

June 1, 2022

Shenzhen Mindray Bio-Medical Electronics Co., LTD Li Lei Manager Regulatory Affairs, Technical Regulation Department Mindray Building, Keji 12th Road South, Hi-tech Industrial Park, Nanshan Shenzhen, Guangdong 518057 China

Re: K220058

Trade/Device Name: BeneVision Central Monitoring System

Regulation Number: 21 CFR 870.2300

Regulation Name: Cardiac Monitor (Including Cardiotachometer And Rate Alarm)

Regulatory Class: Class II

Product Code: MSX, DRT, DQA, DXN, DSB, MHX, DRQ

Dated: December 27, 2021 Received: January 6, 2022

#### Dear Li Lei:

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 <a href="https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm">https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm</a> 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 <u>Federal Register</u>.

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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 <a href="https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products">https://www.fda.gov/combination-products/guidance-regulatory-information/postmarketing-safety-reporting-combination-products</a>); 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 <a href="https://www.fda.gov/medical-devices/medical-device-safety/medical-device-reporting-mdr-how-report-medical-device-problems">https://www.fda.gov/medical-device-problems</a>.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (<a href="https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance">https://www.fda.gov/training-and-continuing-education/cdrh-learn</a>) and CDRH Learn (<a href="https://www.fda.gov/training-and-continuing-education/cdrh-learn">https://www.fda.gov/training-and-continuing-education/cdrh-learn</a>). 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 (<a href="https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice">https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice">https://www.fda.gov/medical-devices/device-advice-comprehensive-regulatory-assistance/contact-us-division-industry-and-consumer-education-dice</a>) for more information or contact DICE by email (<a href="DICE@fda.hhs.gov">DICE@fda.hhs.gov</a>) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Jennifer Shih Kozen
Assistant Director
Division of Cardiac Electrophysiology,
Diagnostics and Monitoring Devices
Office of Cardiovascular Devices
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 <i>(if known)</i><br>K220058 |  |  |
|--|--|--|
| Device Name                                |  |  |
| BeneVision Central Monitoring System       |  |  |
|  |  |  |
| Indications for Use (Describe)             |  |  |

The indications for use of the BeneVision Central Monitoring System include:

- Real time viewing of patient clinical data and alarms
- Storage and Historical review of patient clinical data and alarms
- Printing of real time and historical patient data
- Configuration of local settings as well as synchronizing settings across the network to a remote device
- Transfer of patient clinical data and settings between several CentralStations
- Provides a Resting 12 Lead interpretation of previously stored data

The BeneVision Central Monitoring System is a networked patient monitoring system intended for use in a fixed location, installed in professional healthcare facilities to provide clinicians remote patient monitoring. The network connections between the various devices can be any combination of Ethernet (Wired), Wireless WIFI (WLAN), and Wireless WMTS. The BeneVision Central Monitoring System supports one or more Mindray compatible physiological monitors and will display, store, print, and transfer information received from the compatible monitors. The BeneVision Central Monitoring System supports bi-directional configuration of the compatible monitors.

The telemetry monitoring systems are designed to acquire and monitor physiological data for ambulating patients within a defined coverage area. The BeneVision Central Monitoring System supports Telemetry Systems: TMS-6016, Telepack-608, TMS60, TM80 and TM70.

- The TMS-6016 transmitter is intended for use on Adult and Pediatric patients to monitor ECG and SpO2 physiological data.
- The Panorama Telepack-608 transmitter is intended for use on Adult patients to monitor ECG and SpO2 physiological data.
- The TMS60 transmitter is intended for use on Adult and Pediatric patients over three years old to monitor ECG, SpO2, NIBP and Resp physiological data. The physiological data can be reviewed locally on the display of the transmitter. The CentralStation will support ECG, Heart Rate, SpO2, NIBP, Resp, Pulse Rate, Arrhythmia analysis, QT monitoring, and ST Segment Analysis for the TMS60.
- The TM80/TM70 telemetry monitor is intended for use on Adult and Pediatric patients over three years old to monitor ECG, SpO2, NIBP and Resp physiological data. The physiological data can be analyzed, alarmed, stored, reviewed locally on the display of the monitor, and the CentralStation can config and display the physiological parameters from the TM80/TM70.

| CONTINUE ON A SEPARA   | ATE PAGE IF NEEDED.                                      |
|--|--|
| Prescription Use (Part 21 CFR 801 Subpart D)                 | Over-The-Counter Use (21 CFR 801 Subpart C)              |
| Type of Use (Select one or both, as applicable)              |  |
| supervision of a licensed healthcare practitioner.           |  |
| The Benevision Central Monitoring System is intended for use | e in professional nealthcare facilities under the direct |

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In accordance with 21 CFR 807.87(h) and 21 CFR 807.92 the 510(k) Summary for the BeneVision Central Monitoring System is provided below.

### 1. SUBMITTER

**Applicant:** SHENZHEN MINDRAY BIO-MEDICAL

ELECTRONICS CO., LTD.

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**Contact:** Contact Person: Li Lei

Title: Manager Regulatory Affairs

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**Date Prepared:** December 27, 2021

### 2. DEVICE

**Device Trade Name:** BeneVision Central Monitoring System

**Device Common Name:** System, network and communication, physiological

monitors

**Classification Name and** 

Regulation

21 CFR 870.2300, Cardiac monitor (including

cardiotachometer and rate alarm)

**Primary Product Code:** MSX - System, network and communication,

physiological monitors

**Regulatory Class** II

**Panel** Cardiovascular

**Table 1:** Secondary Product Codes

| Product<br>Code | Regulation<br>Number | Panel          | Regulation description  | <b>Device Common Name</b>   |
|-----------------|----------------------|----------------|---|---|
| DRT             | 21 CFR<br>870.2300   | Cardiovascular | Cardiac Monitor<br>(including<br>cardiotachometer and rate<br>alarm)        | Monitor, cardiac (incl. cardiotachometer & rate alarm)                      |
| DQA             | 21 CFR<br>870.2700   | Anesthesiology | Oximeter  | Oximeter  |
| DXN             | 21 CFR<br>870.1130   | Cardiovascular | Noninvasive blood pressure measurement system                               | System, measurement, blood-pressure, non-invasive                           |
| DSB             | 21 CFR<br>870.2770   | Cardiovascular | Impedance plethysmograph  | Plethysmograph, impedance   |
| MHX             | 21 CFR<br>870.1025   | Cardiovascular | Arrhythmia detector and alarm (including ST-segment measurement and alarm). | Monitor, physiological,<br>patient (with arrhythmia<br>detection or alarms) |
| DRQ             | 21 CFR<br>870.2060   | Cardiovascular | Transducer signal amplifier and conditioner                                 | Amplifier and signal conditioner, transducer signal                         |

### 3. PREDICATE DEVICE

Predicate Device: K193391 - BeneVision Central Monitoring System (SHENZHEN

MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD)

Reference Device: K163584 - M3290B Patient Information Center iX Release C.01(Philips

Medical Systems)

K202405 - BeneVision N Series Patient Monitors (Including BeneVision N12, BeneVision N15, BeneVision N17, BeneVision N19, BeneVision N22, BeneVision N1) (SHENZHEN MINDRAY BIO-MEDICAL

ELECTRONICS CO., LTD)

### 4. **DEVICE DESCRIPTION**

The BeneVision Central Monitoring System (CMS) is a networked patient monitoring system intended for use in healthcare settings by, or under the direction of, a physician to provide clinicians remote patient monitoring. The target patient population is adult patients and pediatrics.

#### 5. INTENDED USE/INDICATIONS FOR USE

The indications for use of the BeneVision Central Monitoring System include:

- Real time viewing of patient clinical data and alarms
- Storage and Historical review of patient clinical data and alarms
- Printing of real time and historical patient data
- Configuration of local settings as well as synchronizing settings across the network to a remote device
- Transfer of patient clinical data and settings between several CentralStations
- Provides a Resting 12 Lead interpretation of previously stored data

The BeneVision Central Monitoring System is a networked patient monitoring system intended for use in a fixed location, installed in professional healthcare facilities to provide clinicians remote patient monitoring. The network connections between the various devices can be any combination of Ethernet (Wired), Wireless WIFI (WLAN), and Wireless WMTS.

The BeneVision Central Monitoring System supports one or more Mindray compatible physiological monitors and will display, store, print, and transfer information received from the compatible monitors. The BeneVision Central Monitoring System supports bi-directional configuration of the compatible monitors.

The telemetry monitoring systems are designed to acquire and monitor physiological data for ambulating patients within a defined coverage area. The BeneVision Central Monitoring System supports Telemetry Systems: TMS-6016, Telepack-608, TMS60, TM80 and TM70.

- The TMS-6016 transmitter is intended for use on Adult and Pediatric patients to monitor ECG and SpO2 physiological data.
- The Panorama Telepack-608 transmitter is intended for use on Adult patients to monitor ECG and SpO2 physiological data.
- The TMS60 transmitter is intended for use on Adult and Pediatric patients over three years old to monitor ECG, SpO2, NIBP and Resp physiological data. The physiological data can be reviewed locally on the display of the transmitter. The CentralStation will support ECG, Heart Rate, SpO2, NIBP, Resp, Pulse Rate, Arrhythmia analysis, QT monitoring, and ST Segment Analysis for the TMS60.
- The TM80/TM70 telemetry monitor is intended for use on Adult and Pediatric patients over three years old to monitor ECG, SpO2, NIBP and Resp physiological data. The physiological data can be analyzed, alarmed, stored, reviewed locally on the display of the monitor, and the CentralStation can config and display the physiological parameters from the TM80/TM70.

The BeneVision Central Monitoring System is intended for use in professional healthcare facilities under the direct supervision of a licensed healthcare practitioner.

## 6. SUBSTANTIAL EQUIVALENCE

### **Comparison of Indications**

Both the predicate device and the subject device are patient monitoring systems intended to be used in healthcare facilities under the direction of clinical professionals.

The indications for use statement of the subject BeneVision Central Monitoring System has been modified to include support a resting 12 Lead interpretation. Although this feature is not present in the predicate BeneVision Central Monitoring System, it is present in Mindray's N Series Monitors (K202405).

In conclusion, the difference of the indications for use do not change the fundamental intended use of the BeneVision Central Monitoring System.

## **Technological Comparisons**

The table below provides a comparison of the technological features of the BeneVision CentralStation, WorkStation, ViewStation, and CMS Viewer compared to the CentralStation, WorkStation, ViewStation, and CMS Viewer cleared in K193391. The features in gray are features which are different between the predicate device and the subject devices. These changes marked with an asterisks (\*) are non-significant.

Table 2: Technological Comparison

| Feature   | As Cleared in K193391   | Modificatio   | Applied To   |  |   |   |  |
|---|---|---|--|--|---|---|--|
|   |   | ns Made to<br>Subject<br>Device   | CentralSt ation  | WorkSta<br>tion  | ViewSta<br>tion   | CMS<br>Viewer   |  |
| Operation<br>System   | Microsoft Windows 7/8/10/Server 2012/Server 2016  | 1.Added Microsoft Windows Server 2019 *  2. Deleted Microsoft Windows 7 3.The CentralStati on supports installation on the Virtual Machine Platform when running as service such as VMWare and Hyper- V | A<br>(CentralSt<br>ation only<br>supports<br>Windows<br>10/Server<br>2016/Serv<br>er 2019) | A<br>(WorkSta<br>tion only<br>supports<br>Windows<br>10) | A<br>(ViewSta<br>tion only<br>supports<br>Window<br>s 10) | A<br>(CMS<br>Viewer<br>only<br>supports<br>Windows<br>8/10/Serv<br>er 2012) |  |
| Display<br>(including<br>touchscree<br>n<br>capability)                 | resolution:1920 x<br>1080,1280*1024   | No change   | A  | A  | A   | A   |  |
| Audio   | Built-in speakers   | No change   | A  | A  | A   | NA  |  |
| Recorder  | Mindray thermal array module product  | No change   | A  | A  | A   | NA  |  |
| Network   | 100 Mbps, Ethernet 802.3  | No change   | A  | A  | A   | A   |  |
| Max<br>connection<br>sare<br>supported<br>for one<br>CentralStat<br>ion | Up to 32 WorkStation or<br>ViewStation connections<br>are supported for one<br>CentralStation | No change   | A  | NA   | NA  | NA  |  |

| Feature  | As Cleared in K193391  | Modificatio   | Applied To      |                 |                 |   |
|--|--|---|-----------------|-----------------|-----------------|---|
|  |  | ns Made to<br>Subject<br>Device                     | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer                             |
| Patient<br>Monitor<br>Numbers –<br>Number<br>Supported | 1.Support 32 monitors running as application. 2. Running as service Up to 128 montors with no patient display, the display is provided by WorkStations | Support 64<br>monitors<br>running as<br>application | A               | A               | A               | A (CMSVie wer only support 36 monitors) * |

| Feature   | As Cleared in K193391  | Modificatio  | Applied To      |                 |                 |               |  |
|---|--|--|-----------------|-----------------|-----------------|---------------|--|
|   |  | ns Made to<br>Subject<br>Device  | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| Telemetry<br>Systems<br>and<br>monitors           | Supports the following telemetry systems and monitors:  - TMS-6016 (K183238)  - TMS60 (K183238)  - Telepack-608 (K183238)  - TM80(K193391)  - TM70(K193391)  | No change  | A               | A               | A               | A             |  |
| Communic ation protocol (and compatible monitors) | CMS+ protocol: DPM3 (K072235) DPM4/5 (K070791) DPM6/7 (K092449) Passport 12m/17m (170876) Passport8/12 (K153448) Passport V (K091834) Accutorr 7/VS-900 (K170712) T1 (K152902)  ELAN protocol: Spectrum (K062098) Spectrum OR (K062098) Passport II (K020550) V12/21 (K150352)  MD2 protocol: CMS Viewer (K193391) ViewStation (K193391) TM80 (K193391) TM80 (K193391) TM70(K193391) BeneVision N22/N19/N17/N15/N12/N 1(K199391) | 1.Added VS<br>8/8A/9(K21<br>1475) *<br>2.Added<br>ePM Series<br>Patient<br>Monitors<br>(Including<br>ePM 10,<br>ePM12,<br>ePM 15,<br>ePM 15M)<br>(K200015) * | A               | A               | A               | A             |  |

| Feature                                 | As Cleared in K193391   | Modificatio                     | Applied To      |                 |                 |               |  |
|---|---|---------------------------------|-----------------|-----------------|-----------------|---------------|--|
|   |   | ns Made to<br>Subject<br>Device | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| Bi-<br>directional<br>Configurat<br>ion | Patient demographics, alarm settings and parameter settings For TM80: patient demographics, alarm settings and parameter setup information can be set by both the CentralStation and TM80. The QRS threshold, ST point/ISO point/J point, and ST and QT template can only be set by the CentralStation. | No change                       | A               | A               | NA              | NA            |  |
| Calculatio<br>ns                        | Supports five calculation mode: Drug Calculation Hemodynamics Calculation Oxygenation Calculation Ventilation Calculation Renal Calculation   | No change                       | A               | A               | A               | NA            |  |
| View<br>Other Bed                       | Provides the user the ability to remotely view 32 patient's parameters, waveforms, and alarms from a patient monitor connected to anotherBeneVision Central Monitoring System   | No change                       | A               | A               | A               | NA            |  |
| HL7<br>Output                           | Provide HL7 interface output  | No change                       | A               | NA              | NA              | NA            |  |
| Paging<br>Interface                     | Enables transmission of configured alarm notifications to a third-party paging system   | No change                       | A               | A               | NA              | NA            |  |
| Data Reviev                             | N   |                                 |                 |                 |                 |               |  |
| Dynamic short trend                     | 8 hours   | No change                       | A               | A               | A               | A             |  |
| Trend review                            | 240 hours   | No change                       | A               | A               | A               | A             |  |

| Feature                     | As Cleared in K193391   | Modificatio                     | Applied To      |                 |                 |               |  |
|-----------------------------|---|---------------------------------|-----------------|-----------------|-----------------|---------------|--|
|                             |   | ns Made to<br>Subject<br>Device | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| Wave<br>review              | 240 hours of full-disclosure<br>waveforms and compressed<br>waveforms   | No change                       | A               | A               | A               | A             |  |
| NIBP<br>review              | Most recent 3000 NIBP measurements  | No change                       | A               | A               | A               | A             |  |
| Event review                | 3000 events   | No change                       | A               | A               | A               | A             |  |
| 12-lead<br>review           | 720 12-lead analysis<br>results, 12 analysis<br>waveforms for each<br>analysis result   | No change                       | A               | A               | A               | A             |  |
| ST review                   | Most recent 240 hours of ST segments  | No change                       | A               | A               | A               | A             |  |
| Cardiac<br>output<br>review | 720 measurements  | No change                       | A               | A               | A               | A             |  |
| Print                       | Patient information, real- time waveform, real-time alarm, Alarm Settings, Multi-lead ECG Report, CSA Report, waveform review, Arrhythmia Statistic Result, Trend Review, C.O. measurement, events, 12- lead Review, ST review, QT View Report, drug calculations, hemodynamics calculations, oxygenation calculations, ventilation calculations, ICG hemodynamic parameter, CCO hemodynamic parameter, SvO2/ScvO2 oxygenation parameters | No change                       | A               | A               | A               | A             |  |

| Feature          | As Cleared in K193391   | Modificatio                     | Applied To      |                 |                 |               |  |
|------------------|---|---------------------------------|-----------------|-----------------|-----------------|---------------|--|
|                  |   | ns Made to<br>Subject<br>Device | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| Records          | Patient information, real-time waveform, real-time alarm, waveform review, C.O. measurement, events, 12-lead Review, ST review, drug calculation, hemodynamics calculations, oxygenation calculations, ventilation calculations, ICG hemodynamic parameter, CCO hemodynamic parameter, SvO <sub>2</sub> /ScvO <sub>2</sub> oxygenation parameters | No change                       | A               | A               | A               | NA            |  |
| Data<br>storage  | The patient data will be saved in an encrypted file.  | No change                       | A               | NA              | NA              | NA            |  |
| ECG Featu        | res   |                                 |                 |                 |                 |               |  |
| ECG<br>Algorithm | Supports Mindray and<br>Mortara   | No change                       | A               | A               | A               | A             |  |
| ECG<br>Functions | 3-lead, 5-lead, 6-lead<br>selectable,<br>Arrhythmia detection, ST<br>segment analysis, QT<br>Analysis, Heart rate   | No change                       | A               | A               | A               | A             |  |
| HR               | Adult:  Range:15~300 bpm  Accuracy: ±1 bpm or ±1%, whichever is greater  Pediatric:  Range:15~350 bpm accuracy: ±1 bpm or ±1%, whichever is greater   | No change                       | A               | A               | A               | A             |  |
| ST               | Range: -2.0~2.0mV<br>Accuracy: ±0.02mV or<br>±10%, whichever is<br>greater, in the range of -<br>0.8mV to +0.8mV; not<br>specified in other range   | No change                       | A               | A               | A               | A             |  |

| Feature  | As Cleared in K193391   | Modificatio                     | Applied To      |                 |                 |  |  |
|--|---|---------------------------------|-----------------|-----------------|-----------------|--|--|
|  |   | ns Made to<br>Subject<br>Device | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer  |  |
| J Point<br>Auto<br>Detection                       | J-point Auto detection for ST algorithm. Supports automatically detecting the location of the J-point on the ST template.   | No change                       | A               | A               | A               | A  |  |
| ARR  | Mindray algorithm: Asystol, V-Fib/V-Tach, V-Tach, Vent Brady, Extreme Tachy, Extreme Brady, PVCs/min, Vent Rhythm, Couplet, Bigeminy Trigeminy, R on T, Run PVCs, PVC, Tachy, Brady, Missed Beats, Pacer Not Pacing, Pacer Not Capture, Multiform PVC, Nonsus V-Tach, Pause, Irr Rhythm, Pauses/min, and A-Fib  Mortara algorithm: Asystol, V-Fib, V-Tach, Vent Rhythm, Couplet, Run PVCs, PVCs/min, Bigeminy Trigeminy, R on T, Multiform PVC, Irr Rhythm, Tachy, Brady, Pacer Not Pacing, Pacer Not Capture, Extreme Tachy, Extreme Brady, Pause and Pauses/min | No change                       | A               | A               | A               | A (CMS Viewer receives ARR alarms from CentralSt ation and only displays ARR alarms, therefore there are no modificati on) |  |
| Adjustable<br>Leads for<br>Arrhythmi<br>a Analysis | Adjustable Leads for<br>Arrhythmia Analysis.<br>Supports selectable ECG<br>leads as primary detection<br>lead, secondary detection<br>lead and beat classification<br>lead for arrhythmia<br>analysis   | No change                       | A               | A               | NA              | NA   |  |

| Feature  | As Cleared in K193391   | Modificatio                     | Applied To      |                 |                 |               |  |
|----------|---|---------------------------------|-----------------|-----------------|-----------------|---------------|--|
|          |   | ns Made to<br>Subject<br>Device | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| QT       | Mindray algorithm:  | No change                       | A               | A               | A               | A             |  |
| Analysis | - QT measurement range: [200, 800] ms   |                                 |                 |                 |                 |               |  |
|          | <ul> <li>QT accuracy [200, 800]</li> <li>ms: ± 30 ms, beyond</li> <li>this range is not</li> <li>specified</li> </ul> |                                 |                 |                 |                 |               |  |
|          | - QT resolution: [200,<br>800] ms: 4 ms, beyond<br>this range is not<br>specified                                     |                                 |                 |                 |                 |               |  |
|          | - QTc measurement range: [200, 800] ms  |                                 |                 |                 |                 |               |  |
|          | - QTc resolution [200,<br>800] ms: 1 ms, beyond<br>this range is not<br>specified                                     |                                 |                 |                 |                 |               |  |
|          | - QT-HR measurement range: Adult: [15, 150] bpm, pediatric: [15, 180] bpm   |                                 |                 |                 |                 |               |  |
|          | Mortara algorithm:  |                                 |                 |                 |                 |               |  |
|          | - QT measurement range: [300, 600] ms   |                                 |                 |                 |                 |               |  |
|          | <ul> <li>QT accuracy [300, 600]</li> <li>ms: ± 30 ms, beyond</li> <li>this range is not</li> <li>specified</li> </ul> |                                 |                 |                 |                 |               |  |
|          | - QT resolution: [300, 600] ms: 2 ms, beyond this range is not specified  |                                 |                 |                 |                 |               |  |
|          | - QTc measurement range: [300, 600] ms  |                                 |                 |                 |                 |               |  |
|          | - QTc resolution [300, 600] ms: 1 ms, beyond this range is not specified  |                                 |                 |                 |                 |               |  |
|          | - QT-HR measurement range: Adult: [43, 130] bpm,  |                                 |                 |                 |                 |               |  |
|          | - pediatric: [43, 130] bpm  |                                 |                 |                 |                 |               |  |

| Feature   | As Cleared in K193391  | Modificatio  |                 | Applied To      |                 |               |  |
|---|--|--|-----------------|-----------------|-----------------|---------------|--|
|   |  | ns Made to<br>Subject<br>Device  | CentralSt ation | WorkSta<br>tion | ViewSta<br>tion | CMS<br>Viewer |  |
| QRS<br>Detection<br>Threshold   | Adjustable QRS Detection threshold.  QRS threshold range: 0.16-0.48mV.   | No change  | A               | A               | NA              | NA            |  |
| Pace mark   | Detects and marks pace pulse.  Amplitude: ±2 to ±700 mV  Duration: 0.1 to 2 ms  Rise time: 10 to 100 µs  | No change  | A               | A               | A               | A             |  |
| Pace pulse<br>rejection   | Meets the requirements of IEC60601-2-27 2011: Section 201.12.1.101.13. The following pulses without overshoot will be rejected: Amplitude: ±2 to ±700 mV Duration: 0.1 to 2 ms Rise time: 10 to 100 μs | No change  | A               | A               | A               | A             |  |
| New Featur  | es   |  |                 | 1               | l               | 1             |  |
| The system provides a resting 12 Lead interpretati on of previously stored data | Not provided   | Supports the user to select a period of waveform from the historical data storage to analyze, the result will be saved in 12 lead review | A               | A               | NA              | NA            |  |

# **Substantial Equivalence Conclusion**

In conclusion, the differences in respect to the indications for use and technological characteristics do not raise new questions of safety and effectiveness as compared to the predicate device.

To establish the substantial equivalence of the BeneVision Central Monitoring System, Mindray conducted functional and system level testing to validate the performance of the devices. The results of the bench testing show that the subject device meets its specifications and is substantially equivalent to the predicate device.

In addition, Mindray has conducted testing to ensure the subject devices meet relevant consensus standards.

### 7. PERFORMANCE DATA

### **Biocompatibility Testing**

Not applicable. The changes are just concerned with Software, not relate to Biocompatibility Testing.

# **Software Verification and Validation Testing**

Software verification and validation testing was conducted, and documentation was provided, as recommended by FDA's Guidance for Industry and FDA Staff, "Guidance for the Content of Premarket Submissions for Software Contained in Medical Devices." Verification of the BeneVision Central Monitoring System was conducted to ensure that the product works as designed. Validation was conducted to check the design and performance of the product.

### **Electrical safety and electromagnetic compatibility (EMC)**

Not applicable. The changes are just concerned with Software, not relate to Electrical safety and electromagnetic compatibility.

## **Bench Testing**

To establish the substantial equivalence of the BeneVision Central Monitoring System, Mindray conducted functional and system level testing to validate the performance of the devices. The results of the bench testing show that the subject device meets its accuracy specification, and is substantially equivalent to the predicate device.

In addition, Mindray has conducted testing to ensure the subject devices meet relevant consensus standards.

• IEC 60601-2-25:2011 Medical electrical equipment - Part 2-25: Particular requirements for the basic safety and essential performance of electrocardiographs

## **Animal Testing**

Not applicable. Animal studies are not necessary to establish the substantial equivalence of this device.

#### **Clinical Data**

Not applicable. Clinical testing is not required to establish substantial equivalence to the predicate device.

# 8. CONCLUSION

Based on the detailed comparison between the predicate devices and the subject devices, and the functional and system level testing, the BeneVision Central Monitoring System can be found substantially equivalent to the predicate devices.