

Determination of Minimum Inhibitory Concentrations

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Running heading: Determination of MIC's

Minimum inhibitory concentrations (MICs) are defined as the lowest concentration of antimicrobial that will inhibit the visible growth of a micro-organism after overnight incubation, and minimum bactericidal concentrations (MBCs) the lowest concentration of antimicrobial that will prevent the growth of an organism after sub-culture on to antibiotic-free media. MICs are used by diagnostic laboratories, mainly to confirm resistance, but most often as a research tool to determine the *in-vitro* activity of new antimicrobials, and data from such studies have been used to determine MIC breakpoints. MBC determinations are undertaken less frequently and their major use has been reserved for isolates from the blood of patients with endocarditis. Standardized methods for determining MICs and MBCs are described in this paper. Like all standardized procedures, the method must be adhered to and may not be adapted by the user. The method gives information on the storage of standard antibiotic powder, preparation of stock antibiotic solutions, media, preparation of inocula, incubation conditions, and reading and interpretation of results. Tables giving expected MIC ranges for control NCTC and ATCC strains are also supplied.

Introduction

Minimum inhibitory concentrations (MICs) are considered the 'gold standard' for determining the susceptibility of organisms to antimicrobials and are therefore used to judge the performance of all other methods of susceptibility testing. MICs are used in diagnostic laboratories to confirm unusual resistance, to give a definitive answer when a borderline result is obtained by other methods of testing, or when disc diffusion methods are not appropriate, for example when determining the susceptibility of coagulase-negative staphylococci to teicoplanin.

The range of antibiotic concentrations used for determining MICs is universally accepted to be in doubling dilution steps up and down from 1 mg/L as required. The MIC is defined as the lowest concentration of a drug that will inhibit the visible growth of an organism after overnight incubation (this period is extended for organisms such as anaerobes, which require prolonged incubation for growth).

The agar dilution method described below is an amended version of the procedure described in the BSAC Guide to Sensitivity Testing¹ and can be adapted for determining the minimum bactericidal concentration (MBC) of an antimicrobial for an organism by substituting Iso-Sensitest Agar (ISA; Oxoid, Basingstoke, UK) with Iso-Sensitest Broth (ISTB; Oxoid) and then subculturing to drug-free media or can be truncated for use as a 'breakpoint' method. However, if the method is adapted, control strains cited below may not act as adequate controls for the concentration of antibiotic contained within prepared plates.

1. Antibiotic stock solutions: general considerations

- 1.1. Obtain standard powder from the pharmaceutical company or a reputable supplier such as Sigma (Poole, Dorset, UK).
- 1.2. Obtain information from the supplier regarding expiry date, potency, solubility, stability as a powder and in solution, storage conditions and any relevant COSHH (Control of Substances Hazardous to Health) information.
- 1.3. Always prepare stock solutions following the manufacturer's recommendations.
- 1.4. Freeze and thaw stock solutions only once and then discard them. Table I shows the suppliers, solvent, diluents and storage conditions for antibiotics.

2. Preparation of antibiotic stock solutions

2.1. Choose a suitable range of antibiotic concentrations for the organisms to be tested (see suggested ranges in Table II).

2.2. Prepare stock solutions using the formula

$$\frac{1000}{P} \times V \times C = W$$

where P = potency given by the manufacturer ($\mu\text{g}/\text{mg}$), V = volume required (mL), C = final concentration of solution (multiples of 1000) (mg/L), and W = weight of antibiotic in mg to be dissolved in volume V (mL).

For example, $\frac{1000}{980} \times 20 \times 10 = 204.08 \text{ mg}$

Powder (204.08 mg at a potency of 980 $\mu\text{g}/\text{mg}$) dissolved in 20 mL of solvent = 10,000 mg/L stock solution.

Microbial contamination of powder is extremely rare.² If broth methods are to be used, stock solution may be filter sterilized (0.2 μm pore size cellulose acetate filters; Sartorius AG, Goettingen, Germany); however, it must be ascertained from the manufacturer that the antibiotic does not bind to the surface of the filter.

For preparation of further stock solutions, from the initial 10,000 mg/L solution, prepare the following:

1 mL of 10,000 mg/L solution + 9 mL diluent* = 1000 mg/L

100 μl of 10,000 mg/L solution + 9.9 mL diluent* = 100 mg/L

* Consult Table 1 for appropriate sterile diluent.

3. Preparation of antibiotic dilution range

Example of dilution range: 0.25 - 128 mg/L.

Label 11 universal containers (containers and amounts of antibiotic and agar can be varied depending on the number of plates to be poured) as follows:

128, 64, 32, 16, 8, 4, 2, 1, 0.5, 0.25 and 0 mg/L.

From the 10,000 mg/L stock, dispense the following amounts with a micropipette:

256 μl into the container labelled 128

128 μl into the container labelled 64

64 μl into the container labelled 32

32 μl into the container labelled 16

From the 1000 mg/L stock, dispense the following amounts:

160 μl into the container labelled 8

80 μl into the container labelled 4

40 μl into the container labelled 2

From the stock 100 mg/L dispense the following amounts:

200 μl into the bottle labelled 1

100 μl into the container labelled 0.5

50 μl into the container labelled 0.25

No antibiotic is added to the bottle labelled 0 mg/L (antibiotic free growth control).

Other methods for preparing antibiotic dilutions can be used.²

4. Preparation of agar dilution plates

Prepare ISA or equivalent medium following the manufacturer's instructions. To prevent organisms such as *Proteus* species from swarming, media have been adapted by increasing agar content or adding 50 mg/L *p*-nitrophenyl glycerol

(PNPG) (BDH Merck, Lutterworth, Leicestershire, UK) or 350 mg/L Matexil (AstraZeneca, Cheshire, UK).³ PNPG, Matexil and increased agar concentration can all alter MICs significantly with some agents. They must not be used unless essential and there is evidence that they do not affect antimicrobial action. Table III shows the appropriate medium for different organisms.

- 4.1. Add 20 mL of cooled molten agar (ensure that the medium is cooled to 50°C before adding to the antibiotic) to each container, including the antibiotic-free control. Mix well before pouring into 90 mm Petri dishes. Add agar, mix and pour each concentration in turn, so agents are kept at 50°C for minimum period of time.
- 4.2. Allow agar to set and then dry surface of the plates, for c. 10 min in a fan assisted drying cabinet (without ultraviolet light) or in a still incubator (time needed will depend on the efficiency of the incubator).
- 4.3. Store plates at 4-8°C protected from light until inoculated. Ideally, plates should be used on the day of preparation. If plates are to be stored at 4-8°C before use, the stability of the drug must be determined by individual laboratories as part of the routine quality control programme.

5. Preparation of Inoculum

The inoculum should be adjusted so that 10^4 cfu/spot are applied to the plates. The following procedure describes a method for preparing the desired inoculum by comparison with a 0.5 McFarland standard.

NB. Studies undertaken by Yeo *et al* have confirmed that the heavier inoculum of 10^6 cfu/spot, rather than the standard inoculum of 10^4 cfu/spot is required when determining the MICs to ampicillin and amoxycillin for *M. catarrhalis*.

5.1. Preparation of the McFarland standard

Add 0.5 ml of 0.048 M BaCl₂ (1.17% w/v BaCl₂.2H₂O) to 99.5 ml of 0.18 M H₂SO₄ (1% v/v) with constant stirring. Distribute the standard into screw cap tubes of the same size and with the same volume as those used in growing the broth cultures. Seal the tubes tightly to prevent loss by evaporation. Store protected from light at room temperature. Vigorously agitate the turbidity standard on a vortex mixer before use. Standards may be stored for up to six months after which time they should be discarded. Alternatively prepared standards can be purchased (bioMerieux, Basingstoke, UK).

5.2. Preparation of inoculum

These suspensions should be used within 30 min of preparation.

5.2.1. Growth method

This method used for non-fastidious organisms eg Enterobacteriaceae, *Pseudomonas* spp and staphylococci. Touch at least four morphologically similar colonies with a sterile loop. Transfer growth into ISB or equivalent that has been shown not to affect the performance of the test and incubate broth with shaking at 35-37°C until the visible turbidity is equal to or greater than the 0.5 McFarland standard. Alternatively an overnight broth culture can be used.

5.2.2. Direct colony suspension method

The method of choice for fastidious organism, eg *Haemophilus* spp. *Neisseria gonorrhoeae* and *Streptococcus pneumoniae*. Colonies are taken directly from the plate into ISB (or equivalent) or distilled water. The suspension should match or exceed the density of the

0.5 McFarland standard. With some organisms the production of an even suspension of the required turbidity is difficult and growth in broth is a more satisfactory option.

5.2.3. *Preparation of inoculum for testing anaerobes*

5.2.3.1. *Anaerobes other than Bacteroides*

Cultures should be grown on blood agar enriched with haemin and menadione. The colonies should not be >72 h old and should not remain in an aerobic atmosphere for >30 min before preparing a suspension. Prepare a suspension in Wilkins & Chalgren Broth (Oxoid, Difco) to match a 0.5 McFarland standard. Anaerobic organisms have markedly different sizes and shapes, so using a turbidity standard as described has limitations. However, currently this is the only practical procedure for clinical laboratories.

5.2.3.2. *Bacteroides*

In 1 mL of sterile distilled water emulsify growth from a plate that has not been incubated for >24 h and prepare a suspension to match or exceed a 0.5 McFarland standard. Mix using a vortex mixer.

5.3. *Adjustment of the organism suspension to the density of the 0.5 McFarland standard.*

Adjust the density of the organism suspension prepared to equal that of the 0.5 McFarland standard by adding sterile distilled water. To aid comparison, compare the test and standard against a white background with a contrasting black line. Suspensions should contain between 10^7 and 10^8 cfu/ml depending on genera.² For the agar dilution method further dilution of suspension in sterile distilled water before inoculation is shown in Table IV.

6. Quality Control

Appropriate controls, depending on genera, must be included with every batch of MIC determinations. Control strains available from national collections are shown in Table V.

7. Inoculation

Use a multipoint inoculator (Denley; Mast Diagnostics, Bootle, UK) to deliver 1-2 μ l of suspension on to the surface of the agar. Allow the inoculum to be absorbed into the agar before incubation.

8. Incubation conditions

Conditions for incubation are shown in Table VI.

9. Reading and interpretation

- 9.1. After incubation ensure that all of the organisms have grown on the antibiotic-free control plate.
- 9.2. The MIC is defined as the lowest concentration of antibiotic at which there is no visible growth of the organism. The growth of one or two colonies or a fine film of growth should be disregarded.
- 9.3. The MIC for the control strain should be within plus or minus one two-fold dilution of the expected MIC (see Table VII).

10. Broth dilution MICs

- 10.1. *Macrodilution*
 - 10.1.1. Follow steps in Sections 1 to 3.
 - 10.1.2. Antibiotic ranges should be prepared one step higher than the final dilution range required, i.e. if a final dilution range of 0.5, 1, 2, 4, 8, and 16 mg/L is required then a range of 1, 2, 4, 8, 16, and 32 mg/L should be prepared to compensate for the addition of an equal volume of inoculum.
 - 10.1.3. Substitute the broth equivalent for the media cited in section 4. To improve the detection of visible growth when the medium is supplemented with blood, use lysed horse blood. The performance of lysed blood used for MIC testing may vary, therefore individual laboratories should confirm, as part of their QC programme, that the lysed blood used supports the growth of the organism being tested.
 - 10.1.4. Arrange sufficient 75 x 12 mm sterile capped tubes in two rows for each antibiotic to cover the range of antibiotic dilutions chosen in duplicate.
 - 10.1.5. Transfer 1mL volumes of each antibiotic dilution in broth to the tubes.
 - 10.1.6. Prepare inocula equivalent to a 0.5 Mcfarland standard following the procedures cited in Section 5. A final inoculum of 5×10^5 cfu/mL is required and therefore suspensions equivalent to a 0.5 McFarland standard should be diluted 1:100 in broth medium used for preparing the antibiotic dilutions for the following organisms: Haemolytic streptococci, staphylococci, Enterobacteriaceae, *S. pneumoniae*, *Pseudomonas* spp., *Moxarella catarrhalis*, *Acinetobacter* spp, *Neisseria meningitidis*, *Haemophilus* spp., *N. gonorrhoeae*, enterococci.
 - 10.1.7. Add 1 mL aliquots of test organism to one set of tubes and 1 mL of control organism to the other. Mix contents of the tubes thoroughly.
 - 10.1.8. Include inoculated and uninoculated tubes of antibiotic-free broth (the first tube controls the adequacy of the broth to support the growth of the organism, the second is a check of sterility). Incubate at 35-37°C for 18-20 h in air.
- 10.2. *Microdilution*
 - 10.2.1. Follow steps 1 to 3 as for broth macrodilution.
 - 10.2.2. Label a 96 well sterile microtitre tray with the appropriate antibiotic dilutions.
 - 10.2.3. Add 75 µl of each antibiotic dilution to two rows of wells.
 - 10.2.4. Prepare organism suspension as for broth macrodilution.
 - 10.2.5. Dispense 75 µl of test organism into one row and 75 µl of control into the second row of wells.
 - 10.2.6. Include inoculated and uninoculated wells of antibiotic-free broth (the first controls the adequacy of the broth to support the growth of the organism, the second is a check of sterility).
 - 10.2.7. Cover with lid or plate sealing tape and incubate at 35-37°C for 18-20 h in air.
- 10.3. *Reading and Interpretation*
 - 10.3.1. Read the MIC endpoint as the lowest concentration of antibiotic at which there is no visible growth.

10.3.2. The MIC for the control strain should be within one two-fold dilution of the expected MIC (see Table VII).

Table I. Preparation and storage of antibiotic solutions (stored solutions should contain ≥ 1000 mg/L)

| Antibiotic | Solvent | Diluent | 4°C | -20°C | -70°C | Storage of powder | Supplier ^a |
|---|----------------------|--------------|----------|------------|----------|--|--------------------------|
| 14 hydroxycyclarithromycin | methanol | water | - | - | - | +4°C; protect from light and moisture | Abbott Laboratories |
| Amikacin (base) | water | water | 7 days | 1 month | | +4-25°C; protect from moisture and light | Bristol Myers Squibb |
| Amoxicillin (trihydrate) | DMSO or ^b | water | 7 days | unstable | 30 days | +4°C; protect from light and moisture | GlaxoSmithKline |
| Ampicillin (trihydrate) | ^b | water | 7 days | unstable | 30 days | +4°C; protect from light and moisture | GlaxoSmithKline |
| Azithromycin (dihydrate) | ^c | water | - | - | - | +4-25°C; protect from moisture and light | Pfizer |
| Aztreonam (anhydrous crystalline B form) | ^b | water | 1 day | 3 months | - | +4°C; protect from light and moisture | Bristol Myers Squibb |
| Carbenicillin (disodium) | water | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Cefaclor | water | water | - | - | - | +4°C; protect from light and moisture | Eli Lilly & Co Ltd |
| Cefepime (dihydrochloride) | water | water | - | - | - | +4°C; protect from light and moisture | Bristol Myers Squibb |
| Cefixime | ^b | water | - | - | - | 2-8°C; protect from moisture and light | Wyeth Laboratories |
| Cefotaxime (sodium) | water | water | 10 days | 6 months | 6 months | +4-25°C; protect from moisture and light | Aventis Pharma |
| Cefoxitin (sodium) | water | water | - | 6 months | - | +4-25°C; protect from moisture and light | Merck Sharpe & Dohme Ltd |
| Cefpirome (sulphate) | water | water | - | - | - | 2-8°C; protect from moisture and light | Aventis Pharma |
| Cefpodoxime (sodium) | water | water | - | - | - | 2-8°C; protect from moisture and light | Aventis Pharma |
| Ceftazidime (pentahydrate) | ^b | water | 1 day | 3 months | - | +4-25°C; protect from moisture and light | GlaxoSmithKline |
| Ceftizoxime (sodium) | water | water | 7 days | - | - | +4-25°C; protect from moisture and light | GlaxoSmithKline |
| Ceftriaxone (disodium) | water | water | - | - | - | 2-8°C; protect from moisture and light | Roche Products Ltd |
| Cefuroxime (sodium) | water | water | 3 days | 30 days | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Cephalexin (hydrate) | water | water | 7 days | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Cephradine | water | water | 1 day | - | - | +4°C; protect from light and moisture | Bristol Myers Squibb |
| Chloramphenicol | ^c | water | - | - | - | +4°C; protect from light and moisture | Sigma |
| Ciprofloxacin (hydrochloride monohydrate) | water | water | 2 weeks | 3 months | 3 months | +4-25°C; protect from moisture and light | Bayer |
| Clarithromycin | DMSO | water | - | - | - | 15-30°C; protect from light and moisture | Abbott Laboratories |
| Clavulanate (acid) | ^d | ^d | 1-5 days | unsuitable | 4 weeks | 2-8°C; protect from moisture and light | GlaxoSmithKline |
| Clindamycin (hydrochloride) | water | water | - | - | - | +4°C; protect from light and moisture | Sigma |
| Cloxacillin (sodium monohydrate) | water | water | - | - | - | 15-30°C; protect from light and moisture | GlaxoSmithKline |
| Colistin (sulphate) | water | water | - | - | - | 2-8°C; protect from moisture and light | Pharmax |
| Doxycycline (hydrochloride) | water | water | - | - | - | 2-8°C; protect from moisture and light | Pfizer |
| Erythromycin (base) | ^c | water | 1 week | - | - | +4°C; protect from light and moisture | Abbott Laboratories |
| Flucloxacillin (sodium) | water | water | - | - | - | 2-8°C; protect from moisture and light | GlaxoSmithKline |
| Fosfomycin (calcium) | water | water | - | - | - | 2-8°C; protect from moisture and light | Pharmax |
| Fusidic acid (sodium) | ^c | water | - | - | - | +4-25°C; protect from moisture and light | Leo Laboratories |

| Antibiotic | Solvent | Diluent | 4°C | -20°C | -70°C | Storage of powder | Supplier ^a |
|--|--------------|--------------|----------|-----------------|-----------------|--|--------------------------|
| Gatifloxacin | ^e | water | - | - | - | +4°C; protect from light and moisture | Grunenthal |
| Gemifloxacin (base) | methanol | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Gentamicin (sulphate) | water | water | 6 months | NR | NR | +4-25°C; protect from moisture and light | Aventis Pharma |
| Grepafloxacin (hydrochloride) | ^e | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Telithromycin | ^f | ^g | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Imipenem (monohydrate) | ^h | ^h | 1 day | NR | 1 month | 15-30°C; protect from light and moisture | Merck Sharpe & Dohme Ltd |
| Kanamycin (monosulphate) | water | water | - | - | - | +4°C; protect from light and moisture | Sanofi Winthrop |
| Levofloxacin (hemihydrate) | water | water | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Linezolid | water | water | - | - | - | +4°C; protect from light and moisture | Pharmacia & Upjohn Ltd |
| Mecillinam | water | water | - | - | - | +4°C; protect from light and moisture | Leo Laboratories |
| Meropenem (trihydrate) | water | water | - | - | - | +4°C; protect from light and moisture | Zeneca Pharma |
| Methicillin (sodium) | water | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Metronidazole | water | water | - | - | - | +4-25°C; protect from moisture and light | Aventis Pharma |
| Mezlocillin | water | water | 1 week | 1 month | 4 months | +4-25°C; protect from moisture and light | Bayer |
| Moxifloxacin (hydrochloride) | water | water | - | - | - | +4°C; protect from light and moisture | Bayer |
| Mupirocin (lithium) | water | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Nalidixic acid | ^e | water | - | - | - | +4°C; protect from light and moisture | Sanofi Winthrop |
| Netilmicin (sulphate) | water | water | 6 months | 6 months | 6 months | +4°C; protect from light and moisture | Schering Plough |
| Nitrofurantoin | DMF | DMF | - | - | - | +4°C; protect from light and moisture | Proctor & Gamble |
| Norfloxacin | ^f | water | - | - | - | +4°C; protect from light and moisture | Merck Sharpe & Dohme Ltd |
| Ofloxacin | ^b | water | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Oxacillin (sodium) | water | water | - | - | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Penicillin (benzyl)[potassium] | water | water | - | 1 month | 1 month | +4°C; protect from light and moisture | GlaxoSmithKline |
| Piperacillin (sodium) | water | water | 2 days | 1 month | - | +4-25°C; protect from moisture and light | Wyeth Laboratories |
| Quinupristin/dalfopristin | water | water | - | 1 month | - | 2-8°C; protect from moisture and light | Aventis Pharma |
| Rifampicin (crystalline) | DMSO | water | 1 month | 1 month | - | +4°C; protect from light and moisture | Aventis Pharma |
| Roxithromycin | ^c | water | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Sparfloxacin | ^e | water | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Spectinomycin (dihydrochloride pentahydrate) | water | water | - | - | - | +4°C; protect from light and moisture | Pharmacia & Upjohn Ltd |
| Streptomycin (sulphate) | water | water | - | - | - | +4°C; protect from light and moisture | Medeva Pharma Ltd |
| Sulphamethoxazole (free acid) | ^e | water | 1 month | 6 months | 2 years | +4-25°C; protect from moisture and light | GlaxoSmithKline |
| Tazobactam (sodium salt) | ^b | water | - | - | - | +4°C; protect from light and moisture | Wyeth Laboratories |
| Teicoplanin | ^c | water | - | - | - | +4°C; protect from light and moisture | Aventis Pharma |
| Tetracycline (hydrochloride) | water | water | - | NR ⁱ | NR ^j | unopened vials 2 years at RT | Wyeth Laboratories |

| Antibiotic | Solvent | Diluent | 4°C | -20°C | -70°C | Storage of powder | Supplier ^a |
|----------------------------|--------------|---------|---------|----------|---------|--|-----------------------|
| Ticarcillin (sodium) | water | water | 1 week | 1 month | - | +4°C; protect from light and moisture | GlaxoSmithKline |
| Tobramycin (sulphate) | water | water | 1 week | 3 months | - | +4°C; protect from light and moisture | Eli Lilly & Co Ltd |
| Trimethoprim (base) | ^f | water | 1 month | 6 months | 2 years | +4-25°C; protect from moisture and light | GlaxoSmithKline |
| Vancomycin (hydrochloride) | water | water | 1 week | 3 months | - | +4°C; protect from light and moisture | Eli Lilly & Co Ltd |

^a Many agents are available from Sigma, Poole, UK

^b Saturated NaHCO₃ solution,

^c Ethanol,

^d Phosphate buffer (0.1 M, pH6),

^e Water and 0.1 M NaOH dropwise to dissolve,

^f Water (1 mL) + 10 µl glacial acetic acid,

^g Phosphate buffer (0.07 M, pH 8),

^h 1 M MOPS pH 6.8 buffer,

ⁱ Precipitation on freezing

NR = not recommended; DMF = dimethyl formamide; DMSO = dimethylsulphoxide. All solutions should be placed in glass containers.

Table II. Suggested ranges for MIC determinations (mg/L)

| Antibiotic | Enterobacteriaceae | <i>Pseudomonas</i> spp. | <i>Haemophilus</i> spp. | <i>Neisseria</i> spp. | <i>B. fragilis</i> | Staphylococci | Haemolytic streptococci | Enterococci | Pneumococci |
|-------------------------------|--------------------|----------------------------|----------------------------|--------------------------|--------------------|---------------|----------------------------|-------------|-------------|
| Amikacin | 0.03-128 | 0.06-128 | 0.12-16 | 0.5-16 | - | 0.008-128 | 1-128 | 1-128 | 1-128 |
| Amoxicillin | 0.25-128 | - | 0.06-128 | 0.004-32 | 1-128 | 0.03-128 | 0.008-0.12 | 0.12-128 | 0.008-4 |
| Ampicillin | 0.25-128 | - | 0.06-128 | 0.004-32 | 1-128 | 0.03-128 | 0.008-0.12 | 0.12-128 | 0.008-4 |
| Azithromycin | 0.25-128 | - | - | - | - | - | - | - | - |
| Azlocillin | 0.25-128 | 0.5-512 | 0.03-2 | 0.004-8 | 1-16 | 0.06-128 | - | - | - |
| Aztreonam | 0.004-128 | 0.5-128 | 0.015-2 | 0.015-2 | 8-128 | >128 | - | - | - |
| Cefaclor | - | - | 0.5-128 | - | - | - | - | - | 0.25-64 |
| Cefixime | 0.03-128 | - | 0.008-0.12 | 0.002-1 | 8-128 | 4-64 | 0.03-0.5 | 8-128 | 0.12-16 |
| Cefotaxime | 0.004-128 | 0.5-128 | 0.004-0.5 | 0.004-0.5 | 0.5-128 | 0.5-128 | - | - | - |
| Cefoxitin | 0.5-128 | - | 1-8 | 0.06-8 | 2-128 | 1-32 | - | - | - |
| Cefpirome | 0.008-32 | 0.25-128 | 0.008-0.5 | 0.001-0.12 | 4-128 | 0.06-128 | 0.004-0.12 | 1-128 | 0.008-1 |
| Cefpodoxime | 0.06-128 | 0.25-128 | 0.06-0.5 | 0.002-0.06 | 8-128 | 1-128 | 0.015-0.12 | 1-128 | 0.03-4 |
| Ceftazidime | 0.004-128 | 0.25-128 | 0.015-0.5 | 0.004-0.5 | 4-128 | 2-128 | 0.03-1 | 0.12-128 | 0.03-32 |
| Ceftizoxime | 0.004-128 | - | 0.008-0.25 | 0.004-0.015 | 0.5-128 | 1-128 | - | - | - |
| Ceftriaxone | 0.001-128 | 0.5-128 | 0.001-0.06 | 0.001-0.06 | 2-128 | 0.25-128 | 0.008-0.12 | 0.004-128 | 0.004-16 |
| Cefuroxime | 0.03-128 | - | 0.25-16 | 0.008-1 | 1-128 | 0.25-64 | 0.008-0.12 | 2-128 | 0.015-8 |
| Cephalexin | 0.25-128 | - | 1-128 | - | 4-128 | 0.5-128 | - | - | - |
| Cephradine | 0.25-128 | - | 1-128 | - | 1-128 | 0.25-128 | - | - | - |
| Chloramphenicol | 0.25-128 | - | 0.06-128 | 0.06-8 | 1-8 | 2-16 | 1-16 | 1-128 | 1-16 |
| Ciprofloxacin | 0.004-128 | 0.015-128 | 0.002-0.06 | 0.001-0.12 | 2-8 | 0.06-128 | 0.12-4 | 0.25-128 | 0.25-128 |
| Clarithromycin | - | - | 1-32 | 0.015-1 | 0.03-2 | 0.03-128 | 0.015-16 | 0.03-128 | 0.03-128 |
| Co-amoxiclav ^a | 0.5-128 | - | 0.03-128 | 0.004-32 | 0.5-128 | 0.008-16 | 0.008-0.12 | 0.12-16 | 0.008-4 |
| Clindamycin | - | - | - | - | 0.015-2 | 0.03-8 | - | - | - |
| Colistin | 0.5-128 | 0.5-64 | - | - | - | - | - | - | - |
| Quinupristin/ dalfopristin | - | - | - | - | 4-32 | 0.12-16 | 0.12-1 | 0.25-8 | 0.12-32 |
| Doxycycline | - | - | 0.03-128 | 0.25-16 | - | 0.06-128 | - | - | - |
| Erythromycin | - | - | 0.25-128 | 0.03-0.5 | 0.25-128 | 0.06-128 | 0.06-8 | 0.25-128 | 0.06-128 |
| Fusidic acid | - | - | - | - | - | 0.03-128 | - | - | - |
| Gatifloxacin | - | - | - | 0.001-0.12 | - | - | - | - | - |
| Gemifloxacin | - | - | - | 0.001-0.12 | - | - | - | - | - |
| Gentamicin | 0.03-128 | 0.06-128 | 0.12-16 | 0.5-16 | - | 0.008-128 | - | 0.5-2048 | - |
| Grepafloxacin | - | - | 0.002-0.06 | 0.001-0.12 | - | - | - | - | - |

| Antibiotic | Enterobacteriaceae | <i>Pseudomonas</i> spp. | <i>Haemophilus</i> spp. | <i>Neisseria</i> spp. | <i>B. fragilis</i> | Staphylococci | Haemolytic streptococci | Enterococci | Pneumococci |
|-------------------|--------------------|----------------------------|----------------------------|--------------------------|--------------------|---------------|----------------------------|-------------|-------------|
| Telithromycin | - | - | 0.25-8 | 0.002-0.5 | 0.03-8 | 0.03-128 | 0.001-0.25 | 0.015-4 | 0.004-1 |
| Imipenem | 0.06-4 | 0.06-16 | 0.25-4 | 0.004-0.25 | 0.015-4 | 0.03-128 | 0.002-0.25 | 0.25-128 | 0.002-0.25 |
| Levofloxacin | - | - | - | 0.001-0.12 | - | - | - | - | 0.5-32 |
| Linezolid | 0.03-128 | 0.12-16 | 0.007-1 | - | 1-4 | 0.12-8 | 0.25-8 | 0.25-8 | 0.5-8 |
| Mecillinam | 0.03-128 | - | - | - | - | - | - | - | - |
| Meropenem | 0.015-4 | 0.015-16 | 0.015-0.25 | 0.002-0.03 | 0.03-32 | 0.015-128 | 0.002-0.06 | 0.004-128 | 0.002-16 |
| Methicillin | - | - | - | - | - | 0.12-128 | - | - | - |
| Metronidazole | - | - | - | - | 0.06-32 | - | - | - | - |
| Mezlocillin | 0.25-128 | 0.5-512 | - | - | 1-128 | 0.12-128 | - | - | - |
| Moxifloxacin | - | - | - | 0.001-0.12 | - | - | - | - | - |
| Mupirocin | - | - | - | - | - | 0.06-1024 | - | - | - |
| Nalidixic acid | 1-128 | 32-128 | 0.015-2 | 0.5-8 | 32-64 | 16-128 | - | - | - |
| Netilmicin | 0.03-128 | 0.06-128 | 0.12-16 | 0.5-16 | - | 0.008-128 | - | - | - |
| Ofloxacin | 0.06-128 | 0.25-8 | 0.015-2 | 0.001-0.06 | 1-8 | 0.12-128 | - | 1-128 | 1-128 |
| Oxacillin | - | - | - | - | - | 0.12-128 | - | - | - |
| Penicillin | - | - | - | 0.004-32 | 4-128 | 0.015-128 | 0.004-0.06 | 0.5-128 | 0.015-4 |
| Piperacillin | 0.25-128 | 0.5-512 | 0.004-128 | 0.015-32 | 0.25-128 | 0.25-128 | - | - | - |
| Rifampicin | - | - | - | 0.25-2 | - | 0.004-128 | - | - | - |
| Roxithromycin | - | - | 2-32 | 0.015-2 | 0.12-16 | 0.03-128 | 0.015-16 | 0.03-128 | 0.03-128 |
| Sparfloxacin | 0.008-128 | 0.12-16 | 0.004-0.03 | 0.001-0.12 | 0.12-1 | 0.06-0.25 | 0.12-1 | 0.25-128 | 0.12-128 |
| Spectinomycin | - | - | - | 4-64 | - | - | - | - | - |
| Sulphamethoxazole | 4-128 | - | 0.5-32 | 0.25-8 | - | - | - | - | - |
| Teicoplanin | - | - | - | - | - | 0.06-32 | - | 0.5-2048 | - |
| Tetracycline | 0.25-128 | - | 0.06-128 | - | - | 0.06-128 | - | - | - |
| Ticarillin | 0.25-128 | 0.5-512 | 0.06-128 | - | 4-128 | 0.5-128 | - | - | - |
| Tobramycin | 0.03-128 | 0.06-128 | - | 0.5-16 | - | 0.008-128 | - | - | - |
| Trimethoprim | 0.03-128 | - | 0.015-16 | - | - | 0.03-8 | - | - | - |
| Vancomycin | - | - | - | - | - | 0.06-32 | 0.12-1 | 0.12-128 | 0.12-1 |

^aRatio of one part clavulanic acid: two parts amoxicillin

Table III. Appropriate media for different organisms.

| Organism | Medium to be Used |
|--|---|
| Enterobacteriaceae | ISA |
| <i>Pseudomonas</i> spp. | ISA |
| Staphylococci (other than methicillin/oxacillin) | ISA |
| Staphylococci (methicillin/oxacillin) | Columbia agar with 2% NaCl |
| Enterococci | ISA |
| <i>Streptococcus pneumoniae</i> | ISA + 5% defibrinated horse blood |
| β -haemolytic streptococci | ISA + 5% defibrinated horse blood |
| <i>Moraxella catarrhalis</i> | ISA + 5% defibrinated horse blood |
| <i>Haemophilus</i> spp. | ISA + 5% whole horse blood + 20 mg/L NAD |
| <i>Neisseria meningitidis</i> | ISA + 5% defibrinated horse blood |
| <i>Neisseria gonorrhoeae</i> | ISA + 5% defibrinated horse blood |
| Anaerobes | Wilkins & Chalgren agar + 5% defibrinated horse blood |

NAD = nicotinamide adenine dinucleotide

Table IV. Dilution of suspension (adjusted to 0.5 McFarland standard) in sterile distilled water before inoculation of agar dilution plates.

| 1:10 | No dilution |
|--------------------------|-------------------------------------|
| Haemolytic streptococci | <i>S. pneumoniae</i> |
| Enterobacteriaceae | <i>M. catarrhalis</i> |
| <i>Pseudomonas</i> spp | <i>M. meningitidis</i> |
| <i>Acinetobacter</i> spp | <i>N. gonorrhoeae</i> |
| <i>Haemophilus</i> spp | Anaerobes (not <i>Bacteroides</i>) |
| Enterococci | |
| Staphylococci | |
| <i>Bacteroides</i> spp | |

Organism suspensions should be used within 30 min of preparation.

Table V. Appropriate controls, depending on genera, that must be included with every batch of MIC determinations (strain number listed in the NCTC catalogue)

| Organism | ATCC control strain | NCTC control strain |
|-------------------------------|---------------------|---------------------|
| <i>Escherichia coli</i> | 25922 (NCTC 12241) | 10418 |
| <i>Staphylococcus aureus</i> | 25923 (NCTC 12981) | 6571 |
| <i>Pseudomonas aeruginosa</i> | 27853 (NCTC 12934) | 10662 |
| <i>Enterococcus faecalis</i> | 29212 (NCTC 12697) | |
| <i>Haemophilus influenzae</i> | 49247 (NCTC 12699) | 11931 |
| <i>S. pneumoniae</i> | 49619 (NCTC 129977) | |
| <i>N. gonorrhoeae</i> | 49226 (NCTC 12700) | |
| <i>B. fragilis</i> | | 9343 |

Table VI. Conditions for incubation of MIC plates

| Organism | Incubations conditions |
|---|---|
| Enterobacteriaceae | 35-37°C in air for 18-20 h |
| <i>Pseudomonas</i> spp | 35-37°C in air for 18-20 h |
| Staphylococci (other than tests on methicillin/oxacillin) | 35-37°C in air for 18-20 h |
| Staphylococci tests on methicillin/oxacillin | 30°C in air for 24 h |
| <i>M. catarrhalis</i> | 35-37°C in air for 18-20 h |
| β -haemolytic streptococci | 35-37°C in air for 18-20 h |
| Enterococci | 35-37°C in air for 18-20 h |
| Neisseria | 35-37°C in 4-6% CO ₂ in air for 18-20 h |
| <i>S. pneumoniae</i> | 35-37°C in 4-6% CO ₂ in air for 18-20 h |
| Haemophilus spp. | 35-37°C in 4-6% CO ₂ in air for 18-20 h |
| Anaerobes (anaerobic cabinet or jar) | 35-37°C 10% CO ₂ /10%H ₂ /80% N ₂ ^a |

^aincubation time depends on individual organism requirements

Table VIIa . Target MICs (mg/L) for reference strains

| Antibiotic | <i>H. influenzae</i> | <i>H. influenzae</i> | <i>Ent. faecalis</i> | <i>S. pneumoniae</i> | <i>B. fragilis</i> | <i>N. gonorrhoeae</i> |
|-----------------|----------------------|----------------------|----------------------|----------------------|--------------------|-----------------------|
| | NCTC 11931 | ATCC 49247 | ATCC 29212 | ATCC 49619 | NCTC 9343 | ATCC 49226 |
| ABT 492 | 0.001 | - | 0.06 | 0.008 | 0.06 | 0.001 |
| ABT 773 | 2 | 1 | 0.008 | 0.015 | - | 0.03 |
| Amikacin | - | - | 128 | - | - | - |
| Amoxicillin | 0.5 | 4 | 0.5 | 0.06 | 32 | 0.5 |
| Ampicillin | - | - | 1 | 0.06 | 32 | - |
| Azithromycin | 2 | 2 | - | 0.12 | - | - |
| Azlozillin | - | - | - | - | 4 | - |
| Aztreonam | - | - | >128 | - | 2 | - |
| Cefaclor | - | 128 | >32 | 2 | >128 | - |
| Cefamandole | - | - | - | - | 8 | - |
| Cefixime | 0.03 | 0.25 | - | 1 | 64 | - |
| Cefotaxime | - | 0.25 | 32 | 0.06 | 4 | - |
| Cefoxitin | - | - | - | - | 4 | - |
| Cefpirome | 0.06 | 0.5 | 16 | - | 16 | - |
| Cefpodoxime | 0.12 | 0.5 | >32 | 0.12 | 32 | - |
| Ceftazidime | 0.12 | - | >32 | - | 8 | - |
| Ceftriaxone | - | - | >32 | 0.06 | 4 | - |
| Cefuroxime | 2 | 16 | >32 | 0.25 | 32 | - |
| Cephadroxil | - | - | >32 | - | 32 | - |
| Cephalexin | - | - | >32 | - | 64 | - |
| Cephalothin | - | - | 16 | - | - | - |
| Chloramphenicol | - | - | 4 | 4 | 4 | - |
| Ciprofloxacin | 0.008 | 0.008 | 1 | 1 | 2 | 0.004 |
| Clarithromycin | 8 | 4 | - | 0.03 | 0.25 | 0.5 |
| Clindamycin | - | - | 8 | 0.12 | 0.5 | - |
| Co-amoxyclav | 0.5 | 8 | 0.5 | 0.06 | 0.5 | 0.5 |
| Co-trimoxazole | - | 1 | 2 | 4 | - | - |
| Enoxacin | - | - | - | - | 1 | - |
| Ertapenem | 0.12 | 0.5 | - | 0.12 | 0.25 | - |
| Erythromycin | 8 | 8 | 4 | 0.12 | 1 | 0.5 |
| Faropenem | - | - | - | 0.06 | 1 | - |
| Fleroxacin | - | - | - | - | 4 | - |
| Flucloxacillin | - | - | - | - | 16 | - |
| Fucidic acid | - | - | 2 | - | - | - |
| Gatifloxacin | - | - | - | - | 0.5 | - |
| Gemifloxacin | 0.12 | - | 0.03 | 0.03 | 0.25 | 0.002 |
| Gentamicin | - | - | 8 | - | 128 | - |
| Grepafloxacin | - | 0.004 | - | 0.25 | - | - |
| Imipenem | - | - | 0.5 | - | 0.06 | - |
| Levofloxacin | - | 0.015 | - | 0.5 | 0.5 | - |
| Linezolid | - | - | - | 2 | 4 | - |
| Loracarbef | - | 128 | >32 | 2 | >128 | - |
| Mecillinam | - | - | >128 | - | >128 | - |
| Meropenem | - | - | 2 | - | 0.06 | - |
| Metronidazole | - | - | - | - | 0.5 | - |
| Moxalactam | - | - | - | - | 0.25 | - |

| Antibiotic | <i>H. influenzae</i> | <i>H. influenzae</i> | <i>Ent. faecalis</i> | <i>S. pneumoniae</i> | <i>B. fragilis</i> | <i>N. gonorrhoeae</i> |
|-------------------------------------|----------------------|----------------------|----------------------|----------------------|--------------------|-----------------------|
| | NCTC 11931 | ATCC 49247 | ATCC 29212 | ATCC 49619 | NCTC 9343 | ATCC 49226 |
| Moxifloxacin | 0.03 | 0.03 | 0.25 | 0.5 | - | 0.004 |
| Naladixic acid | - | 1 | - | >128 | 64 | - |
| Nitrofurantoin | - | - | 8 | - | - | - |
| Norfloxacin | - | - | 2 | - | 16 | - |
| Ofloxacin | - | - | 2 | - | 1 | - |
| Oxacillin | - | - | - | 1 | - | - |
| Pefloxacin | - | - | - | - | 1 | - |
| Penicillin | - | 4 | 2 | 0.5 | 16 | - |
| Piperacillin | - | - | 2 | - | 2 | - |
| Piperacillin + 4 mg/L tazobactam | - | - | 2 | - | - | - |
| Quinupristin/dalfopri stin | - | - | 1 | 0.5 | 16 | - |
| Rifampicin | - | - | 2 | 0.03 | - | - |
| Roxithromycin | 16 | 16 | - | 0.12 | 2 | - |
| Rufloxacin | - | - | - | - | 16 | - |
| Sparfloxacin | - | 0.002 | - | 0.25 | 1 | - |
| Teicoplanin | - | - | 0.25 | - | - | - |
| Telithromycin | 1 | 2 | 0.008 | 0.008 | - | 0.03 |
| Tetracycline | - | 16 | 16 | 0.12 | 0.5 | - |
| Ticarcillin | - | - | - | - | 4 | - |
| Tobramycin | - | - | 16 | - | - | - |
| Trimethoprim | - | - | 0.25 | 4 | 16 | - |
| Trovafoxacin | 0.008 | 0.002 | 0.06 | 0.12 | 0.12 | - |
| Vancomycin | - | - | 2 | 0.25 | 16 | - |

Table VIIIb. Target MICs (mg/L) for reference strains

| Antibiotic | <i>E. coli</i> | | <i>P. aeruginosa</i> | | <i>S. aureus</i> | | |
|-----------------|----------------|---------------|----------------------|---------------|------------------|---------------|---------------|
| | NCTC 10418 | ATCC 25922 | NCTC 10662 | ATCC 27853 | NCTC 6571 | ATCC 25923 | ATCC 29213 |
| Amikacin | 0.5 | 1 | 2 | 2 | 1 | - | 2 |
| ABT 492 | 0.015 | 0.03 | 0.25 | 0.25 | 0.001 | 0.004 | 0.004 |
| ABT 773 | - | - | - | - | 0.015 | 0.03 | 0.03 |
| Amoxycillin | 2 | 4 | >128 | >128 | 0.12 | 0.25 | - |
| Ampicillin | 2 | 4 | >128 | >128 | 0.06 | - | - |
| Azithromycin | - | - | - | - | 0.12 | 0.12 | - |
| Azlozillin | 4 | - | 4 | - | 0.25 | - | - |
| Aztreonam | 0.03 | 0.25 | 4 | 2 | >128 | - | >128 |
| Carbenicillin | 2 | - | 32 | - | 0.5 | - | - |
| Cefaclor | 1 | 2 | >128 | >128 | 1 | - | 1 |
| Cefamandole | 0.25 | - | >128 | >128 | 0.25 | - | - |
| Cefixime | 0.06 | 0.25 | 16 | - | 8 | 8 | 16 |
| Cefotaxime | 0.03 | 0.06 | 8 | 8 | 0.5 | - | 1 |
| Cefotetan | 0.06 | - | >128 | >128 | 4 | - | - |
| Cefoxitin | 4 | - | >128 | >128 | 2 | - | - |
| Cefpirome | 0.03 | 0.03 | 4 | 1 | 0.25 | - | 0.5 |
| Cefpodoxime | 0.25 | 0.25 | 128 | >128 | 1 | 4 | 2 |
| Ceftazidime | 0.06 | 0.25 | 1 | 1 | 4 | - | 8 |
| Ceftizoxime | 0.008 | - | - | - | 2 | - | - |
| Ceftriaxone | 0.03 | 0.06 | 8 | 8 | 1 | - | 2 |
| Cefuroxime | 2 | 4 | >128 | >128 | 0.5 | 1 | 1 |
| Cephadroxil | 8 | 8 | >128 | >128 | 1 | - | 2 |
| Cephalexin | 4 | 8 | >128 | >128 | 1 | - | 4 |
| Cephaloridine | - | - | >128 | >128 | 0.06 | - | - |
| Cephalothin | 4 | 8 | >128 | >128 | 0.5 | - | 0.25 |
| Cephradine | - | - | >128 | >128 | 2 | - | - |
| Chloramphenicol | 2 | 4 | 128 | - | 2 | - | 2 |
| Ciprofloxacin | 0.015 | 0.015 | 0.25 | 0.25 | 0.12 | 0.5 | 0.5 |
| Clarithromycin | - | - | - | - | 0.12 | 0.12 | 0.12 |
| Clindamycin | - | - | - | - | 0.06 | 0.12 | 0.06 |
| Co-amoxyclav | 2 | 4 | >128 | 128 | 0.12 | 0.12 | 0.25 |
| Colistin | 0.5 | - | 2 | - | 128 | - | - |
| Dirythromycin | - | - | - | - | 1 | - | 1 |
| Enoxacin | 0.25 | - | 1 | - | 0.5 | - | - |
| Ertapenem | 0.008 | 0.015 | - | - | - | - | - |
| Erythromycin | - | - | - | - | 0.12 | 0.5 | 0.25 |
| Faropenem | 0.25 | - | >128 | >128 | 0.12 | - | - |
| Fleroxacin | 0.06 | 0.12 | 1 | - | 0.5 | - | - |
| Flucloxacillin | - | - | >128 | >128 | 0.06 | - | - |
| Flumequine | 2 | - | >128 | >128 | - | - | - |
| Fosfomycin | 4 | - | >128 | >128 | 8 | - | - |
| Fucidic acid | >128 | - | - | - | 0.06 | 0.12 | 0.06 |
| Gatifloxacin | 0.015 | - | 1 | - | 0.03 | - | - |
| Gemifloxacin | 0.008 | 0.008 | 0.25 | 0.25 | 0.015 | 0.03 | 0.03 |
| Gentamicin | 0.25 | 0.5 | 1 | 1 | 0.12 | 0.25 | 0.25 |
| Grepafloxacin | 0.03 | 0.03 | 0.5 | - | 0.03 | - | - |

| Antibiotic | <i>E. coli</i> | | <i>P. aeruginosa</i> | | <i>S. aureus</i> | | |
|-------------------------------------|----------------|---------------|----------------------|---------------|------------------|---------------|---------------|
| | NCTC 10418 | ATCC 25922 | NCTC 10662 | ATCC 27853 | NCTC 6571 | ATCC 25923 | ATCC 29213 |
| Imipenem | 0.06 | 0.12 | 2 | 1 | 0.015 | - | 0.015 |
| Kanamycin | 1 | - | 1 | - | 2 | - | - |
| Levofloxacin | 0.03 | 0.03 | 0.5 | 0.5 | 0.12 | 0.25 | 0.25 |
| Linezolid | - | - | - | - | 0.5 | 1 | - |
| Lomefloxacin | - | - | - | - | 0.5 | - | - |
| Mecillinam | 0.12 | 0.12 | 8 | - | 8 | - | 64 |
| Meropenem | 0.015 | 0.008 | 2 | 0.25 | 0.03 | - | 0.06 |
| Methicillin | - | - | >128 | >128 | 1 | 2 | 2 |
| Mezlocillin | 2 | - | 8 | - | 0.5 | - | - |
| Moxalactam | 0.03 | - | 8 | - | 8 | - | - |
| Moxifloxacin | 0.03 | 0.03 | 2 | 2 | 0.06 | 0.06 | - |
| Mupirocin | - | - | - | - | 0.25 | 0.25 | 0.12 |
| Naladixic acid | 2 | 4 | >128 | >128 | >128 | 128 | 128 |
| Neomycin | - | - | 32 | - | 0.12 | - | - |
| Netilmicin | 0.5 | - | 1 | - | 0.25 | - | - |
| Nitrofurantoin | 4 | 8 | - | - | 8 | - | 16 |
| Norfloxacin | 0.06 | 0.06 | 1 | 1 | 0.25 | - | 1 |
| Ofloxacin | 0.06 | 0.03 | 1 | 1 | 0.25 | - | 0.5 |
| Oxacillin | - | - | >128 | >128 | 0.25 | 0.25 | 0.25 |
| Pefloxacin | 0.06 | - | 0.5 | - | 0.25 | - | - |
| Quinupristin/ dalfopristin | - | - | - | - | 0.12 | 0.25 | 0.25 |
| Penicillin | - | - | >128 | >128 | 0.03 | 0.03 | 0.12 |
| Piperacillin | 0.5 | 2 | 4 | 2 | 0.25 | - | 1 |
| Piperacillin + 4 mg/L tazobactam | 1 | 2 | 4 | 2 | 0.25 | - | 1 |
| Rifampicin | 16 | - | - | - | 0.004 | 0.015 | 0.004 |
| Roxithromycin | - | - | - | - | 0.25 | 0.5 | 0.5 |
| Rufloxacin | 0.5 | - | 8 | - | 1 | - | - |
| Sparfloxacin | 0.015 | 0.015 | 0.5 | 0.5 | 0.03 | - | - |
| Sulphonamide | 16 | - | >128 | >128 | 64 | - | - |
| Teicoplanin | - | - | - | - | 0.25 | 0.5 | 0.5 |
| Telithromycin | - | - | - | - | 0.03 | 0.06 | 0.06 |
| Temocillin | 2 | - | >128 | - | 128 | - | - |
| Tetracycline | 1 | 2 | - | 32 | 0.06 | - | 0.5 |
| Ticarcillin | 1 | - | 16 | - | 0.5 | - | - |
| Ticarcillin + 4 mg/L clavulanate | - | - | 32 | 16 | - | - | - |
| Tobramycin | 0.25 | 0.5 | 0.5 | 0.5 | 0.12 | - | 0.5 |
| Trimethoprim | 0.12 | 0.25 | 32 | - | 0.25 | - | 0.5 |
| Trovafloxacin | 0.015 | 0.015 | 0.5 | 0.5 | 0.015 | 0.03 | 0.03 |
| Vancomycin | - | - | - | - | 0.5 | 0.5 | 1 |

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