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. D ff B-. **%** ff ٩, II. SYSTEM MODEL .R . T. - $\mathbf{A}_{\mathbf{x}}$ • . 🕰 :🛰 BS 🚯 , 🛰 🔨 4, 4, BS (MS) . D ff В 🍡 . f👆 BS В --SINR, BS, (MBRP), (MIRP). A ٩. • A. BS Layout 4 4 FA . B T- H N 🛰 f K L .T-, BS /B A., T. - É 📥 \mathbb{R}^2 ٩. А, Р [3], [26], [25], [31]. O $\mathbb{B}\lambda_{ok}, \lambda_{cl} \mathbf{f} \leftarrow k^{\mathbf{k}}$ -🔨 l^t *** 1**. – 🕰 🕰 🛛 🚯 MS . C BBS **B**, **A**, k = 1, ..., K **A** l = 1, ..., L. **T**, f • ***** MS 🛰 🛛 🖁 🗛 f . ₩4, 44, 14, 18 BS f B f 🔩 _ بالا f - بالا ***** BS.W MS f - BS 👆 MS BT. А, . S 🛛 🐴 🛛 BSN Α, ΗN BQ . A BA MS f . O BS A f B. Radio Environment and Downlink SINR T. **N** f 🗛 BS 🔊 BS В . A ▲_- . A ▲_ • ۱. ff В f B. **f** (4.54) **f f f** SINR f 4. N. **%** f **B**MS -SINR Α., 🔍 🖪 f Τ. f $\mathbf{A}_{\mathbf{A}} i^{\mathbf{A}_{\mathbf{A}}} BS \mathbf{f} \mathbf{A}_{\mathbf{A}} k^{\mathbf{A}_{\mathbf{A}}}$ B $\mathbf{A}_{\mathbf{k}_{i}^{-}}$ B 🔨 🕺 f 🔩 BS 🔩 fA, f4. f *** *** [26], [27]. U R f f ▲, ▲, BS ▲,)B ▲., [22] [24] Α., B η, 🔨 ٩. -SINR 🦜 f 🔩 H N 🗛 🚽 BS B **N N** $\mathrm{SINR}_{ki} = \frac{P_{ok}\Psi_{oki}R_{oki}^{-\varepsilon_{ok}}}{2}$ f . I [30], B. -1940 🄊 🖪 🗛 🛛 H 🛛 N ⊮Bf MBRP (1) $\overline{I_o - P_{ok} \Psi_{oki} R_{oki}^{-\varepsilon_{ok}} + I_c + \eta},$ B. ₿**ጚ**, ,f ♣ **N N** -🄊 🔊 👟 H N 👘 . I [1] [3], В 🍡 ۳. -'o' ¶. 'c' ¶. ٩. K f MIRP • B A $\begin{array}{rcl}
\mathbf{B}, & I_o = & \begin{matrix} K & \\ m=1 \end{matrix} \\ \mathbf{f} & \begin{matrix} n=1 \end{matrix} P_{om} \Psi_{omn} R_{omn}^{-\varepsilon_{omn}} \\ \mathbf{f} & \begin{matrix} n=1 \end{matrix} \\ \mathbf{f} & \begin{matrix} n=1 \end{matrix}$ ٩. B. Α. f 👆 Α. ' A_{4,-} **Bh**. ff . BS; $\{P_{om}, \Psi_{omn}, \varepsilon_{om}, R_{omn}\}_{m=1, n=1}^{m=K, n=1}$ **45**654284.6(f -BS 🔩 -SINR I A , **~. f**. f , A., f $f \rightarrow MS \rightarrow n^{-1} BS f$ ۳. . W . Α., ; $I_c = \begin{bmatrix} L \\ l=1 \end{bmatrix}_{n=1}^{L} P_{cl} \Psi_{cln} R_{cln}^{-\varepsilon_{cl}}$ 🔩 m🍢 , fN. f B omn SINR 🔩 🔌 🔨 . B B T. f. f. B.F **NBf** f -🔺 MBRP 🌂 MIRP . W 🛰 Α, B f -BS 🤊 -SINR BW • B ٩. f f 🕹 H N 🔩 føBA–, HN Α. f . Was As SINRAS AS M f As 1, В. 🤊 👆 H N -SINR -B 🔨 MIRP В ٩. -BS 🖟 🍡 🔩 MBRP .E. 👟 , В • В , 🄊 f 🙏 ٩ ٨. B 🔪 🛛 🗛 🕹 BS 🦸 🗛 . F B--)B ٩. . W B **4**,4, ₿

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() \Re B R_{ol1} $\frac{K}{l=1}$

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Tier 1 SIR threhold (in dB)

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- $\mathbf{f} \mathbf{C} \quad \mathbf{i} \mathbf{K} \quad [32], \quad -s\eta \quad \mathbf{f} \mathbf{K} \quad \mathbf{i} \mathbf{i} \mathbf{K} \quad \mathbf{i} \mathbf{i} \mathbf{i} \mathbf{i} \mathbf{i} \mathbf{i}$





G BS , *****, *****, [2, **T***, 2], *****, *****, **B**S **f** Rf 🔩 $R = (P_{ok}\Psi_{ok})^{-1} R^{\varepsilon_{ok}}$ As As BS **7** A., . 1-D P 👆 BS 🐿 🛛 🚯 Α., $\lambda_{ok}(r), \qquad \mathbb{E} \ \Psi_{ok}^{\frac{2}{c_{ok}}} < , f \qquad \bigstar \ k =$ f. 1, 2, \cdots , K. S B f \sim $K = (P_c \Psi_c)^{-1} R^{\varepsilon_c} \sim K = 1 - D P$, R = $\mathbf{A}_{\mathcal{B}} \mathbf{B} \mathbf{f}_{\mathcal{C}} \qquad \lambda(r), \qquad \mathbb{E} \Psi_{\mathcal{C}}^{\frac{2}{\varepsilon_{\mathcal{C}}}} < \mathbf{F}_{\mathcal{C}}$ f 🔩 M 🔩 [32, P 18] 🍡 ▲ M T [32, P 55] f ▲ P F. ▲ , ▲ BS ▲ ff _____B *** * f ▲** _____ f ▲ BS 1-D 🛰 P B **A.** . B)B.4., S. **A.** . . . f Rs **T**-, ,**4**, [32, P 16] f P . Р A.N. Bf _____ $\sum_{k=1}^{K} \lambda_{ok}(r), r = 0.$ $\lambda(r) =$ Ι. 2-D 2-, 🔩 SINR f A.A. ***** .E 🔩 , ٩. 2-A BSA f 🔩 R' (10).

C. Proof for Lemma 2

T H N SINR MIRP **f** . F $m = 1, \dots, K, c$ (**f** k)

),
$$\mathbf{f}$$
 \mathbf{f} $P_{om}\Psi_{om,l} \stackrel{-\frac{1}{\varepsilon}}{\overset{l=1}{\overset{l}{1}{\overset{l=1}{\overset{l}}{\overset{l=1}{\overset{l=1}{\overset{l=1}{\overset{l}{1}{\overset{l=1}{\overset{l}}{\overset{l}{1}{\overset{l=1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}{1}{\overset{l}}{\overset{l}}$

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