

August 13th, 2025

Bruker Daltonics GmbH & Co. KG
Kirsten Webner
Director Regulatory Affairs
Fahrenheitstrasse 4
28359 Bremen, Germany

Re: K251495

Trade/Device Name: MBT Compass HT CA Software; MBT FAST Shuttle US IVD
Regulation Number: 21 CFR 866.3378
Regulation Name: Clinical Mass Spectrometry Microorganism Identification And Differentiation
System
Regulatory Class: Class II
Product Code: QBN,QNJ
Dated: May 15, 2025
Received: May 15, 2025

Dear Kirsten Webner:

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 and Part 809); 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,

JOSEPH BRIGGS -S

Joseph Briggs
Deputy Director
Division of Microbiology Devices
OHT7: Office of In Vitro Diagnostics
Office of Product Evaluation and Quality
Center for Devices and Radiological Health

Enclosure

Indications for Use

510(k) Number (if known)

K251495

Device Name

MBT Compass HT CA Software; MBT FAST Shuttle US IVD

Indications for Use (Describe)

The MBT Sepsityper is a qualitative in vitro diagnostic device consisting of an MBT-CA (Sepsityper) software extension and a reagent kit (MBT Sepsityper Kit US IVD) for use in conjunction with other clinical and laboratory findings to aid in the early diagnosis of bacterial and yeast infections from positively flagged blood cultures using the MALDI Biotyper CA System.

The MBT Sepsityper Kit US IVD is a disposable blood culture processing device that includes associated reagents that are intended to concentrate and purify microbial cells from blood culture samples identified as positive by a continuous monitoring blood culture system and confirmed to demonstrate the presence of a single organism as determined by Gram stain. This sample preparation manual method is performed by laboratory health professionals in a clinical diagnostic setting. Subculturing of positive blood cultures is necessary to recover organisms for identification of organisms not identified by the MBT-CA System, for susceptibility testing and for differentiation of mixed growth.

Positive MBT Sepsityper results do not rule out co-infection with organisms that may not be detected by the MBT-CA System. Results of the MBT Sepsityper should not be used as the sole basis for diagnosis, treatment, or other patient management decisions. Results of the MBT Sepsityper should be correlated with Gram stain results and used in conjunction with other clinical and laboratory findings to aid in the diagnosis of bacterial and yeast bloodstream infections.

Organisms recovered from positive blood culture bottles that are suitable for identification using the MBT Sepsityper Kit US IVD and MBT-CA Systems are listed in the MALDI Biotyper CA System Package Insert Reference Library.

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

I. SUBMITTER

Bruker Daltonics GmbH & Co. KG
Fahrenheitstraße 4
28359 Bremen, Germany
Phone: 004942122054860
Contact Person: Dr. Kirsten Webner
Date Prepared: 11th August 2025

II. DEVICE IDENTIFICATION

Product Names: MBT Compass HT CA and MBT FAST Shuttle US IVD to be used with MALDI Biotyper CA System; MALDI Biotyper smart CA System; MALDI Biotyper sirius CA System, MALDI Biotyper sirius one CA System and MBT Sepsityper (MBT-CA System)
Common Name: System, Mass Spectrometry, MALDI-TOF, Microorganism Identification, Cultured Isolates
Regulation Section: 21 CFR 866.3378
Device Class: Class II
Product Code(s): QBN; associated code: QNJ

III. PREDICATE DEVICE

Trade/Device Name: MBT-CA System with MBT Sepsityper
510(k) Submitter/Holder: Bruker Daltonics GmbH & Co. KG
510(k) Reference: K193419

IV. DEVICE DESCRIPTION

The MALDI Biotyper CA System uses MALDI (matrix-assisted laser desorption/ionization) TOF (time of flight) mass spectrometry technology for the identification of organisms isolated from clinical samples. Identification can be performed from an isolated colony or from a cell extract. The sample material is transferred to a target plate, dried and overlaid with a matrix. The MBT FAST Shuttle US IVD is an optional hardware tool that may be used for drying the samples deposited on the MALDI target plate under controlled conditions.

The MALDI process transforms the proteins and peptides from the isolated microorganisms into positively charged ions. This is achieved by irradiating the matrix-sample composite with a UV laser. The matrix absorbs laser energy and transfers protons to the intact proteins or peptides in the gas phase. These ions are electrostatically accelerated and arrive in the flight tube at a mass-dependent speed. Because different proteins/peptides have different masses, ions arrive at the detector at different times (time of flight). The MBT-CA System measures the time (in the nanosecond range) between pulsed acceleration and the corresponding detector signal of the ions, and the time is converted into an exact molecular mass.

The highly abundant microbial ribosomal proteins result in a mass spectrum with a characteristic mass and intensity distribution pattern. This pattern is species-specific for many bacteria and

yeasts and can be used as a 'molecular fingerprint' to identify a test organism. The spectrum of the unknown test organism, acquired through the software MBT Compass HT CA of the MBT-CA System, is electronically transformed into a peak list. Using a biostatistical algorithm, this peak list is compared to reference peak lists of organisms in the MBT-CA Reference Library and a log(score) between 0.00 and 3.00 is calculated. The higher the log(score), the higher the degree of similarity to a given organism in the MBT-CA Reference Library. The log(score) ranges reflect the probability of organism identification.

Table 1. Summary of all components of the system.

List of Components	Short description and Trade Name
Hardware	Mass Spectrometers: microflex LT/SH microflex LT/SH smart MALDI Biotyper sirius MALDI Biotyper sirius one
	Optional hardware used for sample preparation: MBT Shuttle, ergonomic target holder MBT FAST Shuttle US IVD for standardized and accelerated drying of matrix and other liquids MBT Pilot System - US IVD for guided sample transfer MBT Galaxy System - US IVD for liquid dispensing
Kits	Optional workflow: MBT Sepsityper Kit US IVD
Reagents	Calibration and Quality Control: US IVD Bacterial Test Standard (BTS) Matrix solution: US IVD HCCA portioned (α -Cyano-4-hydroxycinnamic acid)
Consumable (MALDI target plate)	US IVD 48 Spot Target (48 positions reusable steel targets)
	MBT Biotarget 96 US IVD (96 positions disposable targets)
Software	Instrument Control Software: flexControl
	Software with GUI and performing data analysis: MALDI Biotyper CA System software or MBT Compass HT CA
	Optional: MBT CA Sepsityper software extension (with MALDI Biotyper CA System software) or MBT HT Sepsityper CA Module (with MBT Compass HT CA)

V. INTENDED USE and INDICATIONS FOR USE

“The MALDI Biotyper CA System is a mass spectrometer system using matrix-assisted laser desorption/ionization - time of flight (MALDI-TOF) for the identification and differentiation of microorganisms cultured from human specimens.

The MALDI Biotyper CA System is a qualitative in vitro diagnostic device indicated for use in conjunction with other clinical and laboratory findings to aid in the diagnosis of bacterial and yeast infections.”

The MBT Sepsityper is a qualitative in vitro diagnostic device consisting of an MBT-CA (Sepsityper) software extension and a reagent kit (MBT Sepsityper Kit US IVD) for use in conjunction with other

clinical and laboratory findings to aid in the early diagnosis of bacterial and yeast infections from positively flagged blood cultures using the MALDI Biotyper CA System.

The MBT Sepsityper Kit US IVD is a disposable blood culture processing device that includes associated reagents that are intended to concentrate and purify microbial cells from blood culture samples identified as positive by a continuous monitoring blood culture system and confirmed to demonstrate the presence of a single organism as determined by Gram stain. This sample preparation manual method is performed by laboratory health professionals in a clinical diagnostic setting. Subculturing of positive blood cultures is necessary to recover organisms for identification of organisms not identified by the MBT-CA System, for susceptibility testing and for differentiation of mixed growth.

Positive MBT Sepsityper results do not rule out co-infection with organisms that may not be detected by the MBT-CA System. Results of the MBT Sepsityper should not be used as the sole basis for diagnosis, treatment, or other patient management decisions. Results of the MBT Sepsityper should be correlated with Gram stain results and used in conjunction with other clinical and laboratory findings to aid in the diagnosis of bacterial and yeast bloodstream infections.

Organisms recovered from positive blood culture bottles that are suitable for identification using the MBT Sepsityper Kit US IVD and MBT-CA Systems are listed in the MALDI Biotyper CA System Package Insert Reference Library.

VI. COMPARISON OF TECHNOLOGICAL CHARACTERISTICS WITH THE PREDICATE DEVICE

Table 2. Similarities and Differences between current and predicate devices.

	MBT-CA System with MBT Compass HT CA	MBT-CA System with MBT Sepsityper
Device Type	System	Same
Product Codes	QBN, QNJ	Same
General Device Description	Clinical mass spectrometry microorganism identification and differentiation system	Same
Type of Test	Automated Mass Spectrometry System	Same
Intended Use	The MALDI Biotyper CA System is a mass spectrometer system using matrix-assisted laser desorption/ionization - time of flight (MALDI-TOF) for the identification and differentiation of microorganisms cultured from human specimens. The MALDI Biotyper CA System is a qualitative in vitro diagnostic device indicated for use in conjunction with other clinical and laboratory findings to aid in the diagnosis of bacterial and yeast infections.	Same
Indications for Use (MBT Sepsityper)	The MBT Sepsityper is a qualitative in vitro diagnostic device consisting of an MBT-CA (Sepsityper) software extension and a reagent kit (MBT Sepsityper Kit US IVD) for use in conjunction with other clinical and laboratory findings to aid in	Same

	the early diagnosis of bacterial and yeast infections from positively flagged blood cultures using the MALDI Biotyper CA System. The MBT Sepsityper Kit US IVD is a disposable blood culture processing device that includes associated reagents that are intended to concentrate and purify microbial cells from blood culture samples identified as positive by a continuous monitoring blood culture system and confirmed to demonstrate the presence of a single organism as determined by Gram stain. This sample preparation manual method is performed by laboratory health professionals in a clinical diagnostic setting. Subculturing of positive blood cultures is necessary to recover organisms for identification of organisms not identified by the MBT-CA System, for susceptibility testing and for differentiation of mixed growth. Positive MBT Sepsityper results do not rule out co-infection with organisms that may not be detected by the MBT-CA System. Results of the MBT Sepsityper should not be used as the sole basis for diagnosis, treatment, or other patient management decisions. Results of the MBT Sepsityper should be correlated with Gram stain results and used in conjunction with other clinical and laboratory findings to aid in the diagnosis of bacterial and yeast bloodstream infections. Organisms recovered from positive blood culture bottles that are suitable for identification using the MBT Sepsityper Kit US IVD and MBT-CA Systems are listed in the MALDI Biotyper CA System Package Insert Reference Library.	
Sample Type	Isolated colonies, positive blood cultures	Same
Sample Preparation Procedure (workflow)	MBT-CA Workflows (DT, eDT, Ext) plus the MBT Sepsityper Workflows (DT, eDT, Ext)	Same
Sample preparation	Matrix solution (US IVD HCCA) is added to the inoculated target spot and dried. Solution can be deposited manually or with MBT Galaxy System. Drying can be performed at room temperature or with use of MBT FAST Shuttle US IVD.	Matrix solution (US IVD HCCA) is added to the inoculated target spot and dried. Solution can be deposited manually or with MBT Galaxy System. Drying can be performed at room temperature.
Sample measurement	Analysis uses MALDI-TOF mass spectrometry. A laser in the MALDI-TOF mass spectrometer irradiates the matrix sample, causing the matrix to evaporate quickly and to release positively charged	Same

	protein ions (“soft” ionization technique). The entirety of the protein masses results in a characteristic mass and intensity distribution of the proteins.	
Analyzed Mass Range	3,000 – 15,000 m/z (Isolated Colonies) 4,000 – 15,000 m/z (Sepsityper samples)	Same
Mass spectrometer Maintenance and Tuning	The MBT-CA System requires regular maintenance. Tuning can be performed remotely by Bruker support through Tune-Ups. The MBT Compass HT CA software has implemented IDeaTune. The IDeaTune utilizes measurement of the BTS-QC sample to keep a well-tuned MBT CA System in an optimal state.	The MBT-CA System requires regular maintenance. Tuning can be performed remotely by Bruker support through Tune-Ups.
Spectra Analysis – Algorithm	Finds the most similar reference pattern by matching all patterns from the reference pattern library against the peak list of the measured spectrum (of the unknown sample).	Same
Spectra Analysis – Library	All species of the reference library are listed in the Package Insert of the MBT-CA System and if reference library is updated than Release Notes are prepared.	Same
Output Design – final output	MALDI Biotyper CA System software demands going to the next preparation method to enhance low confidence results. MBT Compass HT CA allows for declaring a low confidence result as final (no other preparation method needed).	MALDI Biotyper CA System software demands going to the next preparation method to enhance low confidence results.
Output Design - log(score) Value thresholds (for different sample types)	Single colony from agar plate: • High Confidence ID: 2.00 - 3.00; • Low Confidence ID: 1.70 - 1.99; • No Organism ID Possible: 0.0 - 1.69 MBT Sepsityper Samples: • High Confidence ID: 1.80 - 3.00; • Low Confidence ID: 1.60 - 1.79; • No Organism ID Possible: 0.00 - 1.59	Same
Output Design - Mix culture hints	Single colonies: No Sepsityper samples: Yes	Same
Diagnostic Conclusions	Provides an aid to diagnosis after identification of unknown microorganisms (bacteria and yeasts).	Same
Software access control	In MALDI Biotyper CA System software no authentication is required when starting the software and no support for the 21 CFR Part 11 regulations. In MBT Compass HT CA user management for controlling accessibility of software features based on dedicated user roles are offered and additional features for supporting 21 CFR Part 11 compliance are implemented.	In MALDI Biotyper CA System software no authentication is required when starting the software and no support for the 21 CFR Part 11 regulations.
User	Medical Specialist in Microbiology / Laboratory Physician and Technical Assistant	Same

Comparison of Intended use and Indications for use

Addition of MBT Compass HT CA and MBT FAST Shuttle US IVD to the MBT-CA System does not alter the Intended Use or Indications for Use, therefore, they are identical to predicate device.

Comparison of Technological characteristics

MBT-CA System with MBT Compass HT CA and MBT-CA System with MBT Sepsityper have the following identical/similar characteristics that support substantial equivalence in terms on intended use:

- System devices where mass spectrometry is used for identification of microorganisms
- Same sample preparation procedure with the same reagents, kits and consumable to be used
- Same reagent for quality control and calibration
- Optional hardware tools for sample preparation
- Samples are measured by mass spectrometer which is controlled by the identical software and use the same power source
- The same technique and parameters are used for measurement
- Software with user interface where samples are indicated, and output is presented
- Analysis of obtained spectra is performed in the software directly after measurement
- For data analysis software uses the same algorithm for matching measured spectra with those of the reference pattern library
- Similar or identical outputs are provided
- Both are for professional use only by users with same user profile
- Both are to be used in the same setting
- Both are qualitative IVD medical devices which provide aid to the diagnosis.

The following technological characteristics of the MBT-CA System with MBT Compass HT CA are absent in the Predicate Device:

MBT-CA System with MBT Compass HT CA provides additional optional hardware namely MBT FAST Shuttle US IVD. This hardware provides option of drying samples deposited on the MBT Biotarget 96 US IVD (consumable) at well-defined temperature instead of drying at room temperature.

MBT-CA System with MBT Compass HT CA provides also option of new software which can use all processor cores for parallel calculation of results. This change decreases time required to obtain results but has no effect on output content. Small changes allow user to easier handling this software, have better judgment of the provided outcome and ease use of the software. In addition, to allow better access control different user roles are now specified, electronic records and electronic signatures are supported according to 21 CFR Part 11 regulations. In addition, for Maintenance and Tuning of mass spectrometer function called IDealTune has been implemented. All above mentioned changes are implemented to increase ease of use and security of MBT Compass HT CA and does not provide aid to the diagnosis.

Based on previously obtained results MBT Compass HT CA allows for declaring a low confidence result as final (no other preparation method needed). As consequence the low confidence results will provide aid to diagnosis.

Described technological differences does not adversely affect safety and effectiveness of the device.

VII. PERFORMANCE DATA

MBT-CA System with MBT Compass HT CA Performance Validation was performed to evaluate performance of two new components of the MBT-CA System.

For MBT FAST Shuttle US IVD:

- the non-clinical validation evaluated the performance of the MBT FAST Shuttle US IVD against the cleared workflows of the predicate device, ensured safety, repeatability, reproducibility and provided support of the claim of accelerated drying time.

For MBT Compass HT CA:

- the non-clinical validation was used to validate MBT Compass HT CA outputs against defined MBT Compass HT CA inputs and User Requirements. Verification and validation activities established the safety and performance characteristics of the subject device with respect to the predicate device. Additionally, cybersecurity threat assessment was performed, and all appropriate controls were implemented and verified to ensure safety of the subject device.

Analytical validation activities were performed to assess the inclusion of low confidence results as final results and the effectiveness of IDealTune for mass spectrometer maintenance and tuning.

MBT FAST Shuttle US IVD

Non-clinical test - Electromagnetic compatibility (EMC)

Following FDA Guidance „Electromagnetic Compatibility (EMC) of Medical Devices” (June 6, 2022) the test methods of IEC 61326-1 and IEC 61326-2-6 have been applied, and the EMC tests are passed. In addition, the MBT FAST Shuttle US IVD with operating mode “Sample drying” complies with the EMC test levels of IEC 60601-1-2.

Electrical, Mechanical and Thermal (EMT)

Safety: The device complies with IEC 61010-1, IEC 61010-2-010, IEC 61010-2-101 as well as to the national versions for the US (UL standards) and Canadian market (CAN/CSA standards).

Precision (Repeatability/Reproducibility) Study

Repeatability:

This bench top testing was performed at one site and its goal was to assess the repeatability of identification of microorganisms using the MBT CA System with the option of MBT FAST Shuttle US IVD for the drying procedure. Microorganisms consisting of aerobic and anaerobic Gram-negative and Gram-positive bacteria, and yeast organisms were tested in the three sample preparation methods (DT, eDT and Ext) of MBT and Sepsityper workflows. Microbial samples and BTS (quality control) were applied to MBT Biotarget 96 and dried at 35 ($\pm$ 1) °C using the MBT FAST Shuttle. In the next step Matrix HCCA-portioned was applied and again dried at 35 ($\pm$ 1) °C using the MBT FAST Shuttle. Samples were measured with the MBT System and obtained mass spectra were analysed using MBT Compass software and library. One operator performed the DT, eDT, and Ext procedure ten (10) times for each out of 2 runs for MBT and Sepsityper workflows. In total 120 mass spectra were obtained. The number of correct identification results was used to determine the percentage of correct results for each method and workflow. Summary results are given in Table 3.

Table 3. Repeatability-MBT and Sepsityper workflows, matched percentages of correct results (%).

Method	MBT workflow		Sepsityper workflow	
	Run 1	Run 2	Run 1	Run 2
DT	100	90	100	100
eDT	90	100	100	100
Ext	100	100	100	100
Average	96.67	96.67	100	100
Overall average	96.67		100	

Reproducibility:

This testing was performed at 3 sites (for site to site comparison) and at one site (for subsequent comparisons) and its goal was to assess reproducibility of identification of microorganisms using the MBT CA System with option of MBT FAST Shuttle US IVD for the drying procedure. Microorganisms consisting of aerobic and anaerobic Gram-negative and Gram-positive bacteria, and yeast organisms in three sample preparation methods, DT, eDT and Ext were used in MBT and Sepsityper workflows. All study sites used the same set of 10 microorganisms for the study allowing for direct comparison of results. Triplicates of results from each study site were obtained to allow statistical analysis. The same sample preparation procedure as described for repeatability was followed. The results are shown in Tables 4-7.

Table 4. Site to Site comparison of number of correctly identified samples using MBT FAST Shuttle in MBT and Sepsityper workflows.

Type of workflow	Number of samples per study site	% Correctly Identified Samples			
		Site 1	Site 2	Site 3	Total
MBT workflow (DT+eDT+Ext)	900	888/900 (98.3%)	856/900 (95.1%)	876/900 (97.3%)	2617/2700 (96.9%)
Sepsityper workflow (DT+eDT+Ext)	450	445/450 (98.8%)	384/450 (85.3%)	375/450 (83.3%)	1204/1350 (89.1%)

Table 5. MBT FAST Shuttle-to-MBT FAST Shuttle comparison of number of correctly identified samples using MBT FAST Shuttle in MBT and Sepsityper workflows.

Type of workflow	Number of samples per MBT FAST Shuttle	% Correctly Identified Samples			
		MBT FAST Shuttle 1	MBT FAST Shuttle 2	MBT FAST Shuttle 3	Total
MBT workflow (DT+eDT+Ext)	360	347/360 (96.4%)	337/360 (93.6%)	348/360 (96.7%)	1032/1080 (95.6%)
Sepsityper workflow (DT+eDT+Ext)	180	177/180 (98.3%)	177/180 (98.3%)	177/180 (98.3%)	531/540 (98.3%)

Table 6. Operator to Operator comparison of number of correctly identified samples using MBT FAST Shuttle in MBT and Sepsityper workflows.

Workflow	Number samples of per operator	% Correctly Identified Samples		
		Operator 1	Operator 2	Total
MBT workflow (DT+eDT+Ext)	450	438/450 (97.3%)	447/450 (99.3%)	885/900 (98.3%)

Sepsityper workflow (DT+eDT+Ext)	225	224/225 (99.6%)	221/225 (98.2%)	445/450 (98.9%)
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Table 7. Day to Day comparison of number of correctly identified samples using MBT FAST Shuttle in MBT and Sepsityper workflows.

Workflow	Number of samples per day	% Correctly Identified Samples					
		Day 1	Day 2	Day 3	Day 4	Day 5	Total
MBT workflow (DT+eDT+Ext)	180	177/180 (98.3%)	178/180 (98.9%)	174/180 (96.7%)	179/180 (99.4%)	176/180 (97.8%)	884/900 (98.2%)
Sepsityper workflow (DT+eDT+Ext)	90	89/90 (98.9%)	88/90 (97.8%)	90/90 (100%)	90/90 (100%)	88/90 (97.8%)	445/450 (98.9%)

Method comparison Study – Sample drying

This comprehensive study was performed at three sites and its goal was to assess the performance of the sample drying device MBT FAST Shuttle – US IVD in comparison to the sample drying at room temperature. Ten (10) microorganisms covering aerobic and anaerobic Gram-negative and Gram-positive bacteria as well as yeast were also shipped to both US study sites. One operator at each study site performed the DT, eDT, and Ext procedure with each of the ten (10) strains and a blood culture using both drying methods. In total, these thirty-one (31) samples were spotted in triplicates resulting in ninety-three (93) mass spectra. This number of mass spectra was available from all three (3) study sites. Finally, 279 mass spectra of air-dried (RT, 20 – 25 °C) and 279 mass spectra of MBT FAST Shuttle drying process were generated. The log(score) values obtained for each spectrum from all study sites and preparation methods were used to calculate results shown in Table 8.

Table 8. Summary of Log(score) results from three study sites for samples prepared with DT, eDT, Ext and Sepsityper methods where samples were dried at room temperature or using MBT FAST Shuttle.

Study site	Sample preparation method	Number of spots	Log(score)		
			Log(score) means $\pm$ SD Air-dried samples	Log(score) means $\pm$ SD MBT FAST Shuttle dried samples	Log(score) means (Air-dried samples) – (MBT FAST Shuttle dried samples)
All	DT	90	2.30 $\pm$ 0.21	2.27 $\pm$ 0.32	0.03
All	eDT	90	2.26 $\pm$ 0.33	2.32 $\pm$ 0.32	-0.06
All	Ext	90	2.43 $\pm$ 0.14	2.43 $\pm$ 0.14	0
All	Sepsityper	9	2.17 $\pm$ 0.21	2.27 $\pm$ 0.15	-0.1
Study site 1	All	93	2.24 $\pm$ 0.33	2.26 $\pm$ 0.31	-0.02
Study site 2	All	93	2.34 $\pm$ 0.19	2.34 $\pm$ 0.31	0
Study site 3	All	93	2.40 $\pm$ 0.19	2.42 $\pm$ 0.16	-0.02
All	All	279	2.32 $\pm$ 0.25	2.34 $\pm$ 0.28	-0.02

Method comparison Study - Accelerated drying time (claim)

This bench top testing was performed at one study site and its goal was to assess drying time of microbial samples, reagents as well as HCCA Matrix by incubation at 35 ± 1 °C using the MBT FAST Shuttle. As reference the time needed to dry samples under routine conditions was used. A set of ten (10) different microorganisms was prepared by DT, eDT and Ext method and BTS was also prepared on MBT Biotarget 96. All spots were dried under routine conditions [RT, (20 – 25) °C] and applying the MBT FAST Shuttle drying process at elevated temperatures [$35 \pm (1)$ °C]. Drying times were measured and compared for both drying procedures. Three (3) independent test series of drying times were performed with two (2) time intervals each (15 and 30 minutes). Table 9 presents summarised drying times for all methods.

Table 9. Summary of drying times for samples prepared with DT, eDT, Ext, BTS methods where samples were dried at room temperature or using MBT FAST Shuttle.

Test set	Sample preparation method	Air drying Time (minutes)	MBT FAST Shuttle drying times (average between 15 and 30 minutes intervals)
Test set one	DT	12.95	6.45
	eDT	24.88	12.46
	Ext	21.02	11.25
	IVD BTS	22.12	8.34
Extended test set (average of two test series)	DT	7.8	2.47
	eDT	21.58	7.65
	Ext	12.8	4.80
Mean		17.59	7.63
95% confidence intervals		13.38; 21.81	3.41; 11.85

MBT Compass HT CA

Non-clinical evaluation of equivalency between the *MBT Compass HT CA* software and its predecessor *MBT-CA-SW*

Software Verification and Validation Testing

Software verification and validation testing was conducted and documented in accordance with *2023 Content of Premarket Submissions for Device Software Functions, Guidance for Industry and Food and Drug Administration Staff*. Product Design and Software Requirements Traceability has been documented and verified against verification and validation test results. Verification and validation testing includes:

1. Code Review
2. Unit level testing
3. System level testing including MBT HT Sepsityper CA Module

To ensure cybersecurity of the current device vulnerability testing and penetration testing was conducted and documented in accordance with *2023 Cybersecurity in Medical Devices: Quality System Considerations and Content of Premarket Submissions*.

Analytical performance supportive data – low confidence results

A retrospective non-interventional validation was performed using data previously obtained and used for clearance of the previous versions of the MBT-CA System (K130831, K142677, K 163536, K193419). This in-silico study aimed to validate if low confidence results (also referred as yellow log(scores)) can be generally accepted as final results and to confirm that yellow log(scores) generated by DT and/or eDT preparation methods show no significant differences of species identification compared to Ext preparation method.

Altogether, 15,270 spectra measured and identified in clinical studies were used out of which 1,670 yellow log(scores) were re-analyzed and evaluated in terms of their correctness. Isolates from clinical routine were used to compare the results of the MBT-CA System against a gold standard (16S sequencing). Out of the 1,670 DT/eDT samples with low-confidence log(scores), 1,269 samples showed high-confidence species identification results after applying Ext. Only 7 samples out of the 1,269 samples (0.55%) showed a different result after applying Ext sample preparation compared to DT/eDT. The Ext sample preparation would potentially “correct” the initial DT/eDT result in these 7 cases. All samples with different identifications between DT/eDT and Ext did not express incorrect identifications but could be fully justified by applying polyphasic taxonomic rules or have already been addressed by improvement of the MSP reference library.

Supportive Validation Data - IDealTune

The performance of IDealTune (the Auto-Tuning) feature of MBT Compass HT CA software was validated at two laboratory sites. Information about the results of BTS quality check (BTS-QC) was collected from systems with installed MBT Compass HT CA with IDealTune feature under normal operating conditions.

The BTS-QC passing rate was defined as the ratio of the number of MBT runs with passed BTS-QC to the overall number of MBT runs. The number of times when IDealTune functionality performed adjustments was also determined.

Results are shown in Table 10.

Table 10. Summary of observed parameters in two study sites.

Site	Study duration	IDEalTune adjustments event count	Number of BTS-QC	BTS-QC Pass Rate (after BTS preparation adjustment)
Site 1	17 months	24	133	99%
Site 2	14 months	9	76	100%

Summary non-clinical tests:

For MBT FAST Shuttle US IVD:

Presented repeatability and reproducibility results complement each other. It has been shown that for both workflows and for all the methods very high repeatability is obtained when samples are dried using MBT FAST Shuttle. No significant difference was also observed in reproducibility of microorganism identification between different sites, different MBT FAST Shuttle, for different operators or in day-to-day comparison.

It has been shown that no significant difference is observed in the species identification and obtained log(scores) results for all sample preparation methods when samples are air-dried or dried using MBT FAST Shuttle. Presented results identify MBT FAST Shuttle US IVD as appropriate alternative to air-drying of samples. These results indicate that safety and effectiveness profile of MBT-CA System with MBT Compass HT CA is like the predicate device.

It has been shown that significantly shorter drying time is needed for all sample preparation methods when dried using MBT FAST Shuttle than during air (RT) drying. These results indicate that option of MBT FAST Shuttle US IVD will increase effectiveness of current device in comparison to predicate by decreasing sample drying time and consequently sample preparation time.

For MBT Compass HT CA:

Between current and predicate devices there is no change to the inputs, spectra analysis algorithm, reference library and outputs used as aid to diagnosis. Therefore, the regression testing and testing of new requirements presents sufficient evidence of substantial equivalence determination. In addition, it has been shown that quality test is passed by the acquisition system for longer time than when automatic tuning is not used and that with IDealTune no tune-ups are required for over a year. Verification and validation activities established the safety and performance characteristics of the subject device with respect to the predicate device.

It has been shown that only small fraction (0.55%) of microorganisms identified with low confidence when DT and eDT methods are used will be inconsistent with results obtained using Ext method. These results indicate that safety and performance profile of MBT-CA System with MBT Compass HT CA is like the predicate device and low confidence identification can be accepted as a final result.

VIII. CONCLUSIONS

The current device differs from the predicate device only by including two components: MBT Compass HT CA software and MBT FAST Shuttle US IVD, an optional instrument for drying samples. The extensive method comparison testing in combination with repeatability and reproducibility testing was performed to show that MBT FAST Shuttle US IVD is an appropriate alternative to air-drying of samples.

The software verification and validation demonstrate that the MBT Compass HT CA software performs as intended in the specified use conditions.

Therefore, MBT-CA System with MBT Compass HT CA is substantially equivalent to the predicate device in its intended use and technical characteristics. Any differences between the subject and the predicate device have no significant influence on safety or effectiveness. MBT-CA System with MBT Compass HT CA is at least as safe and effective as the legally marketed predicate device, as established through performance testing. Therefore, MBT-CA System with MBT Compass HT CA raises no new issues of safety or effectiveness when compared to the predicate device.