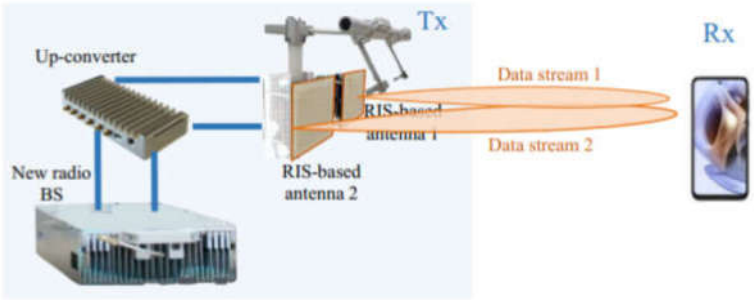
RIS-based antenna: Dual stream transmission performance

- **Principle**
  - The RIS-based antenna radiates out two EM waves with orthogonal polarizations towards two users , and each EM wave carries one data stream
- **Communication Prototype**
  - One transmitter + one receiver
  - Transmitter
    - Commercial 5G NR BS: generate intermediate-frequency signals according to 5G NR specifications
    - Up-converter
    - Two RIS-based antennas: orthogonal polarizations
  - Receiver
    - Off-the-shelf UE powered by MediaTek's 5G baseband modem of type M80



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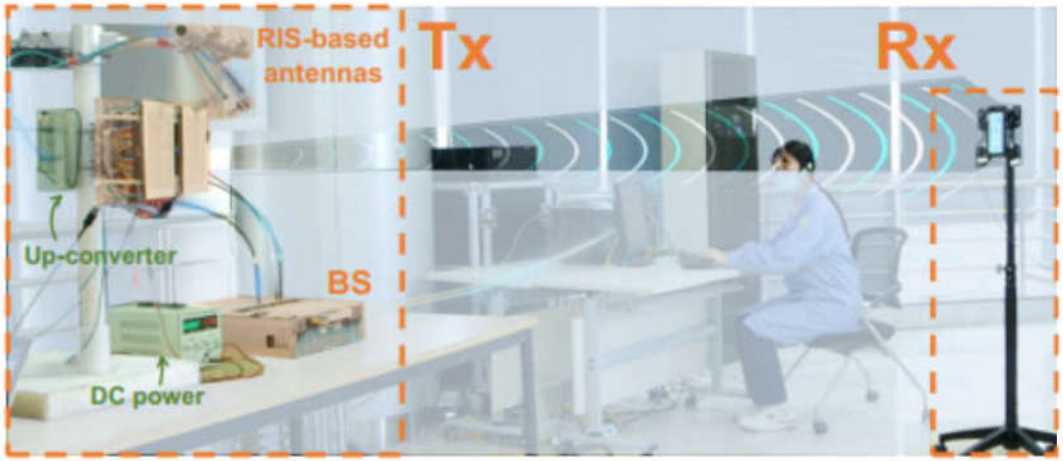
- **Experimental setup**



Parameters	Value
Channel	NR PDSCH
Transmit power	4 W in total
Modulation	64 QAM
Frame structure	DDDSU (S slot: 10:2:2)
Component carrier	4 CC (200MHz for one CC)
Center frequency	26.6 GHz
Tx-Rx distance	3 m

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- **Experimental results**

RIS-based antenna	Antenna gain (dBi)	Sidelobe level (dB)	Cross polarization (dB)	Data rate (two streams)	Power consumption
H-polarized	22.01	-7.43	-15.19	Measured data rate: 5Gpbs (Theoretical peak rate: 5.17 Gbps[1])	RIS-based antennas: 15.8 W (Phased array: 25.6 W[2])
V-polarized	22.11	-13.55	-10.16		

[1]: 3GPP TS 38.306 version 17.3.0, "User equipment (UE) radio access capabilities (Release 17)," Tech. Rep., 01- 2023. [Online]. Available: https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3193
[2]: K. Kibaroglu, M. Sayginer, T. Phelps, and G. M. Rebeiz, "A 64-element 28-GHz phased-array transceiver with 52-dBm EIRP and 8–12-Gb/s 5G link at 300 meters without any calibration," IEEE Trans. Microw. Theory Tech., vol. 66, no. 12, pp. 5796–5811, Dec.