Vysioneer Inc.
% Vicki Lin
Regulatory Specialist
33 Rogers St., # 308
CAMBRIDGE MA 02142

October 12, 2021

Re: K212116
Trade/Device Name: VBrain-OAR
Regulation Number: 21 CFR 892.2050
Regulation Name: Medical image management and processing system
Regulatory Class: Class II
Product Code: QKB
Dated: September 10, 2021
Received: September 13, 2021

Dear Vicki Lin:

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

Thalia T. Mills, Ph.D.
Director
Division of Radiological Health
OHT7: Office of In Vitro Diagnostics
and 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)*
K212116

Device Name
VBrain-OAR

Indications for Use *(Describe)*
VBrain-OAR is a software device intended to assist trained radiotherapy personnel including, but not limited to, radiologists, radiation oncologists, neurosurgeons, radiation therapists, dosimetrists, and medical physicists, during their clinical workflows of brain tumor radiation therapy treatment planning, by providing initial object contours of organs at risk in the brain (i.e., the region of interest, ROI) on axial T1 contrast-enhanced brain MRI images. VBrain-OAR is intended to be used on adult patients only.

VBrain-OAR uses an artificial intelligence algorithm (i.e., deep learning neural networks) to contour (segment) organs at risk (brain stem, eyes, optic nerves, optic chiasm) in the brain on MRI images for trained radiotherapy personnel's attention, which is meant for informational purposes only and not intended for replacing their current standard practice of manual contouring process. VBrain-OAR does not alter the original MRI image, nor does it intend to be used to detect tumors for diagnosis. VBrain-OAR is intended only for contouring and generating contours of organs at risk in the brain; it is not intended to be used with images of other body parts.

VBrain-OAR also contains the automatic image registration feature to register volumetric medical image data. (e.g., MR, CT). It allows rigid image registration to adjust the spatial position and orientation of two images.
Radiation therapy treatment personnel must finalize (confirm or modify) the contours generated by VBrain-OAR, as necessary, using an external platform available at the facility that supports DICOM-RT viewing/editing functions, such as image visualization software and treatment planning system.

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.

This section applies only to requirements of the Paperwork Reduction Act of 1995.

DO NOT SEND YOUR COMPLETED FORM TO THE PRA STAFF EMAIL ADDRESS BELOW.

The burden time for this collection of information is estimated to average 79 hours per response, including the time to review instructions, search existing data sources, gather and maintain the data needed and complete and review the collection of information. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden, to:

Department of Health and Human Services
Food and Drug Administration
Office of Chief Information Officer
Paperwork Reduction Act (PRA) Staff
PRAStaff@fda.hhs.gov

"An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB number."

Section 5 510(k) Summary K212116

5.1 Submitter

Vysioneer Inc.

33 Rogers St. #308, Cambridge, MA 02142

Contact Person:	Vicki Lin (Regulatory Specialist)
Phone:	609-865-8659
Email:	vicki.lin@vysioneer.com
Date Summary Prepared:	September 10, 2021

5.2 Device Name

Trade Name:	VBrain-OAR
Common Name:	Radiological Image Processing Software for Radiation Therapy
Regulation Number / Product Code:	21 CFR 892.2050 / QKB

5.3 Predicate Device

Primary Predicate Device: AccuContour™

510(k) Holder/Submitter: Xiamen Manteia Technology LTD.

510(k) Number: K191928 (Cleared on 02/28/2020)

Reference Device: iPlan

510(k) Holder/Submitter: Brainlab AG

510(k) Number: K113732 (Cleared on 05/07/2012)

5.4 Intended Use / Indications for Use

VBrain-OAR is a software device intended to assist trained radiotherapy personnel including, but not limited to, radiologists, radiation oncologists, neurosurgeons, radiation therapists, dosimetrists, and medical physicists, during their clinical workflows of brain tumor radiation therapy treatment planning, by providing initial object contours of organs at risk in the brain (i.e., the region of interest, ROI) on axial T1 contrast-enhanced brain MRI images. VBrain-OAR is intended to be used on adult patients only.

VBrain-OAR uses an artificial intelligence algorithm (i.e., deep learning neural networks) to contour (segment) organs at risk (brain stem, eyes, optic nerves, optic chiasm) in the brain on MRI images for trained radiotherapy personnel's attention, which is meant for informational purposes only and not intended for replacing their current standard practice of manual contouring process. VBrain-OAR does not alter the original MRI image, nor does it intend to be used to detect tumors for diagnosis. VBrain-OAR is intended only for contouring and generating contours of organs at risk in the brain; it is not intended to be used with images of other body parts.

VBrain-OAR also contains the automatic image registration feature to register volumetric medical image data. (e.g., MR, CT). It allows rigid image registration to adjust the spatial position and orientation of two images.

Radiation therapy treatment personnel must finalize (confirm or modify) the contours generated by VBrain-OAR, as necessary, using an external platform available at the facility that supports DICOM-RT viewing/editing functions, such as image visualization software and treatment planning system.

5.5 Device Description

VBrain-OAR is a software application system indicated for use in the contouring (segmentation) of brain MRI images for the organs at risk (OAR) in the brain during radiation treatment planning and in the registration of multi-modality images. The device consists of 2 algorithm modules, which are contouring algorithm module and registration algorithm module, and a workflow management module. The modules can work independently, and yet can be integrated with each other.

The contouring (segmentation) algorithm module consists of image preprocessing, deep learning neural networks, and postprocessing components, and is intended to contour organs at risk in the brain on the axial T1 contrast-enhanced MR images. It utilizes deep learning neural networks to generate contours for the organs at risk in the brain and export the results as DICOM-RT objects (using the RT Structure Set ROI Contour attribute, RTSTRUCT).

The registration algorithm module registers volumetric medical image data (e.g., MR, CT). It allows rigid image registration to adjust the spatial position and orientation of two images.

The workflow management module is configured to work on a PACS network. Upon user's request, it will pull patient scans or users can send corresponding DICOM images, and it will trigger a predefined workflow, in which different algorithm modules are executed to generate the DICOM output. The DICOM output of a workflow are sent back to the PACS.

5.6 Comparison of Technological Characteristics with the Predicate Device

VBrain-OAR is substantially equivalent to the primary predicate device AccuContour™ (K191928).

The proposed device, VBrain-OAR, and the primary predicate, AccuContour™ (K191928) are both AI-based (deep learning) software devices intended to be used in the workflow of radiation therapy treatment planning by providing tools to automatically segment/contour organs at risk on images as well as perform image registration (image fusion). In addition, VBrain-OAR and the predicate device both use an intensity-based algorithm for image registration. Both the proposed device and AccuContour™ (K191928) are regulated under 21 CFR 892.2050, Product Code QKB (Radiological Image Processing Software for Radiation Therapy).

Both the proposed device and the reference device, iPlan (K113732), are designed to contour organs at risk of brain on MR images and perform image registration (image fusion). The only difference between these two software devices is that VBrain-OAR uses an AI-based algorithm, while iPlan uses an atlas-based algorithm for segmentation of images.

Please see Table 5-1 comparing the intended use and key technological characteristics of VBrain-OAR and the predicate and reference device.

Table 5-1. Comparison with the Predicate and Reference Devices.

	Proposed Device	Primary Predicate Device	Reference Device
Company	Vysioneer Inc.	Xiamen Manteia Technology LTD.	Brainlab AG
Device Name	VBrain-OAR	AccuContour™	iPlan
510k Number	K212116	K191928	K113732
Regulation No.	21CFR 892.2050	21CFR 892.2050	21CFR 892.1750
Classification	II	II	II
Product Code	QKB	QKB	JAK/LLZ
Intended Use/Indication for Use	VBrain-OAR is a software device intended to assist trained radiotherapy personnel	It is used by radiation oncology department to register multimodality images and segment (non-contrast) CT	iPlan's indications for use are the viewing, presentation and documentation of medical imaging,

	Proposed Device	Primary Predicate Device	Reference Device
	including, but not limited to, radiologists, radiation oncologists, neurosurgeons, radiation therapists, dosimetrists, and medical physicists, during their clinical workflows of brain tumor radiation therapy treatment planning, by providing initial object contours of organs at risk in the brain (i.e., the region of interest, ROI) on axial T1 contrast-enhanced brain MRI images. VBrain-OAR is intended to be used on adult patients only. VBrain-OAR uses an artificial intelligence algorithm (i.e., deep learning neural networks) to contour (segment) organs at risk (brain stem, eyes, optic nerves, optic chiasm) in the brain on MRI images for trained radiotherapy personnel's attention, which is meant for informational purposes only and not intended for replacing their current standard practice of manual contouring process. VBrain-OAR does not alter the original MRI image, nor does it intend to be used to detect tumors for diagnosis. VBrain-OAR is intended only for contouring and generating contours of organs at risk in the	images, to generate needed information for treatment planning, treatment evaluation and treatment adaptation. The product has two image process functions: (1) Deep learning contouring: it can automatically contour the organ-at-risk, including head and neck, thorax, abdomen and pelvis (for both male and female), (2) Automatic Registration, and (3) Manual Contour. It also has the following general functions: (1) Receive, add/edit/delete, transmit, input/export, medical images and DICOM data; (2) Patient management; (3) Review of processed images; (4) Open and Save of files.	including different modules for image processing, image fusion, atlas assisted visualization and segmentation, intraoperative functional planning where the output can be used e.g. with stereotactic image guided surgery or other devices for further processing and visualization. Example procedures include but are not limited to: • Planning and simulation of cranial surgical procedures such as tumor resection, shunt placement, minimal-invasive stereotactic interventions, biopsy, planning and simulation of trajectories for stimulation and electrode recording • ENT procedures such as sinus surgery, tumor surgery • Spine procedures such as tumor surgery, pedicle screw planning, vertebroplasty planning • Plan View is an application which is intended to be used for reviewing existing treatment plans • Planning and simulation of cranlo-maxillofacial procedures Typical users of iPlan are medical

	Proposed Device	Primary Predicate Device	Reference Device
	brain; it is not intended to be used with images of other body parts. VBrain-OAR also contains the automatic image registration feature to register volumetric medical image data. (e.g., MR, CT). It allows rigid image registration to adjust the spatial position and orientation of two images. Radiation therapy treatment personnel must finalize (confirm or modify) the contours generated by VBrain-OAR, as necessary, using an external platform available at the facility that supports DICOM-RT viewing/editing functions, such as image visualization software and treatment planning system.		professionals, including but not limited to surgeons and radiologists.
Device Description	VBrain-OAR is a software application system indicated for use in the contouring (segmentation) of brain MRI images for the organs at risk (OAR) in the brain during radiation treatment planning and in the registration of multi-modality images. The device consists of 2 algorithm modules, which are contouring	The proposed device, AccuContour, is a standalone software which is used by radiation oncology department to register multimodality images and segment (non-contrast) CT images, to generate needed information for treatment planning, treatment evaluation and treatment adaptation.	iPlan is a software based treatment planning application providing functionalities like viewing, processing and documentation of medical data including different modules for image preparation, ***image fusion***, ***image segmentation*** where the result is a treatment plan that can be used e.g. for stereotactic and/or image guided surgery.

	Proposed Device	Primary Predicate Device	Reference Device
	algorithm module and registration algorithm module, and a workflow management module. The modules can work independently, and yet can be integrated with each other. The contouring (segmentation) algorithm module consists of image preprocessing, deep learning neural networks, and postprocessing components, and is intended to contour organs at risk in the brain on the axial T1 contrast-enhanced MR images. It utilizes deep learning neural networks to generate contours for the organs at risk in the brain and export the results as DICOM-RT objects (using the RT Structure Set ROI Contour attribute, RTSTRUCT). The registration algorithm module registers volumetric medical image data (e.g., MR, CT). It allows rigid image registration to adjust the spatial position and orientation of two images. The workflow management module is configured to work on a PACS network. Upon	The product has two image process functions: (1) Deep learning contouring: it can automatically contour the organ-at-risk, including head and neck, thorax, abdomen and pelvis (for both male and female), (2) Automatic Registration, and (3) Manual Contour. It also has the following general functions: Receive, add/edit/delete, transmit, input/export, medical images and DICOM data; Patient management; Review of processed images; Open and Save of files.	

	Proposed Device	Primary Predicate Device	Reference Device
	user's request, it will pull patient scans or users can send corresponding DICOM images, and it will trigger a predefined workflow, in which different algorithm modules are executed to generate the DICOM output. The DICOM output of a workflow are sent back to the PACS.		
Segmentation (Contouring) Technology	Deep learning	Deep learning	Atlas-based
Operating System	Linux operating system	Microsoft Windows	Microsoft Windows
User Population	Trained radiotherapy personnel including, but not limited to, radiologists, radiation oncologists, physicians, dosimetrists, and medical physicists.	It is used by radiation oncology department.	Typical users of iPlan are medical professionals, including but not limited to surgeons and radiologists.
Supported Modalities	Segmentation Features for organs at risk in the brain: axial T1 contrast-enhanced MR images. Registration Features: CT, MR	Segmentation Features: Non-Contrast CT Registration Features: CT, MRI, PET	CT, MRI, PET and SPECT
Image segmentation: Localization and Definition of Objects (ROI)	Organs at risk in the brain	Organ-at-risk, including head and neck, thorax, abdomen and pelvis (for both male and female)	Outline anatomical structures using manual or automatic segmentation methods. Advanced manipulation for 3D objects with scaling, logical operations and object splitting.
Image Registration Algorithm	Intensity-based	Intensity-based	Intensity-based

	Proposed Device	Primary Predicate Device	Reference Device
Alteration of Original Images	No	No	No

5.7 Non-Clinical Test (Standalone Performance Data)

Standalone performance testing was conducted to evaluate the contouring (segmentation) performance and registration performance of VBrain-OAR. VBrain-OAR was tested on datasets from multiple institutions.

The segmentation testing demonstrated that the auto-segmentation algorithm of the VBrain-OAR algorithm module provides clinically acceptable contours for organs at risk in the brain structures on an image of a patient.

The registration testing evaluated the quality of the rigid registration of the registration algorithm module on images of multiple modalities, to demonstrate substantial equivalence to the predicate device.

Stratified analysis of both testing showed consistent performance on data across patient sex, multiple imaging hardware and protocols.

5.8 Software Verification and Validation

Software verification and validation testing were conducted, and documentation was provided in accordance with FDA's Guidance for Industry and FDA Staff, "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices" for software devices identified as Major Level of Concern related to radiation therapy treatment planning.

5.9 Substantially Equivalent (SE) Conclusion

Vysioneer Inc. has conducted performance testing on VBrain-OAR. In all the cases, the software showed clinically acceptable performance. Verification and validation testing and hazard analysis demonstrate that VBrain-OAR performs within its design specifications and is as safe and effective as the predicate. The minor technological differences between VBrain-OAR and the predicate device with regard to the intended use do not introduce any new potential risks. Based on the information presented in these 510(k) premarket notifications, VBrain-OAR is considered substantially equivalent to the predicate device.