnostic use of the device and do not affect its safety and effectiveness when used as labeled. In addition, the minor technological differences between the iCAC Device and its predicate devices raise no new issues of safety or effectiveness.