September 6, 2022

Perspectum Ltd.
% Ioan Wigley
Head of Regulatory Affairs
Gemini One
5520 John Smith Drive
Oxford, Oxfordshire OX 2LL
UNITED KINGDOM

Re: K213960
Trade/Device Name: LiverMultiScan v5 (LMSv5)
Regulation Number: 21 CFR 892.1000
Regulation Name: Magnetic resonance diagnostic device
Regulatory Class: Class II
Product Code: LNH
Dated: July 26, 2022
Received: July 26, 2022

Dear Ioan Wigley:

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,

Daniel M. Krainak, Ph.D.
Assistant Director
Magnetic Resonance and Nuclear Medicine 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)*
K213960

Device Name
LiverMultiScan v5

Indications for Use *(Describe)*
LiverMultiScan v5 (LMSv5) is indicated for use as a magnetic resonance diagnostic device software application for non-invasive liver evaluation that enables the generation, display and review of 2D magnetic resonance medical image data and pixel maps for MR relaxation times.

LMSv5 is designed to utilize DICOM 3.0 compliant magnetic resonance image datasets, acquired from compatible MR Systems, to display the internal structure of the abdomen including the liver. Other physical parameters derived from the images may also be produced.

LMSv5 provides several tools, such as automated liver segmentation and region of interest (ROI) placements, to be used for the assessment of selected regions of an image. Quantitative assessment of selected regions includes the determination of triglyceride fat fraction in the liver (PDFF), T2*, LIC (Liver Iron Concentration) and iron corrected T1 (cT1) measurements.

These images and the physical parameters derived from the images, when interpreted by a trained clinician, yield information that may assist in diagnosis.

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.

Date Prepared: 01 September 2022 K213960

Submitter Details

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Subject and Predicate Devices

	Subject Device	Primary Predicate Device	Secondary Predicate Device
510(k) number	Not known	K202170	K043271
Legal Manufacturer	Perspectum Ltd.	Perspectum Ltd.	Inner Vision Biometrics Pty
Owner/Owner Operator	10056574	10056574	/
Device Name	LiverMultiScan v5.0.0	LiverMultiScan v4.0.0	R2-MRI Analysis System (FerriScan)
Proprietary/Common	LiverMultiScan, LMSv5, LMS	LiverMultiScan, LMSv4, LMS	FerriScan
Panel	Radiology	Radiology	Radiology
Regulation	892.1000	892.1000	892.1000
Risk Class	Class II	Class II	Class II
Product Class code	LNH	LNH	LNH
Classification	System, Nuclear Magnetic Resonance Imaging	System, Nuclear Magnetic Resonance Imaging	System, Nuclear Magnetic Resonance Imaging

Subject Device

General Description

LiverMultiScan v5 (LMSv5) is a standalone software device. The purpose of the LiverMultiScan v5 device is to assist a trained operator with the evaluation of information from Magnetic Resonance (MR) images from a single time-point (a patient visit).

LiverMultiScan is a post-processing software device, a trained operator uses tools within the device interface to quantify liver tissue characteristics from parametric maps. LiverMultiScan v5 includes automatic processing functionality based on machine-learning to assist in the quantification of metrics during analysis, such as automatic artefact detection and automatic segmentation of the liver. A summary report from the analysis conducted is generated for interpretation by a clinician.

LiverMultiScan v5 is not intended to replace the established procedures for the assessment of a patient's liver health by a clinician, providing many opportunities for competent human intervention in the clinical care of patients.

The metrics are intended to be used as an additional diagnostic input to provide information to clinicians as part of a wider diagnostic process. It is expected that in the normal course of clinical care, patients will present with clinical symptoms or risk factors which may indicate liver disease. The interpreting clinician needs to take into consideration the device's limitations and accuracy during clinical interpretation.

Information gathered through existing diagnostic tests and clinical evaluation of the patient, as well as information obtained from LiverMultiScan v5 metrics, may contribute to a diagnostic decision.

LiverMultiScan v5 is not a computer-aided diagnostic device and can only present imaging information which must be interpreted by a qualified clinician. LiverMultiScan v5 is an aid to diagnosis; the diagnosis and treatment decisions remain the responsibility of the clinician.

Intended Use and Indications for Use

LiverMultiScan v5 (LMSv5) is indicated for use as a magnetic resonance diagnostic device software application for non-invasive liver evaluation that enables the generation, display and review of 2D magnetic resonance medical image data and pixel maps for MR relaxation times.

LMSv5 is designed to utilize DICOM 3.0 compliant magnetic resonance image datasets, acquired from compatible MR Systems, to display the internal structure of the abdomen including the liver. Other physical parameters derived from the images may also be produced.

LMSv5 provides several tools, such as automated liver segmentation and region of interest (ROI) placements, to be used for the assessment of selected regions of an image. Quantitative assessment of selected regions includes the determination of triglyceride fat fraction in the liver (PDFF), T2*, LIC (Liver Iron Concentration) and iron corrected T1 (cT1) measurements.

These images and the physical parameters derived from the images, when interpreted by a trained clinician, yield information that may assist in diagnosis.

Indications and contraindications

LiverMultiScan is indicated for use where MRI is not contraindicated.

Contraindications

LiverMultiScan is indicated for use where MRI is not contraindicated.

Intended Conditions

LiverMultiScan is not intended to be used for use on any specific disease or condition, but the information provided in the report, when interpreted by a licensed physician, may benefit the clinical management, including diagnosis and monitoring of patients.

Standalone Software

LiverMultiScan is a post-processing software device. All operations and features are directly controlled by the LiverMultiScan device. LiverMultiScan does not control other firmware or software outside of the device

Subject and Predicate Comparison

The following characteristics were compared between the subject device and the predicate device in order to demonstrate substantial equivalence.

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
Intended Use	LiverMultiScan v5 (LMSv5) is indicated for use as a magnetic resonance diagnostic device software application for non-invasive liver evaluation that enables the generation, display and review of 2D magnetic resonance medical image data and pixel maps for MR relaxation times. LMSv5 is designed to utilize DICOM 3.0 compliant magnetic resonance image datasets, acquired from compatible MR Systems, to display the internal structure of the abdomen including the liver. Other physical parameters derived from the images may also be produced.	LiverMultiScan (LMSv4) is indicated for use as a magnetic resonance diagnostic device software application for non-invasive liver evaluation that enables the generation, display and review of 2D magnetic resonance medical image data and pixel maps for MR relaxation times. LiverMultiScan (LMSv4) is designed to utilize DICOM 3.0 compliant magnetic resonance image datasets, acquired from compatible MR systems, to display the internal structure of the abdomen including the liver. Other physical parameters derived from the images may also be produced.	For the analysis of multi-slice, spin-echo MRI data sets of the liver for the measurement of liver R2 and liver iron concentration.

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
	LMSv5 provides several tools, such as automated liver segmentation and region of interest (ROI) placements, to be used for the assessment of selected regions of an image. Quantitative assessment of selected regions includes the determination of triglyceride fat fraction in the liver (PDFF), T2*, LIC (Liver Iron Concentration) and iron corrected T1 (cT1) measurements. These images and the physical parameters derived from the images, when interpreted by a trained clinician, yield information that may assist in diagnosis.	LiverMultiScan (LMSv4) provides a number of tools, such as automated liver segmentation and region of interest (ROI) placements, to be used for the assessment of selected regions of an image. Quantitative assessments of selected regions include the determination of triglyceride fat fraction in the liver (PDFF), T2* and iron-corrected T1 (cT1) measurements. T2* may be optionally computed using the DIXON or LMS MOST methods. These images and the physical parameters derived from the images, when interpreted by a trained clinician, yield information that may assist in diagnosis.	
Indications for Use	Same as intended use	Same as intended use	The R2-MRI Analysis System is an accessory diagnostic device to MRI scanners and is intended for diagnostic use to present images that reflect the magnetic resonance spectra for the determination of iron on the liver.

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
Target Population	Patients suitable to undergo an MRI scan and not contra-indicated for MRI	Patients suitable to undergo an MRI scan and not contra-indicated for MRI	Patients suitable to undergo an MRI scan and not contra-indicated for MRI
Device User	Trained Perspectum internal operator	Trained Perspectum internal operator	Resonance Health's trained analyst
Report User	An interpreting clinician or healthcare practitioner	An interpreting clinician or healthcare practitioner	An interpreting clinician or healthcare practitioner
Device Use Environment	Installation of LiverMultiScan v5 is controlled and is installed on general purpose workstations that meet the minimum technical requirements at Perspectum's image analysis centre by specialist members of staff.	Installation of LMSv4 is controlled and is installed on general purpose workstations that meet the minimum technical requirements at Perspectum's image analysis centre by specialist members of staff.	Image analysis and LIC reporting is performed at a central ISO 13485 certified Service Centre. Hosting platform is resonance health's internal server.
Clinical Setting	LiverMultiScan v5 is a standalone post-processing software device that is intended to be installed on general use workstations at Perspectum's image analysis centre. Operators use LMSv5 to conduct quantitative analysis of liver tissue characteristics to produce a report. The end-users for the output from the device, the report, are clinicians who receive and interpret LiverMultiScan (LMSv5) reports.	LMSv4 is a standalone post-processing software device that is intended to be installed on general use workstations at Perspectum's image analysis centre. Operators use LMS to conduct quantitative analysis of liver tissue characteristics to produce a report. The end-users for the output from the device, the report, are clinicians who receive and interpret LMSv4 reports.	FerriScan is a standalone software tool that is intended to be used by Resonance Health's trained analyst, FerriScan is installed and runs on the Resonance Health's internal server. The report result is overseen by the radiologist and the final decision for clinical management of the patient is made by their treating clinician.
Anatomical Location	Abdomen, including the liver	Abdomen, including the Liver	Abdomen, including the Liver.

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
Energy	LiverMultiScan v5 is a standalone software application, it does not deliver, monitor or depend on energy delivered to or from patients.	LMS is a standalone software application, it does not deliver, monitor or depend on energy delivered to or from patients.	FerriScan is a standalone software application. It does not deliver, monitor or depend on energy delivered to or from patients.
Design: Purpose	LiverMultiScan v5 is a standalone software application that imports MR data sets encompassing the abdomen, including the liver. Visualisation and display of 2D multi-slice, spin-echo MR data can be analysed and quantitative metrics of tissue characteristics are then reported. Datasets imported into LiverMultiScan (LMSv5) are DICOM 3.0 compliant, reported metrics are independent of the MRI equipment vendor.	LMS is a standalone software application that imports MR data sets encompassing the abdomen, including the liver. Visualisation and display of 2D multi-slice, spin-echo MR data can be analysed and quantitative metrics of tissue characteristics are then reported. Datasets imported into LMS are DICOM 3.0 compliant, reported metrics are independent of the MRI equipment vendor.	FerriScan is intended for: • Supporting clinical diagnoses about the status of liver iron concentration. • Supporting the subsequent clinical decision-making processes. • Supporting the use in clinical research trials, directed at studying changes in liver iron concentration as a result of interventions. • It contains an image viewer for importing DICOM images, browsing through patient datasets, viewing images and performing region of interest analysis

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
Design: Tools	Allows for the visualisation via parametric maps and quantification of metrics (cT1, LIC and PDFF) from liver tissue and exportation of results & images to a deliverable report. Quantification is through either full segmentation of the outer liver contour and liver vasculature or manual placement of ROI's on the parametric maps. IQR and median metrics are reported from the segmentation/ROI quantification. automatically detects artefacts on the and are delineated on the parametric map computed images as well as recommends slices to be used as the quantitative output of the device.	Allows for the visualisation via parametric maps and quantification of metrics (cT1, T2* and PDFF) from liver tissue and exportation of results & images to a deliverable report. Quantification is through either full segmentation of the outer liver contour and liver vasculature or manual placement of ROI's on the parametric maps. IQR and median metrics are reported from the segmentation/ROI quantification.	Allows for the visualisation of images that reflect the magnetic resonance spectra for the determination of iron on the liver. It contains an image viewer for • importing DICOM images, • browsing through patient datasets, • viewing images and performing ROI analysis.
Design: MR Relaxometry	T1, iron corrected T1 (cT1) mapping and LIC	T1, iron corrected T1 (cT1) and T2* mapping	R2 (Signal Decay Rate) mapping
Design: Liver Fat Quantification	Utilizes MR images that exploit the difference in resonance frequencies between hydrogen nuclei in water and triglyceride fat using the LiverMultiScan v5 IDEAL method.	Utilizes MR images that exploit the difference in resonance frequencies between hydrogen nuclei in water and triglyceride fat using the LMS IDEAL method.	N/A
Design: Parametric Maps	Iron corrected T1 (cT1), Proton Density Fat Fraction (PDFF) and LIC parametric maps can be created from all supported scanners.	Iron corrected T1 (cT1), T2* and Proton Density Fat Fraction (PDFF) parametric maps can be created from all supported scanners.	FerriScan calculates the signal decay rate (R2) that is used to characterise iron loading in the liver. It produces an output report

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
	It is possible to use the LIC maps and knowledge of the measurements and the scanner field strength to correct for signal changes related to iron deposits, producing a cT1 map. The cT1 map eliminates the effects of elevated iron from the T1 measurement (3) and standardizes for the fat signal across scanner manufacturers. PDFF is quantified using the LMS IDEAL method. Parametric maps of LIC are quantified using the LMS MOST method. LMSv5 uses the measured T2* value and uses them to characterise iron loading in the liver which is then transformed by a defined calibration curve to provide a quantitative measure of liver iron concentration in vivo. LMSv5 presents images that reflect the magnetic resonance spectra for iron determination on the liver.	It is possible to use the T2* and PDFF maps and knowledge of the T2* and PDFF measurements and the scanner field strength to correct for signal changes related to iron deposits, producing a cT1 map. The cT1 map eliminates the effects of elevated iron from the T1 measurement (3) and standardizes for the fat signal across scanner manufacturers. PDFF is quantified using the LMS IDEAL method. Parametric maps of T2* may optionally be computed using either the three-point DIXON method or the LMS MOST method.	comprising R2 which is transformed by a defined calibration curve into a quantitative measure of liver iron concentration in vivo. FerriScan presents images that reflect the magnetic resonance spectra for iron determination on the liver.
Design: Visualisation	Numerous views within the LiverMultiScan v5 interface can be used to assist in analysis of Iron corrected T1 (cT1), triglyceride fat (also known as Proton Density Fat Fraction (PDFF)) and LIC parametric	Numerous views within the LMSv4 interface can be used to assist in analysis, Iron-corrected T1 (cT1), T2* and triglyceride fat (also known as Proton Density Fat Fraction (PDFF)) parametric maps can be created from	Visualisation of multi-slice, spin-echo MRI data sets encompassing the abdomen. Software tool calculates the signal decay rate (R2) that is

Characteristic	LMSv5 (Subject device)	LMSv4 (Primary Predicate Device)	R2-MRI Analysis System (FerriScan) (Secondary Predicate)
	maps can be created from all supported scanners. Parametric maps displayed using the LMSv5 colourmap, designed to have maximum contrast on liver parenchymal tissue.	all supported scanners. R2 maps can also be utilised to assess the quality of the map fitting. Iron- corrected T1 (cT1) displayed using LMSv4 colourmap, designed to have maximum contrast on liver parenchymal tissue.	used to characterise iron loading in the liver, which is then transformed by a defined calibration curve to provide a quantitative measure of liver iron concentration in vivo. LIC is displayed on a map and histogram within the FerriScan LIC report.
Design: Supported Modalities	DICOM 3.0 compliant MR data from supported MRI scanners.	DICOM 3.0 compliant MR data from supported MRI scanners.	DICOM Image Format. Functionality independent of MRI equipment vendor.

Differences between subject and predicate devices

- The LMSv5 device offers additional quantification tools in its interface that are not available in the primary predicate device, LMSv4. LMSv5 automatically detects artefacts on the and are delineated on the parametric map computed images as well as recommends slices to be used as the quantitative output of the device. Artefact areas are overlayed on the parametric maps to assist in quantification and interpretation.

- LMSv5 uses the measured T2* values to characterise iron loading in the liver which is transformed by a defined calibration curve to provide a quantitative measure of liver iron concentration (LIC) in vivo. LMSv5 presents images that reflect the magnetic resonance spectra for iron determination on the liver. The primary predicate device does not offer quantification of LIC. However, the secondary predicate, R2-MRI Analysis System (FerriScan) also produces an outputted report comprising measured R2 values that are transformed by a defined calibration curve into a quantitative measure of liver iron concentration.

Software and Performance Testing

All product specifications were verified and the overall ability of the product to meet user needs was validated. Testing was performed according to internal company procedures. Software testing and validation were conducted according to written test protocols established before testing was conducted. Software verification and validation testing were conducted, and documentation was provided as detailed in FDA's Guidance for Industry and FDA Staff: "Guidance for the content of Premarket Submissions for Software Contained in Medical Devices." The software level of concern for LiverMultiScan v5 is Moderate, as per FDA's guidance document "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices". This device does not control a life supporting or life-sustaining device, nor does it control the delivery of a potentially harmful energy. This device does not control the delivery of treatment, and it does not provide diagnostic information, nor does it provide any vital signs monitoring. The hazard analysis identifies the potential software-related risks of using the device, and the mitigations implemented.

Bench testing included functional verification to ensure software installation, licensing, labeling, and feature functionality all met design requirements. The accuracy and precision of device measurements was assessed using purpose-built phantoms containing vials with different relaxation times corresponding to the physiological ranges of tissue values expected to be seen in-vivo. To assess the precision of LiverMultiScan v5 measurements across supported scanners, in-vivo volunteer data was used. Volunteers participating in the performance testing were representative of the intended patient population. Inter and intra operator variability was also assessed.

LiverMultiScan v5 underwent performance testing under controlled conditions to corroborate that it is safe and effective when used as intended. The performance testing conducted demonstrates that LiverMultiScan v5 is at least as safe and effective as the predicate devices.

Conclusion

LiverMultiScan v5 has the same intended use and similar technological characteristics as the predicate devices, LiverMultiScan v4 and Ferriscan. Software and Performance testing corroborate the differences between the subject device and the predicates do not result in a new intended use and do not raise any questions of safety and effectiveness. It can be concluded that LiverMultiScan v5 is substantially equivalent to the listed predicate devices.