What is claimed is:

1. Polymorphic Form ζ, Form η, Form ι, Form ι-dry, Form ι-dry', or Form B of rifaximin.

2. The polymorph Form ζ of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising 4.69, 7.63, 12.52, 13.87.

3. The polymorph Form ζ of rifaximin of claim 1, comprising an XRPD pattern as substantially depicted in Figure 4 or Figure 15 wherein peaks in the XRPD patterns have a variation of +/-0.2 theta.

4. The polymorph Form η of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising 6.1, 7.3, and 7.5 degrees 2-θ; or 6.1, 7.3, and 7.9 degrees 2-θ; 5.3, 6.1, 7.3, 7.5, 8.8, and 12.7 degrees 2-θ.

5. The polymorph Form ι of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising 5.49, 5.88, 7.86, 9.03, 12.66, and 13.89.

6. The polymorph Form ι of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising 5.9; 7.9; 9.0; or 12.7; 13.9; 14.9; or 5.9; 7.9; 12.7; or 5.9; 9.0; 12.7; or 5.9; 13.9; 14.9; or 5.9; 7.9; 14.9; or 9.0; 12.7; 14.9; or 5.9; 7.9; 9.0; 14.9; or 5.9; 7.9; 9.0; 12.7; or 5.9; 7.9; 9.0; 12.7; 13.9; 14.9.

7. The polymorph Form ι of rifaximin of claim 1, comprising an XRPD pattern as substantially depicted in Figure 3 or Figure 9 wherein peaks in the XRPD patterns have a variation of +/-0.2 theta.

8. The polymorph Form ι of rifaximin of claim 1, comprising thermal data as substantially depicted in Figure 10 or proton NMR spectrum as substantially depicted in Figure 12 or vapor data as substantially depicted in Figure 11 or FT-IR spectrum as substantially depicted in Figure 13.

9. The polymorph Form ι of claim 1, wherein the Form ι is formulated into a pharmaceutically acceptable dosage form.

10. The polymorph From ι-dry of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.10 degree θ) comprising 6.04, 7.90, 8.92, 9.49, 12.76, and 14.14.

11. The polymorph Form ι-dry of rifaximin of claim 1, comprising an XRPD pattern as substantially depicted in Figure 1 or Figure 6 or thermal data as substantially depicted in Figure 7.

12. The polymorph From ι-dry of claim 1, wherein the Form ι-dry is formulated into a pharmaceutically acceptable dosage form.

13. The polymorph From ι-dry' of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.15 degree θ) comprising 6.16, 7.92, 8.89, 9.55, 12.80, and 14.25.

14. The polymorph Form ι-dry' of rifaximin of claim 1, comprising an XRPD pattern as substantially depicted in Figure 2 or Figure 8 wherein peaks in the XRPD patterns have a variation of +/-0.15 theta.

15. The polymorph From ι-dry' of claim 1, wherein the Form ι-dry' is formulated into a pharmaceutically acceptable dosage form.

16. The polymorph From B of claim 1, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.15 degree θ) comprising 5.24, 6.84, 7.74, 8.71, 10.16, and 12.21.

17. The polymorph Form B of claim 1, comprising an XRPD pattern as substantially depicted in Figure 6 wherein peaks in the XRPD patterns have a variation of +/-0.15 theta or having DSC or TGA thermograms as substantially depicted in Figure 17.

18. The polymorphs of claim 1, wherein the polymorphs comprise from between about 50 to about 100% pure polymorphous forms before or after formulation.

19. The polymorphs of claim 1, wherein the polymorphs comprise from between about 75 to about 100% pure polymorphous forms before or after formulation.

20. A pharmaceutical dosage form comprising one or more of polymorphic Form ζ, Form η, Form ι, Form ι-dry, Form ι-dry', or Form B of rifaximin or mixtures thereof.

What is claimed is:

1. A rifaximin polymorph Form ζ, wherein the polymorphic Form ζ exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

4.69, 7.63, 12.52, and 13.87;

4.69, 7.63 and 12.52;

4.69, 7.63 and 13.87;

4.69, 12.52 and 13.87; or

7.63, 12.52 and 13.87.

2. A rifaximin polymorph Form η, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

6.1, 7.3, and 7.5;

6.1, 7.3, and 7.9;

6.1, 7.3 and 8.8;

6.1, 7.3 and 12.7;

6.1, 7.5 and 7.9;

6.1, 7.5 and 8.8;

5.3, 6.1 and 7.3;

5.3, 6.1 and 7.5;

6.1, 7.3, 7.5, 7.9, 8.8 and 12.7;

5.3, 6.1, 7.3, 7.9, 8.8 and 12.7;

5.3, 6.1, 7.3, 7.5, 8.8, and 12.7; or

5.3, 6.1, 7.3, 7.5, 7.9, 8.8 and 12.7.

3. A rifaximin polymorph Form ι, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

5.49, 5.88, 7.86, 9.03, 12.66, and 13.89;

5.49, 5.88, 7.86, 9.03, and 12.66;

5.49, 5.88, 9.03, 12.66 and 13.89;

5.49, 7.86, 9.03, 12.66 and 13.89;

5.49, 5.88, 7.86, 9.03 and 13.89;

5.88, 7.86, 9.03, 12.66 and 13.89;

5.9, 7.9, and 9.0;

12.7, 13.9, and 14.9;

5.9, 7.9, and 12.7;

5.9, 9.0, and 12.7;

5.9, 13.9, and 14.9;

5.9, 7.9, and 14.9;

7.4, 20.0 and 20.9;

9.0, 12.7, and 14.9;

20.0, 20.9 and 23.4;

5.9, 7.9, 9.0, and 14.9;

5.9, 7.9, 9.0, and 12.7;

5.9, 7.4, 7.9 and 9.4;

7.4, 12.7, 13.9 and 23.4;

5.9, 13.9, 14.9, 20.0 and 20.9;

5.9, 7.9, 9.0, 12.7, 13.9, and 14.9;

5.9, 7.4, 7.9, 12.7, 13.9, 14.9, 20.0, 20.9 and 23.4; or

5.9, 7.4, 7.9, 9.0, 9.4, 12.7, 13.9, 14.9, 20.0, 20.9 and 23.4.

4. A rifaximin polymorph Form ι-dry, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

6.04, 7.90, 8.92, 9.49, 12.76, and 14.14;

6.04, 8.92, 9.49, 12.76 and 14.14;

6.04, 7.90, 9.49, 12.76 and 14.14;

6.04, 7.90, 8.92, 9.49 and 14.14;

6.04, 7.90, 8.92, 9.49 and 12.76;

6.04, 7.90, 8.92, 12.76 and 14.14; or

7.90, 8.92, 9.49, 12.76, and 14.14.

5. A rifaximin polymorph Form ι-dry', wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

6.16, 7.92, 8.89, 9.55, 12.80, and 14.25;

6.16, 8.89, 9.55, 12.80 and 14.25;

6.16, 7.92, 9.55, 12.80 and 14.25;

6.16, 7.92, 8.89, 12.80 and 14.25;

6.16, 7.92, 8.89, 9.55 and 14.25;

6.16, 7.92, 8.89, 9.55 and 12.80; or

7.92, 8.89, 9.55, 12.80 and 14.25.

6. A rifaximin polymorph Form B, wherein the polymorph exhibits an X-ray powder diffraction pattern having characteristic peaks expressed in degrees 2θ (+/- 0.20 degree θ) comprising:

5.24, 6.84, 7.74, 8.71, 10.16, and 12.21;

5.24, 7.74, 8.71, 10.16 and 12.21;

5.24, 6.84, 8.71, 10.16 and 12.21;

5.24, 6.84, 7.74, 10.16 and 12.21;

5.24, 6.84, 7.74, 8.71 and 12.21;

5.24, 6.84, 7.74, 8.71 and 10.16;

6.84, 7.74, 8.71, 10.16 and 12.21; or

5.24, 6.84 and 7.74.

7. A pharmaceutical composition comprising the rifaximin polymorph Form ζ of Claim 1, rifaximin polymorph Form η of Claim 2, rifaximin polymorph Form ι of Claim 3, rifaximin polymorph Form ι-dry of Claim 4, rifaximin polymorph Form ι-dry' of Claim 5, or rifaximin polymorph Form B of Claim 6, or mixtures thereof; and a pharmaceutically acceptable carrier.

8. The rifaximin polymorph Form ζ of Claim 1, containing less than 5% by weight total impurities.

9. The rifaximin polymorph Form η of Claim 2, containing less than 5% by weight total impurities.

10. The rifaximin polymorph Form ι of Claim 3, containing less than 5% by weight total impurities.

11. The rifaximin polymorph Form ι-dry of Claim 4, containing less than 5% by weight total impurities.

12. The rifaximin polymorph Form ι-dry' of Claim 5, containing less than 5% by weight total impurities.

13. The rifaximin Form B of Claim 6, containing less than 5% by weight total impurities.

14. The rifaximin polymorph Form ζ of Claim 1, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

15. The rifaximin polymorph Form η of Claim 2, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

16. The rifaximin polymorph Form ι of Claim 3, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

17. The rifaximin polymorph Form ι-dry of Claim 4, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

18. The rifaximin polymorph Form ι-dry' of Claim 5, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.

19. The rifaximin polymorph Form B of Claim 6, wherein the compound is at least 50% pure, or at least 75% pure, or at least 80% pure, or at least 90% pure, or at least 95% pure, or at least 98% pure.