



December 6, 2024

SyntheticMR AB (Publ.)
% Kelliann Payne
Partner
Hogan Lovells US LLP
1735 Market Street, Floor 23
Philadelphia, Pennsylvania 19103

Re: K242524
Trade/Device Name: SyMRI
Regulation Number: 21 CFR 892.1000
Regulation Name: Magnetic Resonance Diagnostic Device
Regulatory Class: Class II
Product Code: LNH
Dated: August 23, 2024
Received: November 6, 2024

Dear Kelliann Payne:

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.

All medical devices, including Class I and unclassified devices and combination product device constituent parts are required to be in compliance with the final Unique Device Identification System rule ("UDI Rule"). The UDI Rule requires, among other things, that a device bear a unique device identifier (UDI) on its label and package (21 CFR 801.20(a)) unless an exception or alternative applies (21 CFR 801.20(b)) and that the dates on the device label be formatted in accordance with 21 CFR 801.18. The UDI Rule (21 CFR 830.300(a) and 830.320(b)) also requires that certain information be submitted to the Global Unique Device Identification Database (GUDID) (21 CFR Part 830 Subpart E). For additional information on these requirements, please see the UDI System webpage at <https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/unique-device-identification-system-udi-system>.

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,

A handwritten signature in black ink, appearing to read 'D. Krainak', is written over a large, light blue, semi-transparent watermark of the letters 'FDA'.

Daniel M. Krainak, Ph.D.
Assistant Director
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

Indications for Use

510(k) Number (if known)

K242524

Device Name

SyMRI

Indications for Use (Describe)

SyMRI is a post-processing software medical device intended for use in visualization of soft tissue. SyMRI analyzes input data from MR imaging systems. SyMRI utilizes data from supported MR sequences to generate parametric maps of R1, R2 relaxation rates, and proton density (PD).

SyMRI is intended for automatic labeling, visualization and volumetric quantification of segmentable brain tissues from a set of MR images. Brain tissue volumes are determined based on modeling of parametric maps from SyMRI.

SyMRI can also generate multiple image contrasts from the parametric maps. SyMRI enables post-acquisition image contrast adjustment.

SyMRI is indicated for head imaging.

When interpreted by a trained physician, output from SyMRI can provide information useful in determining diagnosis. SyMRI 2D is intended to be used in combination with at least one other, conventional MR acquisition (e.g. T2-FLAIR). T1W and T2W images from SyMRI 3D may replace conventional MR images in a clinical setting when interpreting together with a conventional 3D T2W FLAIR image.

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
SyntheticMR's SyMRI

K242524

Submitter

SyntheticMR AB, (Publ.),
Storgatan 11, 582 23 Linköping, Sweden

Phone: +46 (0)730 69 04 90
Contact Person: Madeleine Enström
Date Prepared: 2024-12-06

Name of Device: SyMRI

Common or Usual Name: SyMRI

Classification Name: Magnetic resonance diagnostic device

Regulatory Class: Class II

Product Code: LNH

Predicate Devices

SyntheticMR's SyMRI (K233733)

Device Description

SyMRI works by post-processing a multi-delay, multi-echo acquisition into parametric maps. The acquisition is either a multi-slice 2D approach (M2D-MDME), consisting of 4 delays with a short and a long echo time each (8 images per slice), or a 3D approach (3D-QALAS) consisting of 4 delays with a short echo and 1 delay with a long echo time (5 images per slice).

Quantification and segmentation

Supported acquisition sequence: M2D-MDME and 3D-QALAS

The parametric maps are R1, R2 relaxation rates, and proton density (PD). The inverse relaxation parameters, T1 relaxation time (1/R1), and T2 relaxation time (1/R2) are also provided as parametric maps.

SyMRI also enables the users to obtain volumetric information in the head, including white matter (WM), gray matter (GM), cerebrospinal fluid (CSF), Myelin correlated (MyC) partial volume, brain parenchyma (BP) and intracranial cavity (IC). This is accomplished by using tissue definitions based on

the parametric maps. The tissue definitions provide tissue partial volume, or tissue fraction, per voxel. SyMRI also provides image processing tools to extract the values of the parametric maps, and tissue partial volume, per individual voxel, per region of interest, or the entire imaging volume.

Contrast weighted images

Supported acquisition sequence: M2D-MDME

The parametric maps can be visualized as contrast weighted MR images, such as T1, T2, PD, and Inversion Recovery (IR) weighted images (including T1-FLAIR, T2-FLAIR, STIR, Double IR, and PSIR weighted images).

Supported acquisition sequence: 3D-QALAS

The parametric maps can be visualized as contrast weighted MR images. T1W and T2W images from SyMRI 3D may replace conventional MR images in a clinical setting when interpreting together with a conventional 3D T2W FLAIR image.

Supported acquisition sequence: M2D-MDME and 3D-QALAS

SyMRI calculates the pixel signal intensity as a function of R1, R2, PD, and desired MR scanner settings, such as echo time (TE), repetition time (TR), and inversion delay time (TI). A number of default settings for TE, TR, and TI are provided, but the user has the ability to change the contrast of the images. SyMRI generates all the different image contrasts from the same parametric maps, derived from the same acquisition. This leads to enhanced image slice registration, owing to the absence of inter-acquisition patient movement. SyMRI provides the user the ability to change the contrast of the images after the acquisition. This is performed by adjusting the TE, TR, and/or TI parameters post-acquisition, to generate the specific contrast desired.

SyMRI is intended to be used on data produced by any of the following acquisition sequences:

- MDME sequence data from GE MAGiC
- MDME sequence data from Philips SyntAc
- MDME sequence data from Siemens TSE_MDME
- 3D-QALAS sequence data from Philips 3DsytAc

Intended Use / Indications for Use

SyMRI is a post-processing software medical device intended for use in visualization of soft tissue. SyMRI analyzes input data from MR imaging systems. SyMRI utilizes data from supported MR sequences to generate parametric maps of R1, R2 relaxation rates, and proton density (PD).

SyMRI is intended for automatic labeling, visualization and volumetric quantification of segmentable brain tissues from a set of MR images. Brain tissue volumes are determined based on modeling of parametric maps from SyMRI.

SyMRI can also generate multiple image contrasts from the parametric maps. SyMRI enables post-acquisition image contrast adjustment.

SyMRI is indicated for head imaging.

When interpreted by a trained physician, output from SyMRI can provide information useful in determining diagnosis. SyMRI 2D is intended to be used in combination with at least one other, conventional MR acquisition (e.g. T2-FLAIR). T1W and T2W images from SyMRI 3D may replace conventional MR images in a clinical setting when interpreting together with a conventional 3D T2W FLAIR image.

The subject device has similar intended use and indication for use as the predicate device but SyMRI can now also generate contrast weighted images for diagnostic purposes from data based on the 3D-QALAS sequence. Performance data demonstrate that the device is safe and effective.

Summary of Technological Characteristics

The subject device has the same fundamental design characteristics and is based on the same technologies as found in the currently marketed predicate device SyMRI (K233733).

Both the SyMRI and the predicate device use the same fundamental algorithm to calculate parametric maps from acquired images of supported acquisition sequences. Both SyMRI and the predicate device use a segmentation algorithm to calculate volumetric results based on the parametric maps. The segmentation maps and volumes that are provided are the same as in the predicate device, i.e. WM, GM, CSF, NoN, MyC. No new segmentations are provided. Both the subject device and the predicate device have support for both the M2D-MDME sequence and the 3D-QALAS sequence.

Both SyMRI and the predicate device can visualize synthetic contrast weighted images that are generated from the parametric maps, but for the predicate device only images from the M2D-MDME sequence can be used clinically.

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

	SyMRI	PREDICATE DEVICE SyMRI (K233733)
Product Code	LNH	LNH
Regulation	829.1000	829.1000
Classification	Class II, 510(k)	Class II, 510(k)
Indications for Use	SyMRI is a post-processing software medical device intended for use in visualization of soft tissue. SyMRI analyzes input data from MR imaging systems. SyMRI utilizes data from supported MR sequences to generate parametric maps of R1, R2 relaxation rates, and proton density (PD). SyMRI is intended for automatic labeling, visualization and volumetric quantification of segmentable brain tissues from a set of MR images. Brain tissue volumes are determined based on modeling of parametric maps from SyMRI. SyMRI can also generate multiple image contrasts from the parametric maps. SyMRI enables post-acquisition image contrast adjustment.	SyMRI is a post-processing software medical device intended for use in visualization of soft tissue. SyMRI analyzes input data from MR imaging systems. SyMRI utilizes data from supported MR sequences to generate parametric maps of R1, R2 relaxation rates, and proton density (PD). SyMRI is intended for automatic labeling, visualization and volumetric quantification of segmentable brain tissues from a set of MR images. Brain tissue volumes are determined based on modeling of parametric maps from SyMRI. When interpreted by a trained physician, the parametric maps, tissue maps, and volumetrics from SyMRI can provide information useful in

	SyMRI is indicated for head imaging. When interpreted by a trained physician, output from SyMRI can provide information useful in determining diagnosis. SyMRI 2D is intended to be used in combination with at least one other, conventional MR acquisition (e.g. T2-FLAIR). T1W and T2W images from SyMRI 3D may replace conventional MR images in a clinical setting when interpreting together with a conventional 3D T2W FLAIR image.	determining diagnosis. SyMRI is indicated for head imaging. SyMRI can also generate multiple contrast weighted images from the parametric maps acquired using M2D-MDME sequence. SyMRI enables post-acquisition image contrasts adjustments from acquisition using M2D-MDME sequence. When M2D-MDME acquisition data is used as input to SyMRI the synthetic contrast weighted images can also provide information useful in determining diagnosis. SyMRI is intended to be used in combination with at least one other, conventional MR acquisition (e.g. T2-FLAIR).
User Population	SyMRI is intended to be used by healthcare professionals, e.g. radiologists interpreting the resulting images and quantitative values	SyMRI is intended to be used by healthcare professionals, e.g. radiologists interpreting the resulting images and quantitative values
Patient population	All ages	All ages
Intended use environment	SyMRI is intended to be used in a hospital/clinic setting.	SyMRI is intended to be used in a hospital/clinic setting.
Design	Automatic segmentation and quantification of brain tissues using parametric maps, based on the MR pixel intensity. Automated measurement of brain tissue volumes.	Automatic segmentation and quantification of brain tissues using parametric maps, based on the MR pixel intensity. Automated measurement of brain tissue volumes.
Technology	Generates images and volumes from parametric maps of PD, R1 and R2.	Generates images and volumes from parametric maps of PD, R1 and R2.
Processing Architecture	Automated internal pipeline that performs: - Quantification from supported sequences input to Parametric maps - Segmentation from Parametric maps to Tissue maps - Volume calculation from Tissue maps - Segmentation table summarizes results from Volume calculations. - Generating adjustable synthetic images from Parametric maps	Automated internal pipeline that performs: - Quantification from supported sequences input to Parametric maps - Segmentation from Parametric maps to Tissue maps - Volume calculation from Tissue maps - Segmentation table summarizes results from Volume calculations. - Generating adjustable synthetic images from Parametric maps
Physical Characteristics	Software package. Operates on off-the shelf hardware.	Software package. Operates on off-the shelf hardware.
Operating system	Supports Windows, macOS, and Linux	Supports Windows, macOS, and Linux
Data source 1	GE "MAGiC" sequence	GE "MAGiC" sequence
Data source 2	Philips "SyntAc" sequence	Philips "SyntAc" sequence
Data source 3	Siemens "tse_mdme" sequence	Siemens "tse_mdme" sequence
Data source 4	Philips "3DSyntAc" sequence	Philips "3DSyntAc" sequence
Output	Parametric maps (R1, R2, PD-map) in 2D or 3D	Parametric maps (R1, R2, PD-map) in 2D or 3D
	Tissue segmentation (WM, GM, CSF, MyC, NoN)	Tissue segmentation (WM, GM, CSF, MyC, NoN)
	Visualize segmentations in three planes (Ax, Cor, Sag)	Visualize segmentations in three planes (Ax, Cor, Sag)

	Contrast weighted images (T1w, T2w, FLAIR, PDw, STIR, DIR, PSIR)	Contrast weighted images (T1w, T2w, FLAIR, PDw, STIR, DIR, PSIR)
	Contrast weighted images in 2D or 3D for clinical use	Contrast weighted images in 2D
	Supports DICOM format as output of results that can be displayed on DICOM workstations and PACS	Supports DICOM format as output of results that can be displayed on DICOM workstations and PACS
	Volumes and fractions for multiple previous scans. Calculate difference and % change to previous scan. Reference curve can include multiple time-points.	Volumes and fractions for single scan exported to PACS. Comparison over time done manually.
Safety features	Additional conventional scan. Too many failed pixels check. Sufficient dynamic variation check. Results must be reviewed by a trained physician.	Additional conventional scan. Too many failed pixels check. Sufficient dynamic variation check. Results must be reviewed by a trained physician.

Performance Data

Non-Clinical verification tests have been performed with regards to the requirement specifications and the risk management results. The testing was completed with passing results per the pass/fail criteria defined in the test cases.

The accuracy of R1/R2/PD quantification was evaluated compared to gold standard inversion recovery (R1), CPMG multi-echo (R2), heavy water phantoms (PD) and standard system Model 130 NIST/ISMRM phantom. The R1, R2 and PD measurements show correspondence with the reference values, and the subject device met the same predefined acceptance criteria as the predicate device. It can be concluded that the accuracy and precision of SyMRI is equivalent to the predicate.

The verification results demonstrate that the subject device SyMRI meets the same pre-defined performance criteria as the predicate in terms of accuracy and precision for quantification and segmentation.

Furthermore, a prospective, multi-center, multi-readers clinical investigation was performed to demonstrate that synthetic 3D images are non-inferior to conventional 3D images. 189 subjects were recruited at 6 institutes in the US. The subjects were patients with a wide range of different pathologies, and healthy controls. Both adults and pediatric patients were included. Five experienced radiologists, blinded to the type of images, assessed the images in two reading sessions with a four-week memory washout period in between. The readers assessed artifacts, legibility of anatomical structure, image quality and radiological finding class.

The results showed that synthetic 3D images were non-inferior in terms of sensitivity and specificity in detecting any pathology, as well as non-inferior in diagnostic accuracy of radiological finding class, compared to equivalent conventional MR images over a wide range of brain pathologies.

Furthermore, the result showed that all images had a very high legibility of anatomical structures and that synthetic images had lower prevalence of artifacts compared to the conventional MR images. No

novel artifacts were reported for synthetic MR images. The synthetic images also had slightly higher image quality score compared to conventional images for both T1W and T2W images.

Based on the clinical performance as documented in the pivotal clinical study, SyMRI has a safety and effectiveness profile that is similar to the predicate device.

Conclusions

The subject device SyMRI is as safe and effective as the predicate device SyMRI. The subject 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 ability of the device and do not affect its safety and effectiveness when used as labeled. In addition, the minor technological differences between the subject device and its predicate devices raise no new issues of safety or effectiveness. Performance data demonstrate that the subject device is as safe and effective as the predicate device. Thus, it is substantially equivalent.