EITP30 Modern Wireless Systems - 5G and Beyond

Exercise 20210924

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Exercise: Multi-antenna throughput

- Alice wants to watch a Netflix movie in her phone while she is on a train trip.
- The phone supports LTE, and has 2 antennas.
- Which video quality can she obtain?

Network information:

- In average, 16QAM is used.
- Channel bandwidth allocated for Alice 1.4MHz.
- Coding rate 1/3
- Normal cyclic prefix

Netflix data usage:

- Low quality: 0.3GB/hour
- Medium quality: 0.7GB/hour
- High (HD): 3GB/hour
- High (UHD): 7GB/hour

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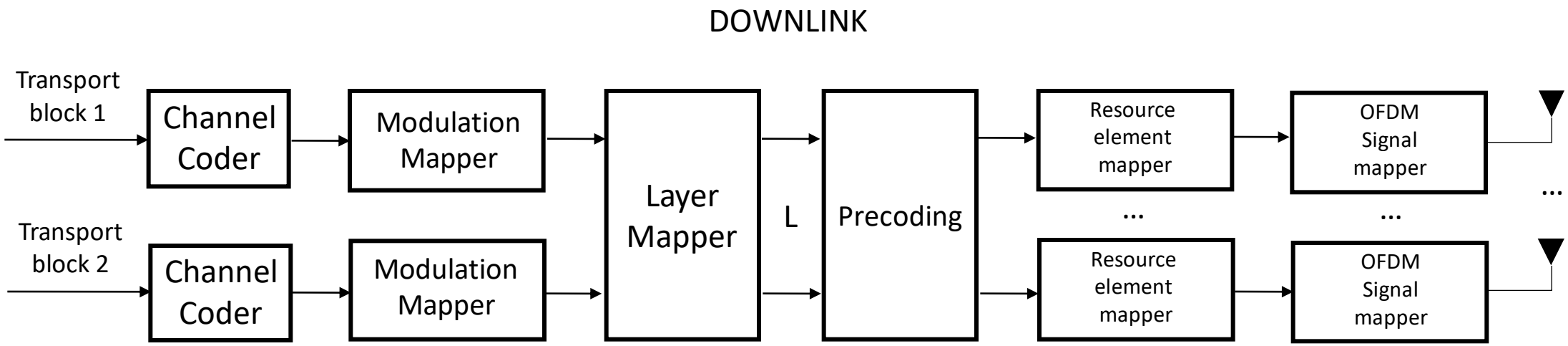
Exercise: Multi-antenna throughput



Transmission bandwidth configuration N_{RB}

Channel bandwidth $BW_{Channel}$ [MHz]	1.4	3	5	10	15	20
Transmission bandwidth configuration N_{RB}	6	15	25	50	75	100

$$R_{\text{uncoded}}^{layer} = \frac{r_c \cdot K \cdot \log_2 M \cdot N_{symb}^{sf}}{T_{sf}} = \frac{\frac{1}{3} \cdot 72 \cdot 4 \cdot 14}{10^{-3}} bps = 1.344\text{Mbps}$$

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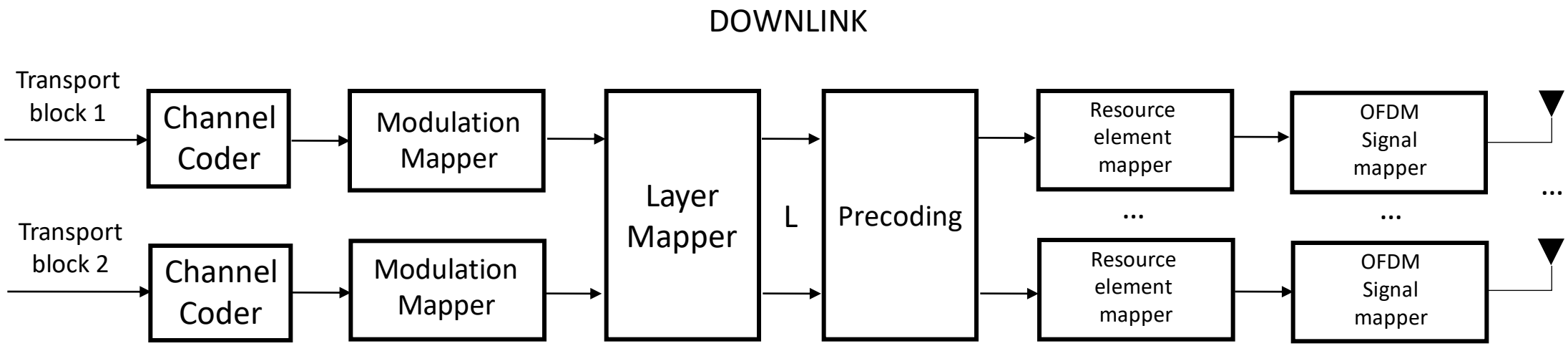
Exercise: Multi-antenna throughput



$R_{\text{uncoded}}^{layer} = 1.344\text{Mbps}$

$L = \left\lfloor \frac{15.556}{1.344} \right\rfloor = 12$

Device has only 2 antennas → Up to 2 layers → $L = \{1,2\}$

UHD → 15.556Mbps

HD → 6.667Mbps

Med. Q. → 1.556Mbps

Low. Q. → 0.667Mbps

$R_{\text{uncoded}}(L = 2) = 2 \cdot R_{\text{uncoded}}^{layer} = 2.688\text{Mbps}$ → Medium Quality

$R_{\text{uncoded}}(L = 1) = R_{\text{uncoded}}^{layer} = 1.344\text{Mbps}$ → Low Quality

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