November 2, 2018

NeuroVision Imaging, LLC
Pepe Davis
VP of Regulatory Affairs and Quality Assurance
1395 Garden Highway, Suite 250
Sacramento, CA 95833

Re: K181501
Trade/Device Name: Afina
Regulation Number: 21 CFR 892.2050
Regulation Name: Picture archiving and communications system
Regulatory Class: Class II
Product Code: NFJ
Dated: September 20, 2018
Received: September 24, 2018

Dear Pepe Davis:

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/CombinationProducts/GuidanceRegulatoryInformation/ucm597488.htm); 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 http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). 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 (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely yours,

Alexander Beylin -S
2018.11.02 11:04:52 -04'00'

for Malvina B. Eydelman, M.D.
Director
Division of Ophthalmic and Ear,
Nose and Throat Devices
Office of Device Evaluation
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: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K181501

Device Name
Afina

Indications for Use *(Describe)*
The Afina software is intended for importing, processing and displaying of retinal images and for the measurement of autofluorescence in the superior field (a circular 50-degree field of view at 20 degrees above fixation) of the retina. Afina is indicated for use only with images collected with validated ophthalmic cameras.

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.

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510(K) SUMMARY

This 510(k) summary of safety and effectiveness information is being submitted in accordance with the requirements of SMDA 1990 and 21 CFR 807.92

1 SUBMITTER'S NAME, ADDRESS, CONTACT PERSON AND DATE PREPARED (21 CFR §807.92(A) (1))

Applicant: NeuroVision Imaging, LLC

1395 Garden Highway, Suite 250

Sacramento, CA 95833

Establishment Registration Number: 3012256561

Contact Person: Pepe Davis

(925) 286-7432

pdavis@neurovision.com

Date Prepared: October 22, 2018

2 NAME OF DEVICE AND CLASSIFICATION (21 CFR §807.92(A) (2))

Trade Name:	Afina (Release 1.1)
Common Name:	Picture archiving and communications system
Regulation Number:	21 CFR 892.2050
Classification Name:	System, Image Management, Ophthalmic
Product Code:	NFJ
Device Class:	Class II

3 PREDICATE DEVICE (21 CFR §807.92(A) (3))

Predicate Device: Zeiss Retina Workplace, K170638

This predicate has not been subject to a design-related recall.

4 DEVICE DESCRIPTION (21 CFR §807.92(A) (4))

Afina is software that transforms a set of field-identical autofluorescent (AF) images captured with a fundus camera into a single enhanced image with improved quality characteristics. It identifies and quantifies AF findings over the retinal AF background within the derived image.

Afina supports licensed healthcare professionals in importing, processing and displaying of retinal images and for the measurement of autofluorescence in the superior field of the retina.

Functionally, Afina imports a set of at least 8 AF images taken of the superior field of the retina (also referred to as a DICOM study), combines them in order to enhance image quality, and then identifies pixels and areas of contiguous pixels (spots) that exhibit autofluorescence that is brighter than the retinal AF background. Once identified, these pixels are quantified as both a count of spots and an overall sum of pixels. These data are consolidated into a single-field patient report that presents images of the field with AF findings identified and spot and pixel counts quantified.

A risk assessment has been performed to identify potential risks of Afina. The risks were evaluated and reduced as far as possible to ensure the safety and effectiveness of Afina. The software is to be used by healthcare professionals and does not directly interact with patients. The report produced by the Afina software provides an objective measurement of autofluorescence but does not provide specific clinical diagnosis. Interpretation of the measurements are made by healthcare professionals.

5 INDICATIONS FOR USE (21 CFR §807.92(A) (5))

The Afina software is intended for importing, processing and displaying of retinal images and for the measurement of autofluorescence in the superior field (a circular 50-degree field of view at 20 degrees above fixation) of the retina. Afina is indicated for use only with images collected with validated ophthalmic cameras.

6 TECHNOLOGICAL CHARACTERISTICS (21 CFR §807.92(A) (6))

The Afina software is technologically similar to its predicate, the Zeiss Retina Workplace. Both devices are software analysis tools which import DICOM images of the retina and process them to produce segmented images and measurements of findings of interest. The Afina software can identify the fovea and optic nerve head to register images similarly to the Zeiss Retina Workplace. The Afina software combines fundus images and identifies findings of interest in autofluorescence images of the retina similarly to the Zeiss Retina Workplace's identification of findings of interest in OCT images of the retina. Overlays of the findings of interest are similarly presented on enhanced fundus images highlighting pixels and spots of autofluorescence above the retinal background autofluorescence. A measurement of this autofluorescence is provided

as a pixel count and as a spot count (where contiguous regions of highlighted pixels are counted).

The following table summarizes the characteristics of the Afina software as compared to the predicate device.

Table 1: Substantial Equivalence Comparison

Characteristic	**Proposed Device**	**Predicate Device**
Trade Name	**NeuroVision Afina**	**Zeiss Retina Workplace 2.0**
Product code(s)	NFJ	NFJ
Device	System, Image Management, Ophthalmic	System, Image Management, Ophthalmic
Regulation Number	892.2050	892.2050
Classification	Class II	Class II
Intended Use	Intended to import, process and display fundus images for viewing and quantification of posterior segment findings	Intended to import, process and display fundus images for viewing and quantification of posterior segment findings
Indications for Use	The Afina software is intended for importing, processing and displaying of retinal images and for the measurement of autofluorescence in the superior field (a circular 50-degree field of view at 20 degrees above fixation) of the retina.	The Retina Workplace is a FORUM application intended for processing and displaying image and optical coherence tomography data. It is also intended for generating reports that contain results from optical coherence tomography and fundus photography. The Retina Workplace uses CIRRUS algorithms and normative databases as quantitative tool for the comparison of macular

Characteristic	Proposed Device	Predicate Device
Trade Name	**NeuroVision Afina**	**Zeiss Retina Workplace 2.0**
		thickness data to a database of normal subjects. The Retina Workplace is intended to aid trained healthcare professionals in the detection, monitoring and management of ocular diseases including, but not limited to, macular holes, cystoid macular edema, diabetic retinopathy and age-related macular degeneration.
Prescription or OTC?	Prescription	Prescription
Software/Hardware?	Software Only	Software Only
Software Platform	Linux	Windows
Image data management?	Yes	Yes
Import of images of the retina	Yes	Yes
Acceptance of images	Yes	Yes
Process images and data from DICOM files	Yes	Yes
Register fundus images	Yes	Yes
Identify center of fundus	Yes	Yes

Characteristic	Proposed Device	Predicate Device
Trade Name	**NeuroVision Afina**	**Zeiss Retina Workplace 2.0**
Analyze retinal images to identify and measure fundus findings of interest	Yes	Yes
Export reports with segmentation overlays	Yes	Yes
Export reports with measurements of fundus findings	Yes	Yes
Centralized storage of images and data?	No	No

7 PERFORMANCE DATA (21 CFR §807.92(B))

7.1 Non-clinical Performance Data (21 CFR §807.92(b) (1))

The Afina 1.1 software was identified as having a moderate level of concern as defined in FDA guidance document "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices." The software documentation included:

Afina Software Development Plan

Afina Risk Management Plan

Afina Risk Analysis

Afina Risk Management Report

Afina Software Requirements

Afina Architecture Design Description

Afina Software Design Description

Afina Requirements Trace Matrix

Afina Software Verification Test Plan

Afina Software System Level Verification Test Report

Afina Software Unit Level Verification Test Report

Afina Validation Test Plan

Afina 1.1 Validation Test Report

Afina 1.1.0 Version Description Document

Full characterization of the technical parameters of all the components of the software, including a description of the algorithms were provided in the Afina Software Requirements, the Afina Architecture Design Description, and the Afina Software Design Description.

A comprehensive risk analysis was provided for the software with detailed description of the hazards, their causes and severity as well as acceptable methods for control of the identified hazards.

The cybersecurity considerations of data confidentiality, data integrity, data availability, denial of service attacks and malware were adequately addressed using a HIPAA compliant and HITRUST certified cloud hosting platform. Risks related to failure of various software components and their potential impact on patient reports and operator failures were also adequately addressed in the risk analysis. This software documentation information provided sufficient evidence of safe and effective software performance.

Performance testing, in the form of software bench testing, was conducted in the form of Unit, and System level verification against the documented product requirements. Verification and validation testing was performed to evaluate the performance and functionality of the software and the software has been found to perform as intended. Each function and/or feature was tested by means of an appropriate test case for the test specification. The verification testing demonstrates that the device performance complies with specifications and requirements identified for the Afina software. The software verification activities were divided into two phases:

• Unit level test cases which included verification of specific image processing functionality as described in the Afina Software Requirements and the Afina Architecture Design Description. These included functional tests for rejecting images, aligning images, enhancing images and segmentation.

• System level test cases which included verification of file transfer interfaces including image import, report output and cybersecurity.

Use Case validation was completed by medical professionals using a production equivalent implementation of the Afina with verified software including representative data (sample data that are representative of clinical cases). The validation participants executed test cases that simulated the use of the software in a clinical environment and completed questionnaires rating the various aspects of the software.

Test plans and reports were provided including pass/fail criteria and results for verification and validation activities at the unit and system level. Verification and validation activities met their acceptance criteria successfully per test plan and proved that the product, Afina, meets its requirements and intended use.

7.2 Clinical Performance Data (21 CFR §807.92(b) (2))

A clinical study was performed to evaluate the repeatability and reproducibility of the Afina autofluorescence measurement for both Pixel Count and Spot Count. The study population included subjects with diseases that manifest in the retina (i.e. various levels and forms of cognitive impairment and subjects with retinal disease exhibiting autofluorescent findings) and normal subjects in order to demonstrate repeatability and reproducibility over a representative dynamic range.

Summary of Protocol

Thirty-two (32) eligible subjects were screened, consented and enrolled between April 21, 2017 and August 25, 2017. One eye of each subject underwent up to three repeated superior retina imaging runs with repositioning between runs (3 focal planes per run, with up to six images per focal plane) on each of three (3) randomly assigned Autofluorescence (AF) fundus cameras meeting the specification requirements for Afina (designated as Camera 1, 2 and 3). The operators were trained to follow the camera Instructions for Use (IFU) and the Afina image capture procedure outlined in the Afina IFU. The three trained camera operators were designated as Operator A, B and C, with two trained back-up operators. To evaluate reproducibility, Operator A used Camera 1, Operator B used Camera 2, and Operator C used Camera 3. Subjects completed imaging during one visit, and within one week of consent.

Results

The demographics of the enrolled study population are shown in Table 2. The gender of the study subjects was reasonably distributed and the age of the study subjects ranged from 44 years to 81 years, with a median age of 72. Therefore, this is a good sample population for the purposes of characterizing the precision of the measurements provided by the Afina software.

Table 2: Demographic Summary

	n/N	%
Gender		
Male	18/32	56%
Female	14/32	44%
Eye		
Left (OS)	9/32	28%
Right (OD)	23/32	72%
Age (year)		
N	32	
Mean	68	
SD	11	
Median	72	
Min	44	
Max	81	
40 - 49	4/32	12.5%
50 - 59	4/32	12.5%
60 - 69	5/32	15.6%
70 - 79	15/32	46.9%
80 - 89	4/32	12.5%
Ethnicity		
Asian/Pacific Islander	2/32	6.3%
Black or African American	2/32	6.3%
Caucasian	27/32	84.3%
Other	1/32	3.1%

Of the 32 eyes imaged (288 planned measurement runs), 25 eyes had Afina qualified run data (194 completed measurements). The range of the autofluorescence measurements obtained from the 25 study eyes with Afina measurements was 2,222 to 58,110 for Pixel Count and 37 to 1350 for Spot Count.

Table 3 summarizes the results for the Spot Count measurements.

Table 3: Spot Count Precision Summary

Statistics	All Camera/Operator Combinations	Camera 1 / Operator A	Camera 2 / Operator B	Camera 3 / Operator C
Number of Eyes	25	22	25	24
Number of Successful	194	63	66	65
Mean Spot Count Value	451.1	429.0	429.2	495.4
Total Standard Deviation	214.4	212.3	192.4	229.8
Repeatability SD[1]	52.4	46.8	48.6	60.4
Repeatability %CV[2]	11.6	10.9	11.3	12.2
Reproducibility SD[3]	89.9	-	-	-
Reproducibility %CV[4]	19.9	-	-	-

1 Repeatability SD = Estimate of the standard deviation among measurements taken on the same eye using the same camera in the same testing session with repositioning.

2 Repeatability %CV = Repeatability SD ÷ Mean x 100. measurements taken on the same eye using different cameras, including repeatability.

3 Reproducibility SD =Estimate of the standard deviation among measurements taken with different camera/operators

4 Reproducibility %CV = Reproducibility SD ÷ Mean x 100.

Table 4 summarizes the results for the Pixel Count measurement analysis. Because the measurement fits a constant %CV model, only the Repeatability %CV and Reproducibility %CV are reported here. The repeatability SD (0.087 on the log scale but variable in the original scale) is not presented in this summary table.

Table 4: Pixel Count Precision Summary

Statistics	All Camera/Operator Combinations	Camera 1 / Operator A	Camera 2 / Operator B	Camera 3 / Operator C
Number of Subjects	25	22	25	24
Number of Successful	194	63	66	65
Mean Pixel Count Value[1]	8398	7726	8842	8600
Repeatability % CV[1]	8.7	9.5	8.1	8.2
Reproducibility % CV[1]	14.4	-	-	-

1 Calculated according to NIST Engineering Statistics Handbook, Section 1.3.6.6.9. Lognormal Distribution: http://www.itl.nist.gov/div898/handbook/eda/section3/eda3669.htm

Subjects were assessed during and after the imaging visit, and received a follow-up telephone call no later than two days following the visit, to assess for any adverse effects. There were no

adverse events, serious adverse events, or anticipated/unanticipated adverse device effects reported during the study.

Study Conclusion

The repeatability and reproducibility study showed the device to be safe and characterized well the variability of the measurements provided by the Afina software. There were no safety events reported.

The variability of the autofluorescence measurements provided by the Afina software shows the device is fit for its purpose as a measurement tool.

7.3 Conclusions (21 CFR §807.92(b) (3))

The verification and validation testing demonstrate that the Afina software performs as intended and is functionally equivalent to the predicate device. The non-clinical and clinical performance data confirm that differences in technological characteristics do not raise different questions of safety and effectiveness.