April 15, 2026

Q-Linea AB
Camilla Russell
Regulatory Affairs Specialist
Dag Hammarskjölds Väg 52 A
Uppsala, SE 75237 SWE

Re: K253573
Trade/Device Name: ASTar BC G- Kit
Regulation Number: 21 CFR 866.1650
Regulation Name: A cellular analysis system for multiplexed antimicrobial susceptibility testing
Regulatory Class: Class II
Product Code: SAN, LON
Dated: March 16, 2026
Received: March 16, 2026

Dear Camilla Russell:

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.

FDA's substantial equivalence determination also included the review and clearance of your Predetermined Change Control Plan (PCCP). Under section 515C(b)(1) of the Act, a new premarket notification is not required for a change to a device cleared under section 510(k) of the Act, if such change is consistent with an established PCCP granted pursuant to section 515C(b)(2) of the Act. Under 21 CFR 807.81(a)(3), a new

premarket notification is required if there is a major change or modification in the intended use of a device, or if there is a change or modification in a device that could significantly affect the safety or effectiveness of the device, e.g., a significant change or modification in design, material, chemical composition, energy source, or manufacturing process. Accordingly, if deviations from the established PCCP result in a major change or modification in the intended use of the device, or result in a change or modification in the device that could significantly affect the safety or effectiveness of the device, then a new premarket notification would be required consistent with section 515C(b)(1) of the Act and 21 CFR 807.81(a)(3). Failure to submit such a premarket submission would constitute adulteration and misbranding under sections 501(f)(1)(B) and 502(o) of the Act, respectively.

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 Management System Regulation (QMSR) (21 CFR Part 820), which includes, but is not limited to, ISO 13485 clause 7.3 (Design controls), ISO 13484 clause 8.3 (Nonconforming product), and ISO 13485 clause 8.5 (Corrective and preventative action). Please note that regardless of whether a change requires premarket review, the QMSR requires device manufacturers to review and approve changes to device design and production (ISO 13485 clause 7.3 and 21 CFR 820.70) and document changes and approvals in the Medical Device File (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 Management System Regulation (QMSR) (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,

Ribhi Shawar -S

Ribhi Shawar, Ph.D. (ABMM)
Branch Chief
General Bacteriology and Antimicrobial Susceptibility Branch
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

Form Approved: OMB No. 0910-0120
Expiration Date: 07/31/2026
See PRA Statement below.

510(k) Number *(if known)*
K253573

Device Name
ASTar BC G- Kit

Indications for Use *(Describe)*
The ASTar System, comprised of the ASTar Instrument with the ASTar BC G− Kit (ASTar BC G− Consumable kit, ASTar BC G− Frozen insert, and ASTar BC G− Kit software), utilizes high-speed, time-lapse microscopy imaging of bacteria for the in vitro, quantitative determination of antimicrobial susceptibility of on-panel Gram-negative bacteria. The test is performed directly on positive blood culture samples signaled as positive by a continuous monitoring blood culture system and confirmed to contain Gram-negative bacilli by Gram stain. Organism identification is required for AST result interpretation and reporting.

Test results from the ASTar BC G− Kit should be interpreted in conjunction with other clinical and laboratory findings. Standard laboratory protocols for processing positive blood cultures should be followed to ensure availability of isolates for supplemental testing. Sub-culturing is necessary to support further testing for: bacteria and antimicrobials not on the ASTar BC G− panel, where inconclusive results are obtained, epidemiologic testing, recovery of organisms present in microbial samples, and susceptibility testing of bacteria in polymicrobial samples.

Testing is indicated for Acinetobacter spp., Enterobacterales, and Pseudomonas aeruginosa, as recognized by the FDA Susceptibility Test Interpretive Criteria (STIC). The ASTar BC G- Kit with ASTar system has demonstrated acceptable performance with the following organisms:

Amikacin: Acinetobacter spp. (Acinetobacter baumannii complex), Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Ampicillin: Enterobacterales (Escherichia coli, Proteus mirabilis)

Ampicillin-sulbactam: Acinetobacter spp. (Acinetobacter baumannii complex), Enterobacterales (Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris)

Aztreonam: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Cefazolin: Enterobacterales (Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus mirabilis)

Cefepime: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Cefotaxime: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Cefoxitin: Enterobacterales (Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae group,

Proteus mirabilis)

Ceftazidime: Acinetobacter spp. (Acinetobacter baumannii complex), Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Ceftazidime-avibactam: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumonae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Ceftolozane-tazobactam: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumonae group, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Ceftriaxone: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumonae group, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Cefuroxime: Enterobacterales (Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis)

Ciprofloxacin: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Ertapenem: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumonae group, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Gentamicin: Enterobacterales (Citrobacter freundix complex, Citrobacter koseri, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Levofloxacin: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens) and Pseudomonas aeruginosa

Meropenem: Acinetobacter spp. (Acinetobacter baumannii complex), Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens), and Pseudmonas aeruginosa

Meropenem-vaborbactam: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Piperacillin-tazobactam: Acinetobacter spp. (Acinetobacter baumannii complex) and Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Escherichia coli, Klebsiella aerogenes, Klebsiella pneumoniae group, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens)

Tigecycline: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Serratia marcescens)

Tobramycin: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Proteus mirabilis, Proteus vulgaris) and Pseudomonas aeruginosa

Trimethoprim-sulfamethoxazole: Enterobacterales (Citrobacter freundii complex, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae group, Morganella morganii, Proteus vulgaris)

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) Substantial Equivalence Determination Performance Summary in Compliance with Section 807.92(c)

Date of Submission: **March 16, 2026**

1 CONTACT DETAILS

Submitter: Q-linea AB
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2 DEVICE

Name of Device:	ASTar® BC G- Kit with ASTar Instrument
Common or Usual Name:	ASTar BC G- Kit with ASTar Instrument
Regulation Name:	A cellular analysis system for multiplexed antimicrobial susceptibility testing
Regulation Number:	21 CFR 866.1650
Regulatory Class:	Class II
Product Code:	SAN, LON
Predicate Device:	K221688 ASTar BC G- Kit with ASTar Instrument

2.1 Purpose for the Submission

With this submission Q-linea aims to expand existing ASTar BC G- Kit panel with additional antimicrobials, and antimicrobial and organism combinations resulting in ASTar BC G- Kit software version 2. The aim is to obtain a substantial equivalence determination for (1) the addition of the following antimicrobial agents to ASTar BC G- Kit: Cefotaxime, Cefoxitin, Ceftolozane-tazobactam, Ceftriaxone and Ertapenem, (2) the addition of further organisms to cleared antimicrobials, and (3) removal of limitations for some antimicrobial and organism combinations where claims could not be established in K221688.

In addition, the clinical breakpoints for categorical interpretation are updated to FDA recognized Susceptibility Test Interpretive Criteria (STIC) current as of February 5, 2026, based on CLSI M100, 36th Ed., 2026 Performance Standard unless otherwise specified by FDA.

Type of test

ASTar BC G- Kit is used with ASTar Instrument for fully automated rapid antimicrobial susceptibility testing (AST) of positive blood cultures samples containing Gram-negative bacteria.

Cleared antimicrobial/organism combinations (K221688):

- Amikacin: Enterobacterales (*Citrobacter freundii, Enterobacter cloacae complex, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Serratia marcescens*), *Pseudomonas aeruginosa*
- Ampicillin: Enterobacterales (*Escherichia coli, Proteus mirabilis*)
- Ampicillin-sulbactam: Enterobacterales (*Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris*)
- Aztreonam: Enterobacterales (*Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)
- Cefazolin: Enterobacterales (*Klebsiella pneumoniae*)
- Cefepime: Enterobacterales (*Citrobacter freundii, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), *Pseudomonas aeruginosa*
- Ceftazidime: Enterobacterales (*Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)
- Ceftazidime-avibactam: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Enterobacter cloacae* complex, *Klebsiella oxytoca, Proteus mirabilis, Serratia marcescens*), *Pseudomonas aeruginosa*
- Cefuroxime: Enterobacterales (*Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis*)
- Ciprofloxacin: Enterobacterales (*Citrobacter koseri*, *Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), *Pseudomonas aeruginosa*
- Gentamicin: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), *Pseudomonas aeruginosa*
- Levofloxacin: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), *Pseudomonas aeruginosa*
- Meropenem: *Acinetobacter* spp. (*Acinetobacter baumannii),* Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Escherichia coli*, *Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), *Pseudomonas aeruginosa*

- Meropenem-vaborbactam: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus mirabilis, Serratia marcescens*)
- Piperacillin-tazobactam: Enterobacterales (*Citrobacter koseri, Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)
- Tigecycline: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Serratia marcescens*)
- Tobramycin: Enterobacterales (*Citrobacter freundii, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Serratia marcescens*)
- Trimethoprim-sulfamethoxazole: Enterobacterales (*Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae, Proteus vulgaris*)

Claimed antimicrobial/organism combinations (Current Submission K253573):

New antimicrobial agents:

- Cefotaxime: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)
- Cefoxitin: Enterobacterales (*Citrobacter koseri, Escherichia coli*, *Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus mirabilis*)
- Ceftolozane-tazobactam: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri*, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis*, *Proteus vulgaris*, *Serratia marcescens*), *Pseudomonas aeruginosa*
- Ceftriaxone: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)
- Ertapenem: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Additional organisms to cleared antimicrobials:

- Amikacin: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter koseri, Escherichia coli*, *Morganella morganii, Proteus vulgaris)*
- Ampicillin-sulbactam: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter koseri, Morganella morganii)*
- Aztreonam: Enterobacterales (*Citrobacter freundii* complex, *Morganella morganii), Pseudomonas aeruginosa*
- Cefazolin: Enterobacterales (*Citrobacter koseri*, *Escherichia coli*, *Klebsiella oxytoca, Proteus mirabilis)*
- Cefepime: Enterobacterales (*Citrobacter koseri*, *Enterobacter cloacae* complex)
- Ceftazidime: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Klebsiella aerogenes, Morganella morganii)*

- Ceftazidime-avibactam: Enterobacterales (*Escherichia coli*, *Klebsiella aerogenes, Klebsiella pneumoniae* group, *Morganella morganii, Proteus vulgaris)*
- Cefuroxime: Enterobacterales (*Citrobacter koseri*)
- Ciprofloxacin: Enterobacterales (*Citrobacter freundii* complex*, Morganella morganii)*
- Gentamicin: Enterobacterales (*Morganella morganii)*
- Levofloxacin: Enterobacterales (*Morganella morganii)*
- Meropenem: Enterobacterales (*Enterobacter cloacae* complex, *Klebsiella aerogenes*, *Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii)*
- Meropenem-vaborbactam: Enterobacterales (*Morganella morganii, Proteus vulgaris)*
- Piperacillin-tazobactam: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter freundii* complex, *Klebsiella aerogenes, Morganella morganii)*
- Tobramycin: Enterobacterales (*Klebsiella aerogenes, Klebsiella oxytoca, Proteus vulgaris), Pseudomonas aeruginosa*
- Trimethoprim-sulfamethoxazole: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri, Morganella morganii)*

Breakpoint updates:

The FDA STIC in ASTar BC G- Kit software (cleared in K221688) was current as of April 21, 2023 (based on CLSI M100 33rd ed.). The latest updated version of FDA STIC is current as of February 5, 2026 (based on CLSI M100 36th ed.), affects the following antimicrobial/organism combinations cleared in ASTar BC G- Kit (K221688):

- Amikacin: Enterobacterales (*Citrobacter freundii* complex, *Enterobacter cloacae* complex, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis*, *Serratia marcescens*), *Pseudomonas aeruginosa*
- Cefepime: Enterobacterales (*Citrobacter freundii* complex, *Escherichia coli*, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis*, *Serratia marcescens*), *Pseudomonas aeruginosa*
- Gentamicin: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis*, *Proteus vulgaris*, *Serratia marcescens*), *Pseudomonas aeruginosa*
- Tobramycin: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli*, *Proteus mirabilis*, *Serratia marcescens*)

Removal of limitations included in the cleared ASTar BC G- Kit (K221688):

Limitations present in K221688 but removed in the current submission (K253573) are listed below. For removal of limitations, clinical testing was performed as part of the clinical study associated with K253573. A few limitations were removed as a result of updated clinical breakpoints, see 6.8.3.

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:
    - Amikacin: *Acinetobacter baumannii* complex*, Escherichia coli, Proteus vulgaris*
    - Ampicillin-sulbactam: *Acinetobacter baumannii* complex

- Aztreonam: *Escherichia coli* when the ASTar MIC is 0.5 µg/mL due to one very major discrepancy, *Citrobacter freundii* complex*, Pseudomonas aeruginosa*
- Cefazolin: *Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Proteus mirabilis*
- Cefepime: *Enterobacter cloacae* complex, *Proteus vulgaris* when the ASTar MIC is 32 µg/mL due to one major discrepancy
- Cefotaxime: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*
- Ceftazidime: *Acinetobacter baumannii* complex*, Citrobacter freundii* complex*, Citrobacter koseri, Klebsiella aerogenes*
- Ceftazidime-avibactam*: Escherichia coli, Klebsiella aerogenes, Klebsiella pneumoniae* group
- Ceftolozane-tazobactam: *Citrobacter freundii* complex, *Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Serratia marcescens*
- Ceftriaxone: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Serratia marcescens*
- Cefuroxime: *Citrobacter koseri*
- Ciprofloxacin: *Citrobacter freundii* complex
- Ertapenem: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*
- Meropenem: *Enterobacter cloacae* complex*, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group
- Piperacillin-tazobactam: *Escherichia coli* when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy, *Klebsiella pneumoniae* group when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy*, Acinetobacter baumannii* complex*, Citrobacter freundii* complex*, Klebsiella aerogenes*
- Tobramycin: *Klebsiella pneumoniae* group when the ASTar MIC is 4.0 µg/mL due to one very major discrepancy, *Klebsiella aerogenes, Klebsiella oxytoca, Proteus vulgaris, Pseudomonas aeruginosa*
- Trimethoprim-sulfamethoxazole: *Citrobacter freundii* complex

- The ability of the ASTar System to detect resistance in the following antimicrobial/organism combinations:
  - Amikacin: *Klebsiella pneumoniae* group, *Pseudomonas aeruginosa*
  - Cefepime: *Citrobacter koseri*
  - Gentamicin: *Proteus mirabilis*, *Pseudomonas aeruginosa*
  - Tobramycin: *Escherichia coli*

Changes made to ASTar BC G- Kit:

The kit software used for result reporting in ASTar BC G- Kit is updated to improve performance for those antimicrobial and organism combinations where claims could not be established in K221688 to enable the removal of limitations. It is also updated for the following combinations cleared in K221688 to enable the removal of limitations:

- Aztreonam / *Escherichia coli*
- Cefepime / *Proteus vulgaris*
- Piperacillin-tazobactam / *Escherichia coli*
- Piperacillin-tazobactam / *Klebsiella pneumoniae* group
- Tobramycin / *Klebsiella pneumoniae* group

The nomenclature for *Acinetobacter baumannii*, *Citrobacter freundii*, *Enterobacter cloacae* complex (refers to *E. cloacae*, *E. hormachei* and *E. asburiae* in K221688) and *Klebsiella pneumoniae* are updated to report AST results for groups/complexes, i.e:

- *Acinetobacter baumannii* complex
- *Citrobacter freundii* complex
- *Enterobacter cloacae* complex
- *Klebsiella pneumoniae* group

3 DEVICE DESCRIPTION

ASTar System is a fully automated system for antimicrobial susceptibility testing (AST). It consists of the ASTar Instrument which is used in combination with dedicated application kits. The ASTar BC G- Kit consists of the ASTar BC G- Consumable kit, ASTar BC G- Frozen insert, and ASTar BC G- Kit software which must be installed on the instrument to process the kit.

The system provides robust and consistent inoculum preparation for AST and utilizes high-speed, time-lapse microscopy imaging of pathogens in broth microdilution to determine minimum inhibitory concentration (MIC) and qualitative susceptibility results. Organism identification using an approved method is required to be entered into the ASTar Instrument for results to be reported. The instrument is designed to carry out sample preparation of up to six samples in parallel, using a dedicated ASTar Cartridge consumable for each sample. In the subsequent AST culturing step, the instrument transfers the prepared sample into a second dedicated consumable, referred to as the ASTar Disc. Up to 12 Discs can be incubated simultaneously in the system. The processed samples can be in different stages of the processing protocol. New samples can be loaded in a random-access manner when there are available slots. Processing of loaded samples will, in most cases, start shortly after loading. If six samples are started at the same time limitations given by the sample scheduler will result in a queue. The operator interacts with the instrument via the touchscreen display by which the operator controls the instrument.

ASTar BC G- Kit is used for *in vitro* determination of antimicrobial susceptibility testing of commonly isolated bacteria derived from positive blood culture samples confirmed positive for Gram-negative bacteria by Gram stain. The antimicrobial and organism combinations are listed in Table 1. Reportable ranges for each antimicrobial are listed in Table 2.

To start an analysis approximately 1 mL of a positive blood culture, confirmed Gram-negative by Gram stain is pipetted into the ASTar Cartridge by the operator and loaded into the system, from which the system purifies and quantifies the bacteria. The bacterial concentration is adjusted to the

appropriate inoculum concentration and produces an inoculum for analysis of non-fastidious organisms. The bacterial suspensions are transferred automatically to the ASTar Disc and antimicrobial susceptibility testing is performed based on a defined short-term protocol. Results are available within approximately six hours. Bacterial growth and response to relevant concentrations of different antimicrobial drugs are measured throughout the incubation period, using a high-performance optical detection system in combination with image analysis algorithms. The system generates an MIC and further qualitative susceptibility results (i.e., S, I, SDD, R) for the tested antimicrobials when applicable. The qualitative results are determined based on established breakpoints stipulated by applicable authorities, i.e., FDA or CLSI. FDA Susceptibility Testing Interpretive Criteria (STIC), are found in Table 2.

Table 1: ASTar BC G- Kit Product Panel. Antimicrobial / organism combinations cleared in K221688 are indicated by an empty circle (○), and new antimicrobial / organisms included in this submission are indicated by a filled circle (●).

Antimicrobial class	**Antimicrobial agent**	***A. baumannii* complex**	***C. freundii* complex**	***C. koseri***	***E. cloacae* complex**	***E. coli***	***K. aerogenes***	***K. oxytoca***	***K. pneumoniae* group**	***M. morganii***	***P. mirabilis***	***P. vulgaris***	***S. marcescens***	***P. aeruginosa***
Penicillins	Ampicillin					○					○			
β-lactam combination agents	Ampicillin-sulbactam [1]	●		●		○		○	○	●	○	○		
	Ceftolozane-tazobactam		●	●	●	●		●	●		●	●	●	●
	Ceftazidime-avibactam [2]		○	○	○	●	●	○	●	●	○	●	○	○
	Meropenem-vaborbactam [3]		○	○	○	○	○	○	○	●	○	●	○	
	Piperacillin-tazobactam [4]	●	●	○		○*	●		○*	●	○	○	○	
Cephalosporin	Cefazolin			●		●		●	○		●			
	Cefepime		○	●	●	○	○	○	○		○	○*	○	○
	Cefotaxime		●	●	●	●		●	●		●	●	●	
	Ceftriaxone		●	●	●	●	●	●	●		●	●	●	
	Cefoxitin			●		●		●	●		●			
	Cefuroxime			●		○		○	○		○			
	Ceftazidime	●	●	●	○	○	●	○	○	●	○	○	○	
Monobactam	Aztreonam		●	○	○	○*	○	○	○	●	○	○	○	●
Carbapenem	**Ertapenem**		●	●	●	●		●	●		●	●	●	
	Meropenem	○	○	○	●	○	●	●	●	●	○	○	○	○
Aminoglycoside	Gentamicin		○	○				○	○	●	○	○	○	**
	Tobramycin		○	○	○	○	●	●	○*		○	●		●
	Amikacin	●	○	●	○	●	○	○	○	●	○	●	○	**
Tetracycline	Tigecycline		○	○	○	○	○	○	○				○	
Fluoroquinolone	Ciprofloxacin		●	○	○	○	○	○	○	●	○	○	○	○
	Levofloxacin		○	○	○	○	○	○	○	●	○	○	○	○
Miscellaneous	Trimethoprim-sulfamethoxazole [5]		●	●	○	○	○	○	○	●		○		

[1] Ampicillin-sulbactam in the ratio 2:1

[2] For susceptibility testing purposes, the concentration of avibactam is fixed at 4 µg/mL

[3] For susceptibility testing purposes, the concentration of vaborbactam is fixed at 8 µg/mL

[4] For susceptibility testing purposes, the concentration of tazobactam is fixed at 4 µg/mL
[5] Trimethoprim-sulfamethoxazole in the ratio 1:19
* Combination updated based on new performance claims
** Removed due to FDA STIC breakpoint changes

Table 2: Antimicrobial reportable ranges for AST and FDA-recognized/approved clinical breakpoints, i.e. susceptible (S), intermediate (I), susceptible-dose dependent (SDD) and resistant (R).

Antimicrobial agent	ASTar BC G– Reportable range (µg/mL)	Organism Group	FDA-Recognized / Approved Breakpoints (µg/mL)		
			S	I/SDD	R
Amikacin	≤2 to ≥256 ≤0.5 to ≥256[1]	*A. baumannii* complex Enterobacterales	≤8 ≤4	16 8	≥32 ≥16
Ampicillin	≤1 to ≥128	Enterobacterales	≤8	16	≥32
Ampicillin-sulbactam	≤1 to ≥128[2]	*A. baumannii* complex Enterobacterales	≤8	16	≥32
Aztreonam	≤0.25 to ≥128[3] ≤0.5 to ≥128	Enterobacterales *P. aeruginosa*	≤4 ≤8	8 16	≥16 ≥32
Cefazolin	≤0.25 to ≥32	Enterobacterales	≤2	4	≥8
Cefepime	≤0.25 to ≥128	Enterobacterales *P. aeruginosa*	≤2 ≤8	4-8[4] 16	≥16 ≥32
Cefotaxime	≤0.25 to ≥16	Enterobacterales	≤1	2	≥4
Cefoxitin	≤1 to ≥128	Enterobacterales	≤4	8	≥16
Ceftazidime	≤0.5 to ≥128 ≤0.25 to ≥128[5]	*A. baumannii* complex Enterobacterales	≤8 ≤4	16 8	≥32 ≥16
Ceftazidime-avibactam	≤0.125 to ≥64[6] ≤0.125 to ≥64	Enterobacterales *P. aeruginosa*	≤8	-	≥16
Ceftolozane-tazobactam	≤0.25 to ≥64	Enterobacterales *P. aeruginosa*	≤2 ≤4	4 8	≥8 ≥16
Ceftriaxone	≤0.25 to ≥16	Enterobacterales	≤1	2	≥4
Cefuroxime	≤1 to ≥128	Enterobacterales	≤8	-	≥16
Ciprofloxacin	≤0.125 to ≥16	Enterobacterales *P. aeruginosa*	≤0.25 ≤0.5	0.5 1	≥1 ≥2
Ertapenem	≤0.06 to ≥16	Enterobacterales	≤0.5	1	≥2
Gentamicin	≤0.25 to ≥64	Enterobacterales	≤2	4	≥8
Levofloxacin	≤0.125 to ≥32	Enterobacterales *P. aeruginosa*	≤0.5 ≤1	1 2	≥2 ≥4
Meropenem	≤0.06 to ≥128 ≤0.06 to ≥128[7] ≤0.06 to ≥128	*A. baumannii* complex Enterobacterales *P. aeruginosa*	≤2 ≤1 ≤2	4 2 4	≥8 ≥4 ≥8
Meropenem-vaborbactam	≤0.25 to ≥64[8]	Enterobacterales	≤4	8	≥16
Piperacillin-tazobactam	≤1 to ≥512 ≤0.25 to ≥512[9]	*A. baumannii* complex Enterobacterales	≤16 ≤8	32-64 16	≥128 ≥32
Tigecycline	≤0.03 to ≥32	Enterobacterales	≤2	4	≥8
Tobramycin	≤0.06 to ≥64[10] ≤0.125 to ≥64	Enterobacterales *P. aeruginosa*	≤2 ≤1	4 2	≥8 ≥4
Trimethoprim-sulfamethoxazole	≤0.06 to ≥16[11]	Enterobacterales	≤2	-	≥4

[1] AST Reportable range for Amikacin is ≤2 to ≥256 µg/mL for *C. koseri*, *E. coli*, *M. morganii* and *P. vulgaris*.
[2] AST Reportable range for Ampicillin-sulbactam is ≤2 to ≥128 µg/mL for *P. vulgaris*.

[3] AST Reportable range for Aztreonam is ≤0.5 to ≥128 µg/mL for *C. freundii* complex*, E. coli* and *M. morganii*.
[4] Interpretive category results for Cefepime/Enterobacterales are susceptible-dose dependent (SDD).
[5] AST Reportable range for Ceftazidime is ≤0.5 to ≥128 µg/mL for *C. freundii* complex, *C. koseri*, *K. aerogenes* and *M. morganii.*
[6] AST Reportable range for Ceftazidime-avibactam is ≤1 to ≥64 µg/mL for *E. coli*, *K. aerogenes*, *K. pneumoniae* group, *M. morganii* and *P. vulgaris*.
[7] AST Reportable range for Meropenem is ≤0.125 to ≥64 µg/mL for *E. cloacae* complex, *K. aerogenes*, *K. oxytoca*, *K. pneumoniae* group and *M. morganii*.
[8] AST Reportable range for Meropenem-vaborbactam is ≤0.5 to ≥64 µg/mL for *M. morganii* and *P. vulgaris*.
[9] AST Reportable range for Piperacillin-tazobactam is ≤1 to ≥512 µg/mL for *C. freundii* complex, *E. coli*, *K. aerogenes, K. pneumoniae* group and *M. morganii*
[10] AST Reportable range for Tobramycin is ≤0.125 to ≥64 µg/mL for *K. aerogenes*, *K. oxytoca*, *K. pneumoniae* group and *P. vulgaris*.
[11] AST Reportable range for Trimethoprim-sulfamethoxazole is ≤0.25 to ≥16 µg/mL for *C. freundii* complex, *C. koseri* and *M. morganii*.

4 INTENDED USE/INDICATIONS FOR USE

Intended Use

The ASTar System is intended to be used for the automated quantitative susceptibility testing for most clinically significant microorganisms. The ASTar System does not provide organism identification.

Indications for Use

The ASTar System, comprised of the ASTar Instrument with the ASTar BC G− Kit (ASTar BC G− Consumable kit, ASTar BC G− Frozen Insert, and ASTar BC G− Kit software), utilizes high-speed, time-lapse microscopy imaging of bacteria for the *in vitro*, quantitative determination of antimicrobial susceptibility of on-panel Gram-negative bacteria. The test is performed directly on positive blood culture samples signaled as positive by a continuous monitoring blood culture system and confirmed to contain Gram-negative bacilli by Gram stain. Organism identification is required for AST result interpretation and reporting.

Test results from the ASTar BC G− Kit should be interpreted in conjunction with other clinical and laboratory findings. Standard laboratory protocols for processing positive blood cultures should be followed to ensure availability of isolates for supplemental testing. Sub-culturing is necessary to support further testing for: bacteria and antimicrobials not on the ASTar BC G− panel, where inconclusive results are obtained, epidemiologic testing, recovery of organisms present in microbial samples, and susceptibility testing of bacteria in polymicrobial samples.

Testing is indicated for *Acinetobacter* spp., Enterobacterales, and *Pseudomonas aeruginosa*, as recognized by the FDA Susceptibility Test Interpretive Criteria (STIC). The ASTar BC G- Kit with ASTar System has demonstrated acceptable performance with the following organisms:

Amikacin: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Ampicillin: Enterobacterales (*Escherichia coli, Proteus mirabilis*)

Ampicillin-sulbactam: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter koseri, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris*)

Aztreonam: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), and *Pseudomonas aeruginosa*

Cefazolin: Enterobacterales (*Citrobacter koseri*, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus mirabilis*)

Cefepime: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri*, *Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens),* and *Pseudomonas aeruginosa*

Cefotaxime: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Cefoxitin: Enterobacterales (*Citrobacter koseri, Escherichia coli*, *Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis*)

Ceftazidime: *Acinetobacter* spp. (*Acinetobacter baumannii* complex), Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Ceftazidime-avibactam: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), and *Pseudomonas aeruginosa*

Ceftolozane-tazobactam: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri*, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis*, *Proteus vulgaris*, *Serratia marcescens*), and *Pseudomonas aeruginosa*

Ceftriaxone: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Cefuroxime: Enterobacterales (*Citrobacter koseri*, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis*)

Ciprofloxacin: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri*, *Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*), and *Pseudomonas aeruginosa*

Ertapenem: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Gentamicin: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Levofloxacin: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)*, Pseudomonas aeruginosa*

Meropenem: *Acinetobacter* spp. (*Acinetobacter baumannii* complex)*,* Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli*, Klebsiella aerogenes, *Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)*,* and *Pseudomonas aeruginosa*

Meropenem-vaborbactam: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Piperacillin-tazobactam: *Acinetobacter* spp. (*Acinetobacter baumannii* complex)*,* Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri, Escherichia coli, Klebsiella aerogenes, Klebsiella pneumoniae* group*, Morganella morganii, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*)

Tigecycline: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Serratia marcescens*)

Tobramycin: Enterobacterales (*Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris*)*,* and *Pseudomonas aeruginosa*

Trimethoprim-sulfamethoxazole: Enterobacterales (*Citrobacter freundii* complex, *Citrobacter koseri*, *Enterobacter cloacae* complex, *Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Morganella morganii, Proteus vulgaris*)

Special Conditions for Use Statements

- Rx – For Prescription Use Only

5 SUBSTANTIAL EQUIVALENCE

This submission is an addition of claims to the K221688 and does not impact the safety or effectiveness of the ASTar System.

Description	Q-linea AB ASTar BC G- Kit (New Device)	Q-linea AB ASTar BC G- Kit K221688 (Predicate Device)
Product Code(s)	SAN, LON	SAN, LON
Primary Regulation	21 CFR 866.1650	21 CFR 866.1650
Device Class	II	II
Device Classification	Fully automated short-term incubation cycle antimicrobial susceptibility system	Fully automated short-term incubation cycle antimicrobial susceptibility system
General Device Similarities		
Intended Use/Indications for Use	The ASTar System is intended to be used for the automated quantitative susceptibility testing for most clinically significant microorganisms. The ASTar System does not provide organism identification. The ASTar System, comprised of the ASTar Instrument with the ASTar BC G− Kit (ASTar BC G− Consumable kit, ASTar BC G− Frozen insert, and ASTar BC G− Kit software), utilizes high-speed, time-lapse microscopy imaging of bacteria for the in vitro, quantitative determination of antimicrobial susceptibility of on-panel Gram-negative bacteria. The test is performed directly on positive blood culture samples signaled as positive by a continuous monitoring blood culture system and confirmed to contain Gram-negative bacilli by Gram stain. Organism identification is required for AST result interpretation and reporting. Test results from the ASTar BC G− Kit should be interpreted in conjunction with other clinical and laboratory findings. Standard laboratory protocols for processing positive blood cultures should be followed to ensure availability of isolates for supplemental testing. Sub-culturing is necessary to support further testing for: bacteria and antimicrobials not on the ASTar BC G− panel, where	Same

	inconclusive results are obtained, epidemiologic testing, recovery of organisms present in microbial samples, and susceptibility testing of bacteria in polymicrobial samples.	
Blood Culture Types Tested	BD BACTEC: Standard Aerobic, Anaerobic; Lytic Anaerobic; Peds Plus, Plus Aerobic, Anaerobic bioMérieux BacT/ALERT: Standard Aerobic, Anaerobic; Plus Aerobic, Anaerobic; PF Plus	Same
Instrument Required	ASTar Instrument	Same
Technology	High-speed, time-lapse microscopy imaging	Same
Sample prep	Direct from sample. No manual McFarland preparation required	Same
Sample Types	Positive Blood Culture	Same
Results	Minimum Inhibitory Concentration (MIC) based Antimicrobial Susceptibility Testing direct from Positive Blood Cultures	Same
General Device Characteristic Differences		
Organisms tested	<u>Gram-Negative Bacteria:</u> *Acinetobacter baumannii* complex *Citrobacter freundii* complex *Citrobacter koseri* *Enterobacter cloacae* complex *Escherichia coli* *Klebsiella aerogenes* *Klebsiella oxytoca* *Klebsiella pneumoniae* group ***Morganella morganii*** *Pseudomonas aeruginosa* *Proteus mirabilis* *Proteus vulgaris* *Serratia marcescens*	<u>Gram-Negative Bacteria:</u> *Acinetobacter baumannii* *Citrobacter freundii* *Citrobacter koseri* *Enterobacter cloacae* complex *Escherichia coli* *Klebsiella aerogenes* *Klebsiella oxytoca* *Klebsiella pneumoniae* *Pseudomonas aeruginosa* *Proteus mirabilis* *Proteus vulgaris* *Serratia marcescens*
Antimicrobial agents	Amikacin Ampicillin Ampicillin-sulbactam Aztreonam Cefazolin Cefepime **Cefotaxime** **Cefoxitin** Ceftazidime Ceftazidime-avibactam **Ceftolozane-tazobactam** **Ceftriaxone** Cefuroxime	Amikacin Ampicillin Ampicillin-sulbactam Aztreonam Cefazolin Cefepime Ceftazidime Ceftazidime-avibactam Cefuroxime Ciprofloxacin Gentamicin Levofloxacin Meropenem

	Ciprofloxacin **Ertapenem** Gentamicin Levofloxacin Meropenem Meropenem-vaborbactam Piperacillin-tazobactam Tigecycline Tobramycin Trimethoprim-sulfamethoxazole	Meropenem-vaborbactam Piperacillin-tazobactam Tigecycline Tobramycin Trimethoprim-sulfamethoxazole
Software Algorithms	Updated algorithm for specific antimicrobial / organism combinations for removal of limitations.	Original algorithms
Test Interpretation and Results Reporting	Expert rules and Susceptibility Test Interpretive Criteria (STIC) according to CLSI M100, 36th Ed., 2026 Performance Standards except for when FDA Antibacterial STIC was different from CLSI M100, then FDA Antibacterial Susceptibility Test Interpretive Criteria (February 2026) was followed	Expert rules and Susceptibility Test Interpretive Criteria (STIC) according to CLSI M100, 33rd Ed., 2023 Performance Standards except for when FDA Antibacterial STIC was different from CLSI M100, then FDA Antibacterial Susceptibility Test Interpretive Criteria (April 2023) was followed

6 PERFORMANCE CHARACTERISTICS

The reproducibility and analytical performance validation was carried out by reanalysis of the analytical data sets (used to demonstrate substantial equivalence of ASTar BC G- Kit software version 1 cleared in K221688). Only the reproducibility study was complemented by additional testing determined by an impact assessment. Due to the complexity of the panel with multiple species relevant to each antimicrobial, the performance data for reproducibility and analytical studies demonstrate the performance of ASTar BC G- Kit software version 2 to support determination of substantial equivalence.

6.1 Reproducibility

Study overview

Reproducibility studies of ASTar System (ASTar BC G− Kit with ASTar Instrument) for positive Gram-negative blood culture bottles, BCBs, included the evaluation of 27 bacterial strains to obtain at least six on-scale MIC values for each antimicrobial. Triplicate samples from each contrived blood culture were tested at three separate sites on at least two separate days (supplementary testing was conducted in-house with three individual instruments). Thus at least six samples for each isolate were tested at each site and each isolate yielded a minimum of 18 results (3 sites x 2 days x 3 replicates). In total, all samples were tested within 16 hours of bottle positivity.

Performance was compared between three sites, with test isolates that are analyzed on at least two separate days to assess inter-site reproducibility and intra-site reproducibility of ASTar System. The system needed to demonstrate an overall reproducibility of ≥ 95% based on the number of results that fall within ±1 doubling dilution between the test MIC result and test MIC mode. Reproducibility was calculated for both best-case scenario (assumes any off-scale results are within one dilution from

the adjacent on-scale result) and worst-case scenario (assumes any off-scale results are more than one dilution from the adjacent on-scale result).

A supplemental reproducibility study was performed post-K221688 clearance with three instruments at a single internal site. The purpose of the supplemental study was to increase the number of valid results for performance evaluation for Cefotaxime, Ceftriaxone, Ceftolozane-tazobactam, and to verify reproducibility for Ceftazidime. Data from the supplemental testing was combined with the study data from K221688 and the aggregated results are summarized in Table 3. Study data from K221688 includes a previous supplemental study performed with three instruments at a single internal site.

Results and Discussion

All antimicrobials show a reproducibility of ≥ 95% for best-case scenario calculations. For worst-case scenario calculations all antimicrobials show reproducibility above 91%.

Table 3. Summary of all reproducibility results from all sites, aggregated with supplemental testing, for ASTar BC G- Kit.

Antibiotic	Best case[a]	Worst case[b]
Amikacin	215/215 (100%)	210/215 (97.7%)
Ampicillin	154/162 (95.1%)	154/162 (95.1%)
Ampicillin-sulbactam	198/198 (100%)	196/198 (99%)
Aztreonam	141/144 (97.9%)	132/144 (91.7%)
Cefazolin	162/162 (100%)	162/162 (100%)
Cefepime	160/161 (99.4%)	160/161 (99.4%)
Cefotaxime	143/144 (99.3%)	136/144 (94.4%)
Cefoxitin	213/215 (99.1%)	206/215 (95.8%)
Ceftazidime	209/216 (96.8%)	197/216 (91.2%)
Ceftazidime-avibactam	125/125 (100%)	115/125 (92%)
Ceftolozane-tazobactam	144/144 (100%)	143/144 (99.3%)
Ceftriaxone	125/125 (100%)	116/125 (92.8%)
Cefuroxime	197/197 (100%)	197/197 (100%)
Ciprofloxacin	197/197 (100%)	197/197 (100%)
Ertapenem	160/160 (100%)	158/160 (98.8%)
Gentamicin	359/359 (100%)	359/359 (100%)
Levofloxacin	251/251 (100%)	241/251 (96%)
Meropenem	196/197 (99.5%)	196/197 (99.5%)
Meropenem-vaborbactam	143/143 (100%)	143/143 (100%)
Piperacillin-tazobactam	286/286 (100%)	273/286 (95.5%)
Tigecycline	373/377 (98.9%)	373/377 (98.9%)
Tobramycin	419/431 (97.2%)	419/431 (97.2%)
Trimethoprim-sulfamethoxazole	180/180 (100%)	171/180 (95%)

[a] Best-case scenario calculation for reproducibility assuming the off-scale result is within a two-fold dilution step from the mode.
[b] Worst-case scenario calculation for reproducibility assuming the off-scale result is greater than a two-fold dilution step from the mode.

6.2 Blood Culture Bottle Compatibility

The data from this study was re-analysed using ASTar BC G- Kit software version 2. The study, which is still applicable, was initially designed and performed for 510(k) clearance in K221688.

Study overview

Ten (10) isolates were included in the study; *E. coli* (x2), *K. oxytoca*, *K. pneumoniae* group, *P. aeruginosa*, *P. mirabilis*, *E. cloacae* complex, *S. marcescens*, *K. aerogenes* and *A. baumannii* complex. These isolates represent the ASTar BC G- Kit panel and were selected to favor resistance phenotypes to provide as many on-scale MIC values as possible. Table 4 lists the BCBs included in this study.

Table 4. Blood culture bottles evaluated for ASTar BC G- Kit.

Manufacturer	BCB Type
bioMérieux	BACT/ALERT FA Plus Aerobic
bioMérieux	BACT/ALERT FN Plus Anaerobic
bioMérieux	BACT/ALERT PF Plus
bioMérieux	BACT/ALERT SN Standard Anaerobic
bioMérieux	BACT/ALERT SA Standard Aerobic
BD	BD BACTEC Peds Plus
BD	BD BACTEC Lytic Anaerobic
BD	BD BACTEC Plus Anaerobic
BD	BD BACTEC Plus Aerobic
BD	BD BACTEC Standard Aerobic
BD	BD BACTEC Standard Anaerobic

In total 11 different BCB types were evaluated. All ten (10) isolates were run in triplicates in the six aerobic bottles. Eight (8) isolates, excluding *A. baumannii* and *P. aeruginosa*, were run in triplicate in the five anaerobic bottles. The bottles were cultured until positive and run on the ASTar System within 16 hours. Results were evaluated for each antimicrobial by bottle type. The pass criteria were the overall essential agreement (EA) as compared to reference MIC obtained by frozen broth microdilution according to CLSI M07 and shall be ≥90% for each antimicrobial. Additionally, mode MIC values for each antimicrobial were compared across all bottle types. The percentage of MIC values within ±1 doubling dilution of the mode MIC for each antimicrobial/bottle were determined. The overall data from these two analyses are summarized in Table 5.

Results and Discussion

All bottle types had an MIC value within ±1 doubling dilution to the mode across all bottle types in >95% of all MICs evaluated, indicating that the ASTar System performed similarly across all bottle types.

Table 5. Overall essential agreement with BMD and number of MIC values ±1 to mode values across all bottle types for antimicrobials in the ASTar BC G- Kit panel.

Blood culture bottle type	Essential Agreement with BMD[1]	MIC values ±1 from mode value in all bottles / Total number of MIC values
BACT/ALERT FA Plus Aerobic	550/555 (99.1%)	556/558 (99.6%)
BACT/ALERT FN Plus Anaerobic	496/501 (99.0%)	503/504 (99.8%)
BACT/ALERT PF Plus	554/555 (99.8%)	557/558 (99.8%)
BACT/ALERT SN Standard Anaerobic	496/501 (99.0%)	503/504 (99.8%)
BACT/ALERT SA Standard Aerobic	543/555 (97.8%)	552/558 (98.9%)
BD BACTEC Peds Plus	551/555 (99.3%)	558/558 (100%)
BD BACTEC Lytic Anaerobic	495/501 (98.8%)	504/504 (100%)
BD BACTEC Plus Anaerobic	495/501 (98.8%)	504/504 (100%)
BD BACTEC Plus Aerobic	551/555 (99.3%)	557/558 (99.8%)
BD BACTEC Standard Aerobic	552/555 (99.5%)	557/558 (99.8%)
BD BACTEC Standard Anaerobic	552/555 (99.5%)	504/504 (100%)

[1] Essential Agreement <90% with BMD was observed for some combinations of antimicrobial / bottle type. For these combinations the individual isolates with results outside EA are specified below (numbers within parentheses show the ratio of replicates within EA/total).
Tobramycin / BACTEC Plus Anaerobic: *K. pneumoniae* QM2403 (0/3), *K. oxytoca* QM2400 (0/3)
Cefazolin / BACTEC Lytic Anaerobic: *E. coli* QM2109 (2/3), *E. coli* QM2145 (2/3)
Tobramycin / BACTEC Lytic Anaerobic: *K. pneumoniae* QM2403 (1/3), *K. oxytoca* QM2400 (2/3)
Tobramycin / BACTEC Plus Aerobic: *K. pneumoniae* QM2403 (2/3), *K. oxytoca* QM2400 (1/3)
Tobramycin / BACTEC Peds Plus: *K. pneumoniae* QM2403 (2/3), *K. oxytoca* QM2400 (1/3)
Tobramycin / BACT/ALERT SA Standard Aerobic: *K. pneumoniae* QM2403 (1/3), *K. oxytoca* QM2400 (0/3)
Tobramycin / BACT/ALERT FA Plus Aerobic: *K. pneumoniae* QM2403 (1/3), *K. oxytoca* QM2400 (1/3)
Cefazolin / BACT/ALERT SN Standard Anaerobic: *E. coli* QM2145 (1/3)
Tobramycin / BACT/ALERT SN Standard Anaerobic: *E. coli* QM2109 (2/3), *K. pneumoniae* QM2403 (2/3), *K. oxytoca* QM2400 (2/3)

Lastly, three bottles from each BCB type were also seeded with fresh human donor blood, but without bacteria, and incubated in the blood culture cabinet for at least 12 hours as a negative control. As expected, these bottles didn't turn positive in the cabinet but were still run on the ASTar System to determine what would happen if a negative bottle was accidentally loaded onto the system. These samples did not complete the concentration adjustment step and were aborted by the instrument.

6.3 Sample Stability

The data from this study was re-analysed using ASTar BC G- Kit software version 2. The study, which is still applicable, was initially designed and performed for 510(k) clearance in K221688.

Study overview

The time to positivity of a blood culture is unpredictable and can vary from hours up to days in the incubator and can depend on factors such as organism, bacterial concentration at blood draw, concurrent antibiotic treatment, and bottle type. Nine (9) isolates from the following organisms were included in this study: *E. coli*, *K. oxytoca*, *K. pneumoniae* group, *P. aeruginosa*, *P. mirabilis*, *E. cloacae* complex, *S. marcescens*, *C. koseri* and *A. baumannii* complex. These isolates represent the ASTar BC G- Kit panel and were selected to favor resistance phenotypes and to include as many on-scale MIC values as possible. All time points were tested in triplicate with all organisms. To assess the stability of positive BCBs prior to loading on the ASTar System, the initial samples were loaded on the ASTar

System within one hour of bottle positivity and the stability samples were stored at either room temperature or remained in the blood culture cabinet at 35 °C for an additional 16 to 24 hours until tested on the ASTar System. The MIC values from the 16-24 hours incubation conditions (room temperature and 35 °C) were compared to the mode MIC values obtained from the samples run within one hour after positivity, see Table 6. If the test MIC value was within ±1 doubling dilution from the initial value, then that MIC value passed, otherwise it failed.

Results and Discussion

Pass/fail criteria were ≥90% of MIC values within ±1 doubling dilution of the mode MIC of initial samples (loaded <1 hour), which was reached for all time/incubation conditions except for Piperacillin-tazobactam time-point > 18-24 hours at 35 °C (87.0%). However, the claimed sample stability is limited to 16 hours, and within the 16–18 hour incubation window at this temperature, the agreement rate is 100%.

The overall number of MIC values ±1 doubling dilution to the mode value in the initial sample was 99.8% for 16–24 hours at room temperature and 98.7% for 16–24 hours at 35°C. Samples stored for up to 16 hours after positivity at either room temperature or at 35 °C in a blood culture cabinet produce equivalent results to samples loaded into the ASTar System within 1-hour of positivity.

Table 6. Stability of samples loaded to the ASTar System within different timeframes after BCB positivity for each time/incubation condition. The format is "number of MIC values ±1 from mode MIC values in initial sample/total MIC values" ("pass rate in %").

Antimicrobial	Room Temperature		35 °C	
	16-18 hours	>18-24 hours	16-18 hours	>18-24 hours
Amikacin	1/1 (100%)	24/24 (100%)	3/3 (100%)	23/23 (100%)
Ampicillin		5/5 (100%)	3/3 (100%)	3/3 (100%)
Ampicillin-sulbactam		16/17 (94.1%)	3/3 (100%)	15/15 (100%)
Aztreonam	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Cefazolin		14/14 (100%)	3/3 (100%)	12/12 (100%)
Cefepime	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Cefotaxime		22/22 (100%)	3/3 (100%)	18/20 (90.0%)
Cefoxitin		14/14 (100%)	3/3 (100%)	12/12 (100%)
Ceftazidime	1/1 (100%)	24/24 (100%)	3/3 (100%)	23/23 (100%)
Ceftazidime-avibactam	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Ceftolozane-tazobactam	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Ceftriaxone		19/19 (100%)	3/3 (100%)	17/17 (100%)
Cefuroxime		17/17 (100%)	3/3 (100%)	14/14 (100%)
Ciprofloxacin	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Ertapenem		19/19 (100%)	3/3 (100%)	17/17 (100%)
Gentamicin	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Levofloxacin	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Meropenem	1/1 (100%)	24/24 (100%)	3/3 (100%)	23/23 (100%)
Meropenem-vaborbactam		19/19 (100%)	3/3 (100%)	17/17 (100%)
Piperacillin-tazobactam	1/1 (100%)	24/24 (100%)	3/3 (100%)	20/23 (87.0%)
Tigecycline		17/17 (100%)		16/17 (94.2%)

Antimicrobial	Room Temperature		35 °C	
	16-18 hours	>18-24 hours	16-18 hours	>18-24 hours
Tobramycin	1/1 (100%)	21/21 (100%)	3/3 (100%)	20/20 (100%)
Trimethoprim-sulfamethoxazole		19/19 (100%)	3/3 (100%)	17/17 (100%)

6.4 Interfering Substances

The data from this study was re-analysed using ASTar BC G- Kit software version 2. The study, which is still applicable, was initially designed and performed for 510(k) clearance in K221688.

Study overview

The ASTar System performance was evaluated with contrived positive BCB spiked with potentially interfering endogenous and exogenous substances at the concentrations indicated in Tables 7 and 8, respectively. All potentially interfering substances were tested with all three organisms included in this study: *E. coli*, *P. aeruginosa* and *A. baumannii* complex. Each organism was also tested without the potential interferent added and this serves as the control samples. All conditions were tested in triplicate. The MIC values obtained from the interferent samples were compared to the mode MICs obtained from the control samples. If a MIC value was within ±1 doubling dilution from the control value, then the sample passed.

Table 7. Potential endogenous interferents, clinically relevant concentration ranges and concentration tested for the ASTar BC G- Kit.

Potential Interferent	Concentrations tested	Clinically relevant concentration range	
Conjugated bilirubin	400 mg/L	Normal adult	0-2 mg/L
Gamma-globulin	50 g/L (plasma concentration)	Normal adult	7.0-16.0 g/L (serum concentration)
RBCs (Hematocrit/Hemoglobin)	20 g/dL	Normal adult	12-18 g/dL
		Anemia	<12 g/dL
WBCs (buffy coat)	12,000 WBCs/µL	Normal adult	4500-11,000 WBC/µL
		Leukocytosis	>12,000 WBC/µL
		Leukopenia	<4000 WBC/µL
Platelets (buffy coat)	400,000 PLTs/µL	Normal adult	150,000-400,000 PLTs/µL
		Thrombocytopenia	<150,000/µL

Table 8. Potential exogenous interferents and concentration tested for the ASTar BC G- Kit.

Potential Interferent	Concentrations tested	Clinically relevant concentration
Intralipid	20 g/L	2 g/L
Sodium Polyanethole sulfonate (SPS)	0.1% w/v (in bottle with blood)	0.04% w/v (in bottle with blood)
Heparin	3000 Units/L	1100 Units/L

Results and Discussion

No interference was observed with any of the eight endogenous or exogenous substances (Table 9). All evaluation categories had a pass rate of 100% except for RBCs (96.7%), WBCs (99.2%) and

conjugated bilirubin (99.2%). The study results suggest that none of the tested interferents reduces quantitative AST performance of positive G- blood cultures run on the ASTar System.

Table 9. Test results for each evaluated interfering substance are shown for isolates with pass rate (%) as compared to control mode MIC values for the ASTar BC G- Kit.

Potential interferent	Number of MIC values ±1 from mode MIC values in control	Pass rate
Conjugated bilirubin	122/123	99.2%
Gamma-globulin	123/123	100%
Intralipid	122/122	100%
SPS	123/123	100%
Heparin	123/123	100%
RBCs (Hemoglobin/Hematocrit)	119/123	96.7%
WBCs	122/123	99.2%
Platelets	99/99	100%

6.5 Interfering Antibiotics

The data from this study was re-analysed using ASTar BC G- Kit software version 2. The study, which is still applicable, was initially designed and performed for 510(k) clearance in K221688.

Study overview

To assess the potential interference of blood drawn from patients already on empiric antimicrobial therapy, contrived positive BCB samples with and without the antibiotics were run on the ASTar System. Three (3) classes of antibiotics present on the ASTar BC G- Kit panel were evaluated (cephalosporin, fluoroquinolone and carbapenem) and the specific antibiotics and test concentrations are indicated in Table 10. Even though it is recommended to use blood culture bottles (BCBs) with resins to remove any antibiotics that could potentially interfere with growth, both resin and non-resin bottles are commonly used for testing patient samples. To determine if the presence or absence of resins would affect any potential interference from the antibiotics, two different bottle types from two main suppliers were evaluated, one containing resins (BD BACTEC Plus Aerobic), and the other lacking resins (bioMérieux BACT/ALERT SA Standard Aerobic). Nine (9) different organisms were used in this study, *K. pneumoniae* group (x4), *E. coli* (x4) and *P. aeruginosa* and due to different resistance patterns in these isolates, not all organisms were used in all experimental combinations, but all organisms were resistant to the potentially interfering antibiotic under evaluation. All applicable combinations were tested in triplicate. If the MIC value was within ±1 from the control value then that MIC value passed, otherwise it failed.

Table 10. Interfering antibiotics and concentration to be tested for the ASTar BC G- Kit.

Antibiotic	Antibiotic class	Test concentration	Highest concentration under therapeutic treatment
Cefotaxime	Cephalosporin	52.8 mg/dL	17.6 mg/dL
Ciprofloxacin	Fluoroquinolone	1.20 mg/dL	0.40 mg/dL
Meropenem	Carbapenem	33.90 mg/dL	11.30 mg/dL

Results and Discussion

All six potentially interfering antibiotics/BCB-combinations evaluated passed the acceptance criteria of >95% pass rate as compared to control samples without interfering antibiotics, see Table 11.

Table 11. Test results for each evaluated potentially interfering antibiotic are shown, with pass rate (%) as compared to control mode/median MIC values for the ASTar BC G- Kit.[1]

Interferent	BCB type	Number of MIC values ±1 from mode value in control / Total number of evaluated MIC values	Pass Rate
Cefotaxime	BD BACTEC Plus Aerobic	201/203	99.0%
	BACT/ALERT SA Standard Aerobic	201/201	100%
Ciprofloxacin	BD BACTEC Plus Aerobic	203/203	100%
	BACT/ALERT SA Standard Aerobic	200/204	98.0%
Meropenem	BD BACTEC Plus Aerobic	165/168	98.2%
	BACT/ALERT SA Standard Aerobic	160/167	95.8%

[1] Pass rate <90% was observed for some combinations of interferent / bottle type / antimicrobial. For these combinations the results are specified below (numbers within parenthesis show the ratio of passed replicates/total).
Cefotaxime / BACTEC: Trimethoprim-sulfamethoxazole 77.8% (7/9)
Ciprofloxacin / BACT/ALERT: Amikacin 88.9% (8/9), Ampicillin-sulbactam 88.9% (8/9), Tobramycin 77.8% (7/9)
Meropenem / BACTEC: Ceftazidime 77.8% (7/9), Trimethoprim-sulfamethoxazole 83.3% (5/6)
Meropenem / BACT/ALERT: Ceftazidime 88.9% (8/9), Meropenem-vaborbactam 50% (3/6), Trimethoprim-sulfamethoxazole 50% (3/6)
Note that the BACTEC bottles contained resins whereas the BACT/ALERT bottles did not contain resins.

6.6 Carry Over and Cross Contamination

The data from this study was re-analysed using ASTar BC G- Kit software version 2. The study, which is still applicable, was initially designed and performed for 510(k) clearance in K221688.

Study overview

Carry over and cross contamination was evaluated in the ASTar System using two different isolates of *E. coli*, one susceptible and the other resistant to many of the antimicrobials on the ASTar BC G- Kit panel. The resistant and susceptible isolates, from contrived positive BCBs, were run in an alternating fashion and lastly with a run of all susceptible isolate samples that served as a control for this study.

Results and Discussion

In total, 14 susceptible samples were evaluated and no carry over or cross contamination was observed as evidenced by 99.7% pass rate (321/322) for the susceptible isolate MIC value. The MIC for the susceptible isolate for each antimicrobial must be within ±1 doubling dilution of the control mode MIC to pass. All six drawers on two different instruments were evaluated.

6.7 Set Inoculum for AST

A set inoculum study was performed for 510(k) clearance in K221688 to assess the accuracy of the ASTar System to measure and adjust the bacterial concentration of a positive BCB prior to AST. This study remains intact as it only involves the inoculum preparation steps which remain unchanged. No MIC results are obtained in this study. See K221688 for details.

6.8 Comparison Study

The purpose of the clinical study was to demonstrate the clinical performance of additional combinations and specific antimicrobial-organism combinations to expand the claims for the already FDA-cleared ASTar BC G- Kit with the ASTar Instrument (ASTar System, K221688) in providing quantitative AST results direct from positive blood culture containing Gram-negative bacteria. Results were compared to reference Frozen Broth Microdilution (BMD) results performed according to CLSI M07 12th Edition. Positive blood cultures included fresh prospective, left-over samples from patients with suspected bacteremia, positive blood cultures contrived with clinical stock isolates from the clinical sites, challenge and stock isolates provided by Thermo Fisher, as well as challenge and stock isolates provided by the Sponsor or sourced from the CDC AR Isolate bank.

This study was conducted at three sites that included two external clinical sites in the United States (US) and one internal site in Sweden, along with one Reference Laboratory in the US.

The clinical testing phase utilized two external US based clinical sites, as well as one internal site, located in Uppsala, Sweden. In total 644 samples were included in the study and the first sample was enrolled and tested at the clinical sites on March 31, 2025, with the last sample enrolled and tested on October 6, 2025.

Within the reference testing phase at the Reference Laboratory, the first challenge isolate was tested on March 4, 2025, with the last isolate tested on October 6, 2025.

The study was supplemented with additional testing at one internal site in Sweden using challenge isolates with predetermined reference MIC. In total 54 samples were included in the supplemental testing, and the first sample was enrolled and tested February 9, 2026, with the last sample enrolled and tested on March 6, 2026.

Testing with the ASTar BC G- Kit on the ASTar Instrument was performed within 16 hours of blood culture positivity during which time the blood culture bottle was either kept on the automated blood culture instrument or stored at room temperature until testing. Organism identification results from a rapid ID method were used to enter the species ID into the ASTar Instrument to generate AST results. If rapid ID results were not available or if the results from the rapid ID method did not provide a specific species on the ASTar BC G- panel, results from MALDI performed on isolates from the purity of the blood culture were used for input into ASTar. MALDI was performed on all isolates and if there was a discrepancy between the rapid ID results and MALDI, MALDI was used for the final organism identification.

Testing was performed during this study with the following blood culture bottle types: BacT/ALERT SN Standard Anaerobic, BacT/ALERT FA Plus Aerobic, BacT/ALERT FN Plus Anaerobic, BD BACTEC Lytic Anaerobic, BD BACTEC Plus Aerobic.

Results from ASTar BC G- Kit testing were compared to frozen BMD run in triplicate according to CLSI M07 to establish a reference Mode MIC for each antimicrobial evaluated. If a Mode MIC could not be established with the first set of three replicates a second set of three frozen replicates was tested. If a Mode MIC cannot be established with the second set of plates, the results for that sample and antimicrobial combination were excluded from analysis.

A total of 698 samples were enrolled in the study, across Fresh PBC (positive blood cultures) and contrived positive blood culture with either clinical stock or challenge isolates. Some samples were excluded due to off-panel organisms, contamination of contrived samples either due to the blood

used for contriving or other sources and protocol deviations. In total 630 samples were included in the performance analysis including 167 fresh, positive blood cultures, 221 contrived with clinical stock isolates and 242 contrived blood cultures with challenge isolates.

The ASTar Instrument performance was evaluated by assessing the first instance of each sample run in the study (based on samples included until October 6, 2025). 97.1% (571/588) of the sample runs produced at least a partial AST result. Of the 17 samples that failed to produce an AST result, 76.5% (13/17) were resolved upon retesting, see Table 13.

Table 13. Summary of instrument performance, calculated from the first instance of each sample run.

ASTar AST Results	n (%)
Complete results	568 (96.6%)
Partial results[1]	3 (0.5%)
No Results[2]	17 (2.9%)
Total	**588 (100%)**

[1] Partial Results are samples with one or more antimicrobials for which no result was reported. These were not retested.
[2] 13 out of 17 runs with No AST Results were able to be resolved upon retesting.

6.8.1 Clinical performance data

AST performance was generally assessed based on criteria outlined in the FDA Special Controls: Antimicrobial Susceptibility Test (AST) Systems - Class II Special Controls Guidance for Industry and FDA. This included assessment of Essential Agreement (EA) when compared to frozen BMD, Category Agreement using FDA recognized susceptibility testing interpretive criteria (STIC), determination of number and rate of very major (VMJ), major (MAJ) and minor (MIN) discrepant results, as well as determination of essential agreement of evaluable results when appropriate.

Table 14 lists the overall AST performance for antimicrobials based on the final proposed panel in the intended use. For performance of each new antimicrobial and for performance to support removal of limitations included in cleared ASTar BC G- Kit with ASTar Instrument (K221688) and/or addition of bacterial species, see individual antimicrobial sections below.

Table 14. Overall AST performance for ASTar BC G- Kit. Interpretation of MIC results are based on FDA Antibacterial Susceptibility Test Interpretive Criteria and CLSI M100-ed36.

Antimicrobial	Group	Assessed	%EA	%Eval EA	%CA	#S	#R	#MIN	#MAJ	#VMJ
Amikacin	*Acinetobacter baumannii* complex	50	96.0	88.9	98.0	32	17	1	0	0
	Enterobacterales	656	95.7	94.0	97.4	610	30	16	1	0
Ampicillin	Enterobacterales	236	97.5	95.2	97.9	121	115	3	2	0
Ampicillin-sulbactam	*Acinetobacter baumannii* complex	50	96.0	97.8	90.0	22	22	5	0	0
	Enterobacterales	494	97.6	97.4	89.9	272	155	49	1	0
Aztreonam	Enterobacterales	612	97.1	83.7	97.4	475	124	14	0	2
	Pseudomonas aeruginosa	83	92.8	91.5	81.9	50	21	15	0	0
Cefazolin	Enterobacterales	373	97.3	96.1	90.1	180	159	34	2	1
Cefepime	Enterobacterales	676	95.1	81.5	96.6	536	118	22	1	0
	Pseudomonas aeruginosa	88	95.5	93.8	86.4	48	33	12	0	0
Cefotaxime	Enterobacterales	433	97.9	76.5	98.2	289	139	5	2	1
Cefoxitin	Enterobacterales	331	97.3	96.6	91.8	233	77	25	0	2
Ceftazidime	*Acinetobacter baumannii* complex	50	98.0	93.8	92.0	9	37	4	0	0
	Enterobacterales	637	90.4	73.0	96.9	463	161	15	3	2
Ceftazidime-avibactam	Enterobacterales	522	95.8	82.8	99.4	500	22	0	2	1
	Pseudomonas aeruginosa	28	100	100	100	27	1	0	0	0
Ceftolozane-tazobactam	Enterobacterales	425	96.0	91.4	98.1	349	72	8	0	0
	Pseudomonas aeruginosa	60	93.3	92.9	93.3	52	4	4	0	0
Ceftriaxone	Enterobacterales	454	98.2	76.7	99.1	308	140	2	2	0
Cefuroxime	Enterobacterales	449	94.4	92.8	96.4	299	150	0	12	4
Ciprofloxacin	Enterobacterales	739	97.7	81.5	96.3	557	165	19	6	2
	Pseudomonas aeruginosa	28	96.4	91.7	82.1	21	3	5	0	0
Ertapenem	Enterobacterales	429	96.3	69.4	98.8	354	70	2	1	2
Gentamicin	Enterobacterales	407	95.3	95.0	97.1	359	42	9	1	2
Levofloxacin	Enterobacterales	710	98.3	93.9	95.1	548	140	30	3	2
	Pseudomonas aeruginosa	28	92.9	92.3	82.1	21	3	5	0	0
Meropenem	*Acinetobacter baumannii* complex	46	95.7	95.0	93.5	25	19	3	0	0
	Enterobacterales	564	91.5	49.5	96.5	507	50	13	2	5
	Pseudomonas aeruginosa	24	91.7	91.3	100	22	1	0	0	0
Meropenem-vaborbactam	Enterobacterales	707	97.2	51.2	99.0	696	7	7	0	0
Piperacillin-tazobactam	*Acinetobacter baumannii* complex	46	97.8	96.3	95.7	6	35	2	0	0
	Enterobacterales	446	95.7	93.2	96.4	363	71	14	1	1
Tigecycline	Enterobacterales	629	96.0	96.0	97.5	608	7	14	0	2
Tobramycin	Enterobacterales	371	94.6	94.5	93.8	290	62	19	4	0
	Pseudomonas aeruginosa	60	90.0	89.3	100	56	4	0	0	0
Trimethoprim-sulfamethoxazole	Enterobacterales	610	96.4	89.1	99.0	463	147	0	5	1

6.8.1.1 AST Performance Assessment of new antimicrobials

Clinical evaluation testing was performed to support the addition of five new antimicrobials where four of the antimicrobials contained a limitation applicable for the whole antimicrobial thus excluding it from Indications of use in K221688. Performance was evaluated across all relevant species and for each antimicrobial-organism combination. Overall, the system met predefined acceptance criteria for most combinations. Limitations were identified for some species due to limited resistant isolates or deviations in performance metrics. The assessment below demonstrates the new performance for each antimicrobial and the resulting limitations.

6.8.1.1.1 Cefotaxime

In K221688, the data for Cefotaxime showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Cefotaxime: *Acinetobacter baumannii* complex*, Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*

The current submission includes data from a total of 433 samples demonstrating the final performance evaluation across indicated species, including 295 (68.1%) clinical samples (fresh prospective or contrived stock isolates) and 138 (31.9%) contrived challenge isolates.

The above limitation was removed for:

Cefotaxime: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*

Summary of performance in current study

Citrobacter koseri, Enterobacter cloacae complex, *Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis* and *Serratia marcescens* met all defined acceptance criteria. *Citrobacter freundii* complex and *Proteus vulgaris* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing. *Escherichia coli* was acceptable with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 25 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%)
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 99.2% and a CA of 99.2% with one VMJ (2.9%) and no MAJ (0%). As the VMJ rate exceeded the 2% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 1 µg/mL. Excluding results at this MIC affects 1 results (1/131; 0.8%) and removes the single VMJ, revising the VMJ rate to 0%.
  - *Perform an alternative method of testing prior to reporting results for Cefotaxime / Escherichia coli when the ASTar MIC is 1 µg/mL due to one very major discrepancy.*
- A total of 54 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.1% and a CA of 98.1% with no VMJ (0%) and one MAJ (2.9%).

- A total of 99 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.0% and a CA of 97.0% with no VMJ (0%) and one MAJ (2.0%).
- A total of 37 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.3% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 15 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.3% and a CA of 93.3% with no VMJ (0%) and no MAJ (0%).
  A total of 31 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.8% and a CA of 93.5% with no VMJ (0%) and no MAJ (0%).

6.8.1.1.2 Cefoxitin

A total of 331 samples were included demonstrating the final performance evaluation across indicated species, including 248 (74.9%) clinical samples (fresh prospective or contrived stock isolates) and 83 (25.1%) contrived challenge isolates.

Summary of performance in current study

Citrobacter koseri, Klebsiella pneumoniae group and *Proteus mirabilis* met all defined acceptance criteria. *Escherichia coli* was acceptable based on evaluable essential agreement. *Klebsiella oxytoca* was acceptable with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 95.5% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.9% and a CA of 87.0% with no VMJ (0%) and no MAJ (0%). Evaluable EA was 96.3%.
- A total of 42 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.2% and a CA of 92.9% with one VMJ (7.1%) and no MAJ (0%). As the VMJ rate exceeded the 2% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 4 µg/mL. Excluding results at this MIC affects four results (4/42; 9.5%) and removes the single VMJ, revising the VMJ rate to 0%.
  - *Perform an alternative method of testing prior to reporting results for Cefoxitin / Klebsiella oxytoca when the ASTar MIC is 4 µg/mL due to one very major discrepancy.*
- A total of 99 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.0% and a CA of 96.0% with no VMJ (0%) and no MAJ (0%).
- A total of 37 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.3% and a CA of 94.6% with one VMJ (20.0%) and no MAJ (0%). As the number of resistant isolates tested is limited this VMJ discrepancy can be considered random.

6.8.1.1.3 Ceftolozane-tazobactam

In K221688, the data for Ceftolozane-tazobactam showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Ceftolozane-tazobactam: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Serratia marcescens*

The current submission includes data from a total of 485 samples demonstrating the final performance evaluation across indicated species, including 333 (68.7%) clinical samples (fresh prospective or contrived stock isolates) and 152 (31.3%) contrived challenge isolates.

The above limitation was removed for:

Ceftolozane-tazobactam: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Pseudomonas aeruginosa, Serratia marcescens*

Summary of performance in current study

Citrobacter koseri, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group, *Proteus mirabilis* and *Pseudomonas aeruginosa* met all defined acceptance criteria. *Citrobacter freundii* complex, *Proteus vulgaris* and *Serratia marcescens* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 94.7% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 25 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.0% and a CA of 92.0% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.5% and a CA of 99.2% with no VMJ (0%) and no MAJ (0%).
- A total of 43 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 88.4% and a CA of 97.7% with no VMJ (0%) and no MAJ (0%). The EA result was very close to meeting the acceptance criteria. Given the high CA and that EA across all Enterobacterales species in this study was 94.5% (447/473) this performance is considered acceptable.
- A total of 98 *Klebsiella pneumoniae* group samples were evaluated. The combined results

from clinical and challenge testing demonstrated an EA of 93.9% and a CA of 96.9% with no VMJ (0%) and no MAJ (0%).

- A total of 37 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.6% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.1% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 60 *Pseudomonas aeruginosa* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.3% and a CA of 93.3% with no VMJ (0%) and no MAJ (0%).
- A total of 33 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.1.4 Ceftriaxone

In K221688, the data for Ceftriaxone showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Ceftriaxone: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Serratia marcescens*

The current submission includes data from a total of 454 samples demonstrating the final performance evaluation across indicated species, including 299 (65.9%) clinical samples (fresh prospective or contrived stock isolates) and 155 (34.1%) contrived challenge isolates.

The limitation above was removed for:

> Ceftriaxone: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae complex, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Serratia marcescens*

Summary of performance in current study

Citrobacter koseri, *Enterobacter cloacae* complex*, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus mirabilis* and *Serratia marcescens* met all defined acceptance criteria. *Citrobacter freundii* complex was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing. *Proteus vulgaris* was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing and with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical

and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

- A total of 24 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.8% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.5% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 20 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.0% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 54 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.1% and a CA of 98.1% with no VMJ (0%) and one MAJ (2.9%).
- A total of 98 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 98.0% with no VMJ (0%) and no MAJ (0%).
- A total of 37 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.6% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 16 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.8% and a CA of 93.8% with no VMJ (0%) and one MAJ (6.7%). As the MAJ rate exceeded the 3% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 4 µg/mL. Excluding results at this MIC affects 1 results (1/16; 6.3%) and removes the single MAJ, revising the MAJ rate to 0%.
    - *Perform an alternative method of testing prior to reporting results for Ceftriaxone / Proteus vulgaris when the ASTar MIC is 4 µg/mL due to one major discrepancy.*
- A total of 33 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.1.5 Ertapenem

In K221688, the data for Ertapenem showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

    Ertapenem: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella aerogenes, Klebsiella oxytoca, Klebsiella pneumoniae* group*, Proteus mirabilis, Proteus vulgaris, Serratia marcescens*

The current submission includes data from a total of 429 samples demonstrating the final performance evaluation across indicated species, including 298 (69.5%) clinical samples (fresh prospective or contrived stock isolates) and 131 (30.5%) contrived challenge isolates.

The above limitation was removed for:

> Ertapenem: *Citrobacter freundii* complex*, Citrobacter koseri, Enterobacter cloacae* complex*, Escherichia coli, Klebsiella oxytoca, Klebsiella pneumoniae* group, *Proteus mirabilis, Proteus vulgaris, Serratia marcescens*

Summary of performance in current study

Citrobacter koseri, *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella oxytoca* and *Serratia marcescens* met all defined acceptance criteria. *Citrobacter freundii* complex, *Proteus mirabilis* and *Proteus vulgaris* were acceptable with limitation due to an insufficient number of resistant isolates at the time of testing. *Klebsiella pneumoniae* group is acceptable with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 25 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 92.0% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.5% and a CA of 99.2% with no VMJ (0%) and no MAJ (0%).
- A total of 43 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 99 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.9% and a CA of 97.0% with one VMJ (2.8%%) and one MAJ (1.6%). As the VMJ rate exceeded the 2% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 0.5 µg/mL. Excluding results at this MIC affects one result (1/100; 1%) and removes the single VMJ, revising the VMJ rate to 0%.
    - *Perform an alternative method of testing prior to reporting results for Ertapenem / Klebsiella pneumoniae* group *when the ASTar MIC is 0.5 µg/mL due to one very major discrepancy.*
- A total of 40 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.0% and a CA of 97.5% with one VMJ (100%) and no MAJ (0%). As the number of resistant isolates tested is limited this VMJ discrepancy can be considered random.
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 33 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.9% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2 Removal of limitations included in K221688 and/or addition of bacterial species

Clinical evaluation testing was performed to support the removal of limitations included in cleared ASTar BC G- Kit with ASTar Instrument (K221688) and/or addition of bacterial species for the antimicrobials listed in the subsections below. Overall, the predefined acceptance criteria were met for most combinations. Limitations were identified for some species due to limited resistant isolates or deviations in performance metrics.

6.8.1.2.1 Amikacin

In K221688, the data for Amikacin with *Acinetobacter baumannii* complex*, Escherichia coli* and *Proteus vulgaris* showed unacceptable performance. The following limitation was therefore included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Amikacin: *Acinetobacter baumannii* complex, *Escherichia coli*, *Proteus vulgaris*

The current submission includes data from testing 246 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Acinetobacter baumannii* complex, *Escherichia coli* and *Proteus vulgaris*.

Summary of performance in current study

Acinetobacter baumannii complex met all defined acceptance criteria. *Citrobacter koseri*, *Escherichia coli*, *Morganella morganii*, and *Proteus vulgaris* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 50 *Acinetobacter baumannii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.0% and a CA of 98.0% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 95.5% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.5% and a CA of 99.2% with no VMJ (0%) and no MAJ (0%).
- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.3% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).
- A total of 16 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.2 Ampicillin-sulbactam

In K221688, the data for Ampicillin-sulbactam with *Acinetobacter baumannii* complex showed

unacceptable performance. The following limitation therefore was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Ampicillin-sulbactam: *Acinetobacter baumannii* complex

The current submission includes data from testing 99 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

Summary of performance in current study
The performance for *Acinetobacter baumannii* complex and *Morganella morganii* was acceptable, and the above limitation for *Acinetobacter baumannii* complex was removed. *Citrobacter koseri* was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 50 *Acinetobacter baumannii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.0% and a CA of 90.0% with no VMJ (0%) and no MAJ (0%).
- A total of 22 Citrobacter koseri samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.3% and a CA of 85.2% with no VMJ (0%) and no MAJ (0%). Evaluable EA was 95.5%.

6.8.1.2.3 Aztreonam

In K221688, the data for Aztreonam with *Escherichia coli* when the ASTar MIC is 0.5 µg/mL due to one very major discrepancy*, Citrobacter freundii* and *Pseudomonas aeruginosa* showed unacceptable performance. The following limitation was therefore included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Aztreonam: *Escherichia coli* when the ASTar MIC is 0.5 µg/mL due to one very major discrepancy, *Citrobacter freundii* complex, *Pseudomonas aeruginosa*

The current submission includes data from testing 259 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Escherichia coli, Citrobacter freundii* complex and *Pseudomonas aeruginosa*.

Summary of performance in current study
Escherichia coli and *Morganella morganii* met all defined acceptance criteria, and *Pseudomonas aeruginosa* was acceptable. *Citrobacter freundii* complex was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 97.7% with no VMJ (0%) and no MAJ (0%).
- A total of 26 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.2% and a CA of 96.2% with no VMJ (0%) and no MAJ (0%).
- A total of 83 *Pseudomonas aeruginosa* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 92.8% and a CA of 81.9% with no VMJ (0%) and no MAJ (0%). Evaluable EA was 91.5%.

6.8.1.2.4 Cefazolin

In K221688, the data for Cefazolin with *Escherichia coli, Klebsiella oxytoca* and *Proteus mirabilis* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Cefazolin: *Citrobacter koseri*, *Escherichia coli*, *Klebsiella oxytoca*, *Proteus mirabilis*

The current submission includes data from testing 233 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Citrobacter koseri*, *Escherichia coli, Klebsiella oxytoca* and *Proteus mirabilis*.

Summary of performance in current study

Escherichia coli and *Citrobacter koseri* met all defined acceptance criteria, and *Klebsiella oxytoca* and *Proteus mirabilis* were acceptable.

Species-level performance

- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 95.5% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.7% and a CA of 93.1% with no VMJ (0%) and no MAJ (0%).
- A total of 43 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.7% and a CA of 88.4% with no VMJ (0%) and one MAJ (20.0%). Evaluable EA was 94.7%. The one MAJ could be considered random as the total MAJ rate for Enterobacterales was 0.9% (1/117) in this study.
- A total of 37 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.3% and a CA of 86.5% with no VMJ (0%) and no MAJ (0%). Evaluable EA was 100%.

6.8.1.2.5 Cefepime

In K221688, the data for Cefepime with *Enterobacter cloacae* complex and *Proteus vulgaris* when the ASTar MIC is 32 µg/mL due to one major discrepancy showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Cefepime: *Enterobacter cloacae* complex, *Proteus vulgaris* when the ASTar MIC is 32 µg/mL due to one major discrepancy

The current submission includes data from testing 64 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Enterobacter cloacae* complex and *Proteus vulgaris*.

Summary of performance in current study

Citrobacter koseri and *Enterobacter cloacae* complex met all defined acceptance criteria. *Proteus vulgaris* was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 25 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 92.0% and a CA of 96.0% with no VMJ (0%) and no MAJ (0%).
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.1% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.6 Ceftazidime

In K221688, the data for Ceftazidime with *Acinetobacter baumannii* complex*, Citrobacter freundii* complex*, Citrobacter koseri, Klebsiella aerogenes* and *Pseudomonas aeruginosa* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Ceftazidime: *Acinetobacter baumannii* complex, *Citrobacter freundii* complex, *Citrobacter koseri*, *Klebsiella aerogenes*, *Pseudomonas aeruginosa*

The current submission includes data from testing 138 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Acinetobacter baumannii* complex, *Citrobacter freundii* complex, *Citrobacter koseri* and *Klebsiella aerogenes*.

Summary of performance in current study
Acinetobacter baumannii complex, *Citrobacter koseri* and *Klebsiella aerogenes* met all defined acceptance criteria. *Citrobacter freundii* complex was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing. *Morganella morganii* was acceptable with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 50 *Acinetobacter baumannii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.0% and a CA of 92.0% with no VMJ (0%) and no MAJ (0%).
- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 21 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.5% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 26 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.2% and a CA of 92.3% with no VMJ (0%) and one MAJ (5.6%). As the MAJ rate exceeded the 3% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 64 µg/mL. Excluding results at this MIC affects two results (2/26; 7.7%) and removes the single MAJ, revising the MAJ rate to 0.0% (0/16).
    - *Perform an alternative method of testing prior to reporting results for Ceftazidime / Morganella morganii when the ASTar MIC is 64 µg/mL due to one major discrepancy.*

6.8.1.2.7 Ceftazidime-avibactam

In K221688, the data for Ceftazidime-avibactam with *Escherichia coli, Klebsiella aerogenes* and *Klebsiella pneumoniae* group showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

    Ceftazidime-avibactam: *Escherichia coli*, *Klebsiella aerogenes*, *Klebsiella pneumoniae* group

The current submission includes data from testing 293 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Escherichia coli, Klebsiella aerogenes* and *Klebsiella pneumoniae* group.

Summary of performance in current study
Escherichia coli and *Klebsiella pneumoniae* group met all defined acceptance criteria. *Klebsiella aerogenes, Morganella morganii* and *Proteus vulgaris* were acceptable with a limitation due to an

insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.5% and a CA of 99.2% with no VMJ (0%) and one MAJ (0.8%).
- A total of 21 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 97 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.9% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.8 Cefuroxime

In K221688, the data for Cefuroxime with *Citrobacter koseri, Enterobacter cloacae* complex and *Klebsiella aerogenes* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Cefuroxime: *Citrobacter koseri*, *Enterobacter cloacae* complex, *Klebsiella aerogenes*

The current submission includes data from testing 22 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Citrobacter koseri*.

Summary of performance in current study

Citrobacter koseri met all defined acceptance criteria.

Species-level performance

- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 95.5% with one VMJ (12.5%) and no MAJ (0%). As the number of resistant isolates tested is limited this VMJ discrepancy can be considered random.

6.8.1.2.9 Ciprofloxacin

In K221688, the data for Ciprofloxacin with *Citrobacter freundii* complex showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Ciprofloxacin: *Citrobacter freundii* complex

The current submission includes data from testing 46 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Citrobacter freundii* complex.

Summary of performance in current study
Morganella morganii met all defined acceptance criteria, and *Citrobacter freundii* complex was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.10 Gentamicin

In K221688, the data for Gentamicin with *Enterobacter cloacae* complex*, Escherichia coli* and *Klebsiella aerogenes* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Gentamicin: *Enterobacter cloacae* complex, *Escherichia coli*, *Klebsiella aerogenes*

The current submission includes data from testing 26 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

Summary of performance in current study

Morganella morganii was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 26 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.2% and a CA of 84.6% with one VMJ (12.5%) and no MAJ (0%). Evaluable EA was 96.0%. As the number of resistant isolates tested is limited this VMJ discrepancy can be considered random.

6.8.1.2.11 Levofloxacin

The current submission includes data from testing 27 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

Summary of performance in current study
Morganella morganii met all defined acceptance criteria.

Species-level performance

- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.12 Meropenem

In K221688, the data for Meropenem with *Escherichia coli* when the ASTar MIC is either 0.5 or 1.0 µg/mL due to three very major discrepancies, *Enterobacter cloacae* complex*, Klebsiella oxytoca* and *Klebsiella pneumoniae* group showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Meropenem: *Escherichia coli* when the ASTar MIC is either 0.5 or 1.0 µg/mL due to three very major discrepancies, *Enterobacter cloacae* complex, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Klebsiella pneumoniae* group

The current submission includes data from testing 224 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Enterobacter cloacae* complex, *Klebsiella aerogenes*, *Klebsiella oxytoca* and *Klebsiella pneumoniae* group.

Summary of performance in current study
Klebsiella oxytoca and *Klebsiella pneumoniae* group met all defined acceptance criteria. *Enterobacter cloacae* complex*, Klebsiella aerogenes* and *Morganella morganii* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 31 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.3% and a CA of 93.5% with two VMJ (50%) and no MAJ (0%). As two VMJ:s were identified, a concentration-specific limitation is proposed when the ASTar MIC is 0.5 or 1 µg/mL. Excluding results at these MIC:s affects 2 results (2/31; 6.5%) and removes the two VMJs, revising the VMJ rate to 0%.
  - *Perform an alternative method of testing prior to reporting results for Meropenem / Enterobacter cloacae complex when the ASTar MIC is 0.5 or 1 µg/mL due to two very major discrepancies.*
- A total of 21 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 95.2% with no VMJ (0%) and no MAJ (0%).
- A total of 43 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.3% and a CA of 97.7% with no VMJ (0%) and one MAJ (2.9%).
- A total of 99 *Klebsiella pneumoniae* group samples were evaluated. The combined results

from clinical and challenge testing demonstrated an EA of 92.9% and a CA of 92.9% with no VMJ (0%) and one MAJ (1.4%).

- A total of 30 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.0% and a CA of 90.0% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.13 Meropenem-vaborbactam

The current submission includes data from testing 44 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

Summary of performance in current study

Morganella morganii and *Proteus vulgaris* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.14 Piperacillin-tazobactam

In K221688, the data for Piperacillin-tazobactam with *Escherichia coli* when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy, *Klebsiella pneumoniae* group when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy and *Acinetobacter baumannii* complex showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Piperacillin-tazobactam: *Escherichia coli* when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy, *Klebsiella pneumoniae* group when the ASTar MIC is 8.0 µg/mL due to one very major discrepancy, *Acinetobacter baumannii* complex, *Citrobacter freundii* complex, *Klebsiella aerogenes*, *Klebsiella oxytoca*

The current submission includes data from testing 342 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Escherichia coli*, *Klebsiella pneumoniae* group, *Acinetobacter baumannii* complex, *Citrobacter freundii* complexand *Klebsiella aerogenes*.

Summary of performance in current study

Acinetobacter baumannii complex, *Escherichia coli*, *Klebsiella aerogenes, Klebsiella pneumoniae* group and *Morganella morganii* met all defined acceptance criteria. *Citrobacter freundii* complex was acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 46 *Acinetobacter baumannii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.8% and a CA of 95.7% with no VMJ (0%) and no MAJ (0%).
- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 131 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.7% and a CA of 96.9% with no VMJ (0%) and no MAJ (0%).
- A total of 21 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.5% and a CA of 90.5% with one VMJ (20%) and no MAJ (0%). As the number of resistant isolates tested is limited the VMJ discrepancies can therefore be considered random.
- A total of 98 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 92.9% and a CA of 91.8% with no VMJ (0%) and one MAJ (2.0%).
- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.3% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.15 Tobramycin

In K221688, the data for Tobramycin with *Klebsiella pneumoniae* group when the ASTar MIC is 4.0 µg/mL due to one very major discrepancy, *Klebsiella aerogenes, Klebsiella oxytoca, Proteus vulgaris* and *Pseudomonas aeruginosa* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

  Tobramycin: *Klebsiella pneumoniae* when the ASTar MIC is 4.0 µg/mL due to one very major discrepancy, *Klebsiella aerogenes*, *Klebsiella oxytoca*, *Proteus vulgaris*, *Pseudomonas aeruginosa*

The current submission includes data from testing 240 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Klebsiella pneumoniae* group*, Klebsiella aerogenes, Klebsiella oxytoca, Proteus vulgaris* and *Pseudomonas aeruginosa*.

Summary of performance in current study

Klebsiella pneumoniae group and *Pseudomonas aeruginosa* met all defined acceptance criteria. *Klebsiella aerogenes* and *Proteus vulgaris* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing, and *Klebsiella oxytoca* was acceptable with a concentration-specific limitation (see species-level performance).

Species-level performance

- A total of 21 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 43 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.7% and a CA of 88.4% with no VMJ (0%) and one MAJ (4.2%). Evaluable EA was 90.7%. As the MAJ rate exceeded the 3% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 32 µg/mL. Excluding results at this MIC affects two results (2/44; 4.5%) and removes the single MAJ, revising the MAJ rate to 0.0% (0/31).
    - *Perform an alternative method of testing prior to reporting results for Tobramycin / Klebsiella oxytoca when the ASTar MIC is 32 µg/mL due to one major discrepancy*
- A total of 99 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.0% and a CA of 93.9% with no VMJ (0%) and one MAJ (1.6%).
- A total of 17 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.1% and a CA of 88.2% with no VMJ (0%) and no MAJ (0%). Evaluable EA was 94.1%.
- A total of 60 *Pseudomonas aeruginosa* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.0% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.1.2.16 Trimethoprim-sulfamethoxazole

In K221688, the data for Trimethoprim-sulfamethoxazole with *Proteus mirabilis* showed unacceptable performance. The following limitation was included in the device labeling:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:

    Trimethoprim-sulfamethoxazole: *Citrobacter freundii* complex, *Proteus mirabilis*

The current submission includes data from testing 68 samples for indicated species including clinical samples (fresh prospective or contrived stock isolates) and contrived challenge isolates.

The above limitation was removed for *Citrobacter freundii* complex.

Summary of performance in current study

The performance for *Citrobacter freundii* complex, *Citrobacter koseri* and *Morganella morganii* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 19 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

- A total of 27 *Morganella morganii* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

6.8.2 Quality control

External quality control (QC) testing was performed on each day of testing throughout the Method Comparison studies. A total of four QC strains are used to QC each antimicrobial on the ASTar BC G- Kit. Each QC isolate control for a separate set of antimicrobials tested. At a minimum one QC isolate was run each day using the ASTar BC G- Kit on the ASTar Instrument and all four QC strains run each week. All external QC passed the >95% pass rate requirement per antimicrobial QC isolate combination.

6.8.3 Updates of breakpoints included in K221688

Clinical performance was assessed for applicable combinations in ASTar BC G- Kit (K221688) to support updates in FDA susceptibility test interpretive criteria (STIC) published after clearance in April 2024. The subsections below demonstrate performance based on updated breakpoints (current as of February 5, 2026) which included recognition of CLSI M100-Ed36 standard for Amikacin, Cefepime, Gentamicin, and Tobramycin against Enterobacterales and *Pseudomonas aeruginosa*.

6.8.3.1 Amikacin

The performance for all Enterobacterales met the defined acceptance criteria. *Citrobacter freundii* complex, *Enterobacter cloacae* complex, *Klebsiella aerogenes, Klebsiella oxytoca, Proteus mirabilis* and *Serratia marcescens* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing. For *Pseudomonas aeruginosa* the breakpoints no longer include interpretive criteria for isolates retained form blood cultures, therefore this combination is removed from indications for use.

Species-level performance

- A total of 27 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.3% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).
- A total of 65 *Enterobacter cloacae* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.9% and a CA of 98.5% with no VMJ (0%) and no MAJ (0%).
- A total of 48 *Klebsiella aerogenes* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.8% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 50 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 98.0% and a CA of 98.0% with no VMJ (0%) and no MAJ (0%).
- A total of 142 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 93.7% and a CA of 95.1% with no VMJ (0%) and one MAJ (0.9%).
- A total of 89 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 94.4% and a CA of 95.5% with no VMJ (0%) and no MAJ (0%).

- A total of 39 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.4% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

Labeling

The number of resistant strains for *Klebsiella pneumoniae* group increased to 20, hence the following limitation was removed:

- The ability of the ASTar System to detect resistance in the following antimicrobial/organism combinations is unknown because of an insufficient number of resistant isolates were available during the clinical study:
    - Amikacin / *Klebsiella pneumoniae* group

6.8.3.2 Cefepime

The performance for *Pseudomonas aeruginosa* met the defined acceptance criteria. For Enterobacterales, the I category was reclassified to SDD which has no impact on the performance evaluation.

Species-level performance

- A total of 88 *Pseudomonas aeruginosa* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 86.4% with no VMJ (0%) and no MAJ (0%). Given that evaluable EA is high (93.8%), and no VMJ or MAJ were observed, the performance of this combination is deemed acceptable with the updated STICs.

Labeling

No *Pseudomonas aeruginosa* specific limitation was included in K221688.

6.8.3.3 Gentamicin

The performance for *Citrobacter freundii* complex, *Citrobacter koseri, Klebsiella oxytoca, Proteus mirabilis, Proteus vulgaris* and *Serratia marcescens* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing. *Klebsiella pneumoniae* group was acceptable with a concentration-specific limitation.

Species-level performance

- A total of 43 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.7% and a CA of 97.7% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 30 *Klebsiella oxytoca* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 96.7% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 140 *Klebsiella pneumoniae* group samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 92.1% and a CA of 95.7% with one VMJ (3.5%) and one MAJ (0.9%). As the VMJ rate exceeded the 2% threshold, a

concentration-specific limitation is proposed when the ASTar MIC is 2 µg/mL. Excluding results at this MIC affects four results (9/140; 6.4%) and removes the single VMJ, revising the VMJ rate to 0%.

- *Perform an alternative method of testing prior to reporting results for Gentamicin / Klebsiella pneumoniae group when the ASTar MIC is 2 µg/mL due to one very major discrepancy*

- A total of 90 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 98.9% with no VMJ (0%) and no MAJ (0%).
- A total of 34 *Proteus vulgaris* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 97.1% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 22 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 100% with no VMJ (0%) and no MAJ (0%).

Labeling

No revisions to the current limitations for the cleared device (K221688) related to Enterobacterales are proposed. For *Klebsiella pneumoniae* group the additional limitation is proposed:

- Perform an alternative method of testing prior to reporting results for the following antimicrobial/organism combinations:
  - Gentamicin / *Klebsiella pneumoniae* group when the ASTar MIC is 2 µg/mL due to one very major discrepancy

For *Pseudomonas aeruginosa*, the updated STICs no longer include interpretive criteria. Consequently, this combination will no longer be included in the Indications for Use of the cleared device (K221688) and the following limitation was removed:

- The ability of the ASTar System to detect resistance in the following antimicrobial/organism combinations is unknown because of an insufficient number of resistant isolates were available during the clinical study:
  - Gentamicin / *Pseudomonas aeruginosa*

6.8.3.4 Tobramycin

The performance for *Enterobacter cloacae* complex and *Escherichia coli* were acceptable. The performance for *Citrobacter freundii* complex, *Citrobacter koseri, Proteus mirabilis* and *Serratia marcescens* were acceptable with a limitation due to an insufficient number of resistant isolates at the time of testing.

Species-level performance

- A total of 27 *Citrobacter freundii* complex samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 100% and a CA of 96.3% with no VMJ (0%) and no MAJ (0%).
- A total of 42 *Citrobacter koseri* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.2% and a CA of 100% with no VMJ (0%) and no MAJ (0%).
- A total of 38 *Enterobacter cloacae* complex samples were evaluated. The combined results

from clinical and challenge testing demonstrated an EA of 94.7% and a CA of 92.1% with no VMJ (0%) and one MAJ (3.2%). As the MAJ rate exceeded the 3% threshold, a concentration-specific limitation is proposed when the ASTar MIC is 8 µg/mL. Excluding results at this MIC affects 2 results (2/38; 5.3%) and removes the single MAJ, revising the MAJ rate to 0%.
    - *Perform an alternative method of testing prior to reporting results for Tobramycin / Enterobacter cloacae complex when the ASTar MIC is 8 µg/mL due to one major discrepancy.*
- A total of 50 *Escherichia coli* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 90.0% and a CA of 90.0% with no VMJ (0%) and no MAJ (0%).
- A total of 34 *Proteus mirabilis* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 91.2% and a CA of 97.1% with no VMJ (0%) and one MAJ (3.0%).
- A total of 22 *Serratia marcescens* samples were evaluated. The combined results from clinical and challenge testing demonstrated an EA of 95.5% and a CA of 68.2% with no VMJ (0%) and no MAJ (0%). As the CA was far from meeting the acceptance criteria after the breakpoint update, this combination is removed from the indications for use

Labeling

The limitation "The ability of ASTar Systems to detect resistance for Tobramycin/*S. marcescens* is unknown because of an insufficient number of resistant isolates available during the clinical study" is replaced by the limitation "Perform an alternative method of testing prior to reporting results for Tobramycin/*S. marcescens*" as the combination is removed from Indications for Use. No other revisions to the current limitations for the cleared device (K221688) related to Tobramycin are proposed.

6.9 Conclusion

Conclusions drawn from the nonclinical and clinical tests (discussed above) demonstrate that ASTar BC G- Kit is as safe and as effective as the predicate device (K221688), and is therefore determined to be substantially equivalent.