DOSIsoft SA
% Ahmad Khalil
Quality and Regulatory Affairs Responsible
45/47 Avenue Carnot
Cachan, 94230
FRANCE

January 18, 2024

Re: K231573
Trade/Device Name: ThinkQA (Edition 2)
Regulation Number: 21 CFR 892.5050
Regulation Name: Medical Charged-Particle Radiation Therapy System
Regulatory Class: Class II
Product Code: IYE
Dated: December 19, 2023
Received: December 19, 2023

Dear Ahmad Khalil:

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 (the 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 available 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.

Additional information about changes that may require a new premarket notification are provided in the FDA guidance documents entitled "Deciding When to Submit a 510(k) for a Change to an Existing Device" (https://www.fda.gov/media/99812/download) and "Deciding When to Submit a 510(k) for a Software Change to an Existing Device" (https://www.fda.gov/media/99785/download).

Your device is also subject to, among other requirements, the Quality System (QS) regulation (21 CFR Part 820), which includes, but is not limited to, 21 CFR 820.30, Design controls; 21 CFR 820.90, Nonconforming product; and 21 CFR 820.100, Corrective and preventive action. Please note that regardless of whether a change requires premarket review, the QS regulation requires device manufacturers to review and approve changes to device design and production (21 CFR 820.30 and 21 CFR 820.70) and document changes and approvals in the device master record (21 CFR 820.181).

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 Part 803) for devices or postmarketing safety reporting (21 CFR Part 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 Part 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR Parts 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR 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,

Lora D. Weidner, Ph.D.
Assistant Director
Radiation Therapy Team
DHT8C: Division of Radiological Imaging
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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)*
K231573

Device Name
ThinkQA (Edition 2)

Indications for Use *(Describe)*
ThinkQA Edition 2 software is used to verify that the dose distribution calculated by a treatment planning system for external beam radiation therapy is consistent with treatment plan parameters.

Based on read-in treatment plan data, ThinkQA Edition 2 re-calculates a dose distribution in a three-dimensional representation of a patient or a phantom and provides dose-volume indicators which compare it to the initial dose distribution calculated by the treatment planning system.

ThinkQA Edition 2 is not a treatment planning system. It is a Quality Assurance software only to be used by qualified and trained radiation therapy personnel.

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.

Premarket Notification 510(k) Summary

[as required by 21 CFR 807.92]

510(k) Summary

1. Date the Summary was prepared: 2024-01-15

2. Contact Details

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- Correspondent Contact: Mr. Ahmad KHALIL
- Correspondent Contact Email: khalil@dosisoft.com

3. Device Name

- Device Trade Name: ThinkQA Edition 2 (2.0.0)
- Common Name: Medical charged-particle radiation therapy system
- Classification Name: Accelerator, Linear, Medical
- Regulation Number: 892.5050
- Product Code: IYE

4. Legally Marketed Predicate Devices

- Predicate # K191944
- Predicate Trade Name (Primary Predicate is listed first): MU2net
- Product Code: IYE

Executive Summary

5. Device Description Summary

ThinkQA Edition 2 is a standalone software device used within a radiation therapy clinic which is designed to perform secondary dose calculation based on DICOM RT treatment plan data provided by a treatment planning system.

ThinkQA Edition 2 is only meant for quality assurance purpose. It cannot define or transmit any instructions to a delivery device, nor does it control any other medical device.

ThinkQA Edition 2 performs dose calculation verifications for radiation therapy plans by doing an independent calculation of dose distribution in a three-dimensional representation of a patient or a phantom. Dose distribution is initially calculated by a treatment planning system which is a software tool that allows to define and transmit treatment plan parameters that will further be used for treatment delivery. Based on treatment plan parameters, ThinkQA Edition 2 re-calculates dose distributions using a proprietary Collapsed Cone Convolution algorithm.
It uses CT images (real patient anatomy) to perform dose computation with Collapsed Cone Convolution.

ThinkQA Edition 2 compares the reference TPS dose distribution with its own calculation using specific indicators such as 3D gamma agreement index on significant volumes. ThinkQA Edition 2 computes Gamma Passing Rate for automatic dose areas and anatomical structures: Planning Target Volumes (PTVs) and Organs at Risk (OARs).
Based on these indicators, ThinkQA Edition 2 displays a pass/fail status that informs the user whether or not the acceptance criteria that he has defined are met. The acceptance criteria does not give in any way information that could be used to determine whether or not the treatment plan is clinically relevant. It just evaluates the consistency between treatment plan parameters and the dose distribution computed by the TPS.

ThinkQA Edition 2 has been designed to be compatible with radiotherapy adaptative workflows. This includes a number of mandatory features:

- User interface design, grouping verifications for adaptive plans under a single primary plan verification;
- Automatic computation upon reception of DICOM data from the TPS;
- Sufficient speed of computation, compatible with adaptive workflow with patient waiting on couch.

The performance of ThinkQA Edition 2 makes it suitable for the following photon treatment delivery techniques: Static beams, IMRT Step & Shoot, Dynamic IMRT with fixed gantry and Rotational IMRT (VMAT).

In order to guaranty the independence of the secondary dose check, the beam models are not intended to be adjusted to match the user's reference TPS. The user only provides its actual measured dose rate in reference conditions and HU-density conversion table.

ThinkQA Edition 2 runs on workstations or virtual machines with Linux CentOS 7 operating system. Its web interface is accessible from any system supporting the specified web browsers defined in chapter ThinkQA Edition 2 web application. ThinkQA Edition 2 is able to communicate with other equipment installed on the network complying with the DICOM and DICOM RT industry standards.

6. Intended Use/Indications for Use

ThinkQA Edition 2 software is used to verify that the dose distribution calculated by a treatment planning system for external beam radiation therapy is consistent with treatment plan parameters.

Based on read-in treatment plan data, ThinkQA Edition 2 re-calculates a dose distribution in a three-dimensional representation of a patient or a phantom and provides dose-volume indicators which compare it to the initial dose distribution calculated by the treatment planning system.

ThinkQA Edition 2 is not a treatment planning system. It is a Quality Assurance software only to be used by qualified and trained radiation therapy personnel.

7. Indication for Use Comparison

ThinkQA Edition 2 and the predicate MU2net are both software solutions used as Quality Assurance to perform secondary dose calculation and verification with respect to a Treatment Planning System (TPS).

Both devices are only to be used by qualified and trained radiation therapy personnel.

Both ThinkQA Edition 2 and MU2net are intended to be used for all EBRT treatment techniques: conventional conformal radiotherapy (3DCRT), fixed-gantry IMRT (static Intensity Modulated Radiation Therapy: Sliding-window and Step-and-Shoot techniques), and rotational IMRT / VMAT (Volumetric Modulated Arc Therapy). Both devices generate a simple pass/fail status according to user defined tolerances and a synthetic pdf report to be included into a Radiotherapy Record and Verify Systems (RVS) or equivalent.

MU2net, in contrary to ThinkQA Edition 2 includes an in vivo dose measurements management. This functionality is not used for the second calculation. Thus ThinkQA Edition 2 has a subset of the MU2net predicate intended use.

8. Technological Comparison

ThinkQA Edition 2 and MU2net are both software solutions that present some similarities and differences in technology as discussed below.

ThinkQA Edition 2 and MU2net are based on similar architectural concepts with automatic data reception and calculation and with results displayed in a web based interface. ThinkQA Edition 2 design includes reinforced cybersecurity risk mitigation that improves safety.

Compared to MU2net, ThinkQA Edition 2 manages additional input data modalities (CT images and dose matrices sent by the TPS). In return, it provides enhanced traceability regarding user actions and data import that increases users ability to audit the device and analyze application events.

MU2net displays a list of plans in the order of receipt, where ThinkQA Edition 2 is tailored for online adaptive workflows in that it groups and identify primary and adaptive plans. It thus allows users to have an overview of the QA for the whole treatment course, which ameliorates device effectiveness for such workflows.

ThinkQA Edition 2 presents differences compared to the predicate device MU2net in terms of dose calculation and dosimetric indicators. This includes the use of the patient geometry instead of a simplified one for the dose calculation, the replacement of a Clarkson dose engine by a Collapsed Cone Convolution algorithm (CCC), a full 3D dose calculation instead of a point-based approach and dosimetric indicators based on a gamma index analysis replacing point based dose differences.
The use of the same patient geometry as the reference TPS allows the user to determine the acceptibility of the plan taking into account its clinical objectives and tolerances. This naturally implies a dose calculation using a CCC dose engine since it provides better perfomances compared to corrective methods while keeping the computation time reasonable, especially in heterogeneous geometries. The full 3D dose calculation allows a global and region-by-region dose analysis using well established metrics (gamma index, DVH, deviations) and offers a more reliable comparison with the clinical objectives validated in the reference TPS.

9. Non-Clinical and/or Clinical Tests Summary

ThinkQA Edition 2 was submitted to performance, functional and algorithmic testing, risk management assessment, including cybersecurity and validation activities under clinically representative conditions. The results of the testing and validation activities under clinically representative conditions demonstrate the safety and effectiveness of ThinkQA Edition 2.

- ***Cybersecurity***

Cybersecurity documentation, including testing was provided to fulfill Section 542B of the FD&C Act.
Three threat scenarios have been chosen and followed in a STRIDE penetration test (Reverse Engineering, Integrity Compromise and Aftermarket Research). The system tests demonstrate that product outputs have met the product input requirements with a mitigation of threats and vulnerabilities as far as possible.

- ***Software Verification and Validation Testing***

ThinkQA Edition 2 was designed and documented in accordance with the recommandations of FDA “Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices” for software devices identified as Major Level of Concern.

- ***Beam Modeling Process***

A systematic beam modelling process and rigorous dosimetric evaluation applying sensitive dose metrics with tight tolerances has been applied to ThinkQA Edition 2 for three beam qualities (6 MV, 6 MV FFF and Elekta Unity 7 MV FFF) and two primary TPS (RayStation and Monaco).
The modelling process was carried out using computed depth dose curves and profiles of various fields size at different depths. In order to comply with the recommendations of the AAPM working group 219, the three beam models were compared to the corresponding measured depth dose curves and profiles. The agreement between ThinkQA Edition 2, the primary TPS and the measured data was found to be excellent in terms of beam shape and absolute dose. In order to guaranty the independence of the secondary dose check prescribed by the AAPM 219 report, these standardized beam models are not intended to be adjusted to match the user’s reference TPS.

- ***Clinical Performance Evaluation***

The dosimetric evaluation was performed on a large variety of plans with a growing complexity and a tight gamma index tolerance (2%/2mm, global, 95% of passing rate). The overall performance of ThinkQA Edition 2 in terms of beam modelling was found to be satisfactory for the three beam models, with all the tested plans respecting the gamma tolerances. An exception should be noted for a few number of Elekta Unity 7 MV FFF plans sensitive to the electron return effect. Additionally, secondary calculation results obtained with the Monaco Monte Carlo TPS highlighted the sensitivity of the gamma index metric to the statistical uncertainty of a MC dose distribution.

The same set of plans were evaluated with the predicate MU2net with the recommended relative tolerance of 5% dose difference with reference dose. ThinkQA Edition 2 and MU2net supported the same decision on whether to validate or reject the evaluated plans. Additionally for situations where MU2net control was inconclusive (e.g, prescription point located outside of the high dose region of the irradiated volume) the full 3D gamma evaluation provided by ThinkQA Edition 2 allowed a decision making.

10 Conclusion

The substantial equivalence discussion sustains the claim that ThinkQA Edition 2 shares the same intended use, clinical and technical characteristics as the predicate device MU2net legally marketed in the U.S. (K191944), with the exception that ThinkQA Edition 2 compared to MU2net's intended use does not include “in vivo dose measurements management”.

In the context of cybersecurity, the device is considered sufficiently safe for its intended use as risks discovered by the penetration testing, have been mitigated as far as possible. The results of verification and validation activities demonstrate the safety and effectiveness of ThinkQA Edition 2.

In conclusion, ThinkQA Edition 2 aligns with the device requirements, user needs, and intended use, showcasing substantial equivalence to the predicate device. Differences in certain features are assessed to have either negligible impact or no significant effect on safety or effectiveness. Thus, DOSIsoft asserts that ThinkQA Edition 2 is substantially equivalent to its predicate device MU2net.