AIRAmed GmbH
℅ Katharina Keutgen
Official Correspondent
Johner Institut GmbH
Niddastr. 91
Frankfurt, 60329
GERMANY

August 25th, 2023

Re: K223180
Trade/Device Name: AIRAscore
Regulation Number: 21 CFR 892.2050
Regulation Name: Medical image management and processing system
Regulatory Class: Class II
Product Code: LLZ
Dated: July 26, 2023
Received: July 26, 2023

Dear Katharina Keutgen:

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,

Ningzhi Li -S

For
Daniel M. Krainak, Ph.D.
Assistant Director
Magnetic Resonance and Nuclear Medicine Team
DHT8C: Division of Radiological Imaging
and Radiation Therapy Devices
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)*

K223180

Device Name
AIRAscore

Indications for Use *(Describe)*

AIRAscore is intended for automatic labeling, visualization and volumetric quantification of segmentable brain structures from a set of MR images. This software is intended to automate the current manual process of identifying, labeling and quantifying the volume of segmentable brain structures identified on MR images.

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) Summary

for

AIRAscore

This summary of 510(k) safety and effectiveness information is being submitted in accordance with the requirement of 21 CFR 807.92:

Sponsor

Sponsor: **AIRAmed GmbH**
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Germany

Contact Person: Dr. Maximilian Stalter
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phone: +49 7071 5393366

Date Prepared: September 21, 2022

510(k) Number: K223180

Device Name and Classification

Proprietary Name: AIRAscore

Device: System, Image Processing, Radiological

Classification Name: Medical image management and processing system
(21 CFR 892.2050, Product Code LLZ)

Predicate Device

Predicate Device: icobrain, K192130

Intended Use

AIRAscore is intended for automatic labeling, visualization and volumetric quantification of segmentable brain structures from a set of MR images. This software is intended to automate the current manual process of identifying, labeling and quantifying the volume of segmentable brain structures identified on MR images.

Device Description and Function

AIRAscore is a software that offers automatic, fast and reliable segmentation of brain volumes into gray matter, white matter, cerebrospinal fluid and, if present, white matter lesions with an additional classification of tissue anatomy.

The AIRAscore software comprises two functions, referred to as "**AIRAscore structure**" and "**AIRAscore MS**". The report created using the AIRAscore structure function contains the volume evaluation for each segmented anatomical area with the raw value, the relative value with respect to the total intracranial volume, and the percentile for the patient compared to a reference set. It furthermore provides a quick overview of potential segment size differences based on the reference set comparison.
If the AIRAscore MS report is requested, it is provided with additional information about the number and the volume of white matter lesions and their categorization (i.e., juxtacortical, periventricular or infratentorial).

For analysis with AIRAscore, incoming MRI data need to comply with the DICOM standard and are checked to fulfill the technical requirements. After successful verification, segmentation is performed using specialized neuronal networks that remain static during the lifetime of a software version. The results are then corrected for head size and compared to an age- and sex adjusted reference collective including a statistical classification. A report is generated and transmitted via a DICOM storage SCU (sender) to a defined DICOM storage SCP (usually the picture archive of the referring physician) using the DICOM format.

Predicate Device Comparison

Table 1: Predicate Device Comparison

Characteristic	New Device	Predicate Device
510(k) Number	K223180	K192130
Device Name, Model	AIRAscore	ico**brain**
Manufacturer	AIRAmed GmbH	icometrix NV
Regulation Number	892.2050	892.2050
Product Code	LLZ	LLZ
Intended Use / Indications for Use	AIRAscore is intended for automatic labeling, visualization and volumetric quantification of segmentable brain structures from a set of MR images. This software is intended to automate the current manual process of identifying, labeling and quantifying the volume of segmentable brain structures identified on MR images.	icobrain is intended for automatic labeling, visualization and volumetric quantification of segmentable brain structures from a set of MR or NCCT images. This software is intended to automate the current manual process of identifying, labeling and quantifying the volume of segmentable brain structures identified on MR or NCCT images. icobrain consists of two distinct image processing pipelines: icobrain cross and icobrain long. icobrain cross is intended to provide volumes from images acquired at a single timepoint. icobrain long is intended to provide changes in volumes between two images that were acquired on the same scanner,

		with the same image acquisition protocol and with the same contrast at two different timepoints. The results of icobrain cross cannot be compared with the results of icobrain long.
Technical Characteristics	• AIRAscore is a software as medical device (SaMD) that runs on AIRAmed internal servers (Software as a Service - SaaS). For sending and receiving DICOM data dedicated interfaces are supplied as accessory. • Operates on off-the-shelf hardware (multiple vendors) • DICOM compatible • Segmentation by machine learning (supervised voxel classification by a Convolutional Neuronal Network) **Input:** • T1-weighted and (optional) fluid-attenuated inversion recovery (FLAIR) MR images from a single time point **Output:** • Multiple electronic report with volumetric information of brain structures (Encapsulated PDF DICOM) • Annotated DICOM images for visual inspection by an expert (Secondary Capture DICOM)	• Software package • Operates on off-the-shelf hardware (multiple vendors) • DICOM compatible • Segmentation by classical machine learning and deep learning (supervised voxel classification by a Convolutional Neuronal Network) **Input:** • T1-weighted and fluid-attenuated inversion recovery (FLAIR) MR images from a single or multiple time points • Non-contrast CT from a single time point **Output:** • Multiple electronic reports with volumetric information of brain structures and midline shift • Annotated DICOM images
Performance Measurement Testing	**Accuracy** • Brain segmentable structure volumes / volume changes compared to manually labeled ground truth **Reproducibility** • Brain segmentable structure volumes / volume changes compared on test-retest images	**Accuracy** • Brain segmentable structure volumes / volume changes compared to simulated and/or manually labeled ground truth **Reproducibility** • Brain segmentable structure volumes / volume changes compared on test-retest images
Environment of Use	Primary users of the system are physicians with finished course of studies, medical license and expert knowledge in neuroanatomy and MR-imaging of the head. The reports and control images are looked at and evaluated in a professional healthcare setting (diagnostic workstation or doctor's office).	icobrain is used by trained professionals in hospitals, imaging centers or in image processing labs.
Testing	• Product Risk assessment • Software verification tests • Software validation tests	• Product Risk assessment • Software verification tests • Software validation tests

Compliance with Standards	• ISO 14971:2019 Medical devices - Application of risk management to medical devices • IEC 62304 Edition 1.1 2015-06 Medical device software - Software life-cycle processes • IEC 62366-1 Edition 1.0 2015-02 Medical devices - Application of usability engineering to medical devices • CFR 21 part 820 Quality System Regulation for Medical Devices • ISO 13485:2016 Medical devices - Quality management systems • NEMA PS 3.1 - 3.20 (2016) Digital imaging and communication in medicine (DICOM) Set	• ISO 14971:2007 Medical devices - Application of risk management to medical devices • IEC 62304:2006 Medical device software - Software life-cycle processes • IEC 62366:2014 Medical devices - Application of usability engineering to medical devices • CFR 21 part 820 Quality System Regulation for Medical Devices • ISO 13485:2016 Medical devices - Quality management systems • ISO 12052:2006 Digital imaging and communication in medicine (DICOM)

Both the subject- and the predicate device have the same intended use and comparable technical features. Both devices use the same machine learning procedures (supervised voxel classification by Convolutional Neural Networks) to perform segmentation tasks. Since the technique is the same in both devices and is known to perform well on segmentation tasks, no different questions regarding safety and effectiveness are raised and both devices are deemed to be substantially equivalent.

Performance Testing

The software verification of AIRAscore included continuous automatic unit testing, integration testing and end-to-end testing during the product realization phase according to IEC 62304. During the verification phase, the components were tested separately to verify the conformance of the development result with the defined software requirements. The verification included the check of the implementation of risk mitigation measures. The efficiency of these measures was either tested during the verification or during the course of the validation.
Afterwards, integration testing was performed to verify that the components work together as specified in the software.

The validation confirmed that AIRAscore performs well across target patient population and scanner manufacturers.

Software verification and validation demonstrated that AIRAscore meets the software requirements.

Performance Standards

AIRAscore complies with the applicable requirements of the following international and national standards:

- ISO 14971 Third Edition 2019-12 - Medical Devices - Application Of Risk Management To Medical Devices
- IEC 62304 Edition 1.1 2015-06 CONSOLIDATED VERSION - Medical Device Software - Software Life Cycle Processes

- IEC 62366-1 Edition 1.0 2015-02 - Medical devices - Part 1: Application of usability engineering to medical devices [Including CORRIGENDUM 1 (2016)]
- NEMA PS 3.1 - 3.20 2021e Digital Imaging and Communications in Medicine (DICOM) Set

The following FDA Guidance Documents have been applied:

- Format for Traditional and Abbreviated 510(k)s, 2019
- Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices, 2005
- Content of Premarket Submissions for Management of Cybersecurity in Medical Devices, 2014
- Cybersecurity for Networked Medical Devices Containing Off-the-Shelf (OTS) Software, 2005
- Off-The-Shelf Software Use in Medical Devices, 2019
- Applying Human Factors and Usability Engineering to Medical Devices, 2016
- Design Considerations and Premarket Submission Recommendations for Interoperable Medical Devices, 2017

Conclusion of Substantial Equivalence Discussion:

Both the subject- and the predicate device have the same intended use and comparable technical features. Both devices use the same machine learning procedures (supervised voxel classification by Convolutional Neural Networks) to perform segmentation tasks. Since the technique is the same in both devices and is known to perform well on segmentation tasks, no different questions regarding safety and effectiveness are raised and both devices are deemed to be substantially equivalent.