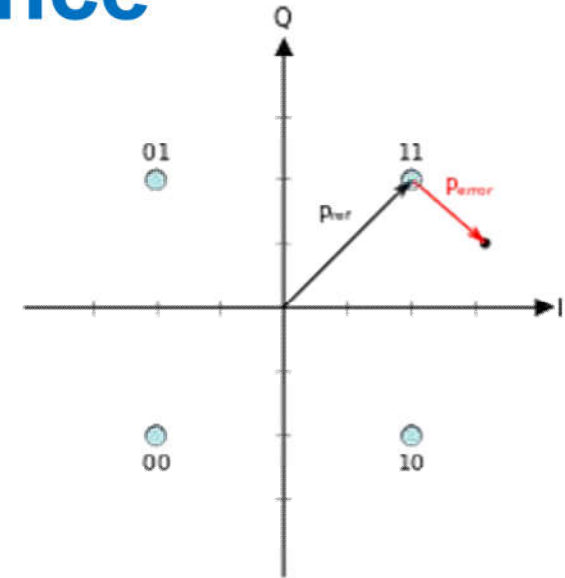


# RIS-based antenna: Single stream transmission performance

- Performance indicator and requirement
  - **Error Vector Magnitude (EVM)**
    - **Definition**
      - **Error vector:** a vector in the I-Q plane between the ideal constellation point and the received point
      - **EVM:** root mean square of error square **normalized by** ideal signal amplitude
    - **Physical meaning:** EVM measures **how far** the received symbols are from the ideal constellations.
    - **Requirement:** different requirements under various modulation modes



## EVM requirement

QPSK-----17.5%

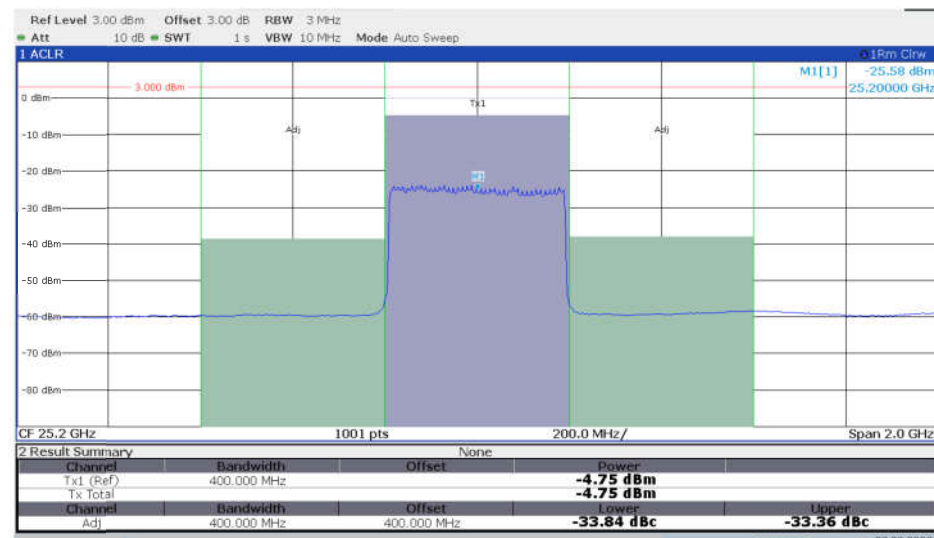
16QAM-----12.5%

64QAM-----8%

256QAM—3.5%

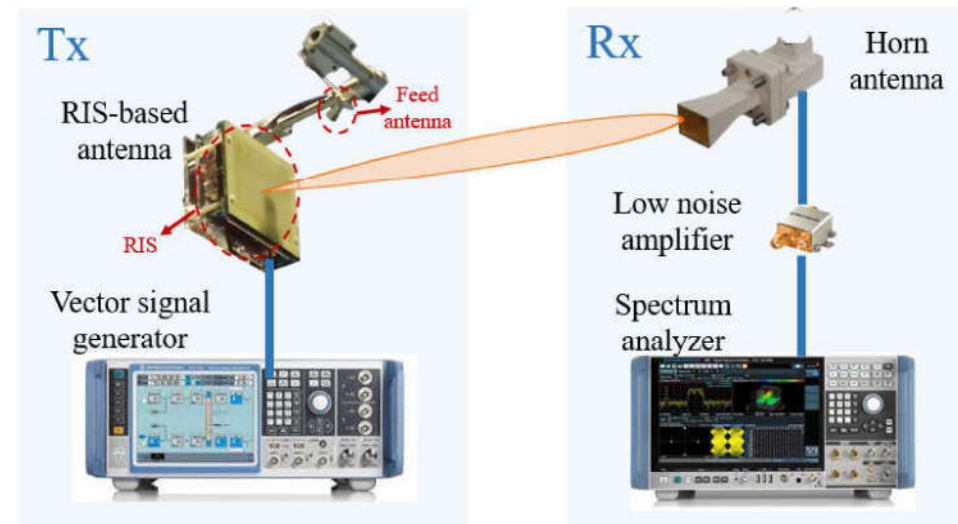
# RIS-based antenna: Single stream transmission performance

- Performance indicator and requirement
  - **Adjacent Channel Leakage Ratio (ACLR)**
    - **Definition:** **ratio** between the power within the designated channel and the power within adjacent channels
    - **Physical meaning:** a measurement of the **interference** to adjacent channels
    - **Requirement:**  $< -30\text{dBc}$



# RIS-based antenna: Single stream transmission performance

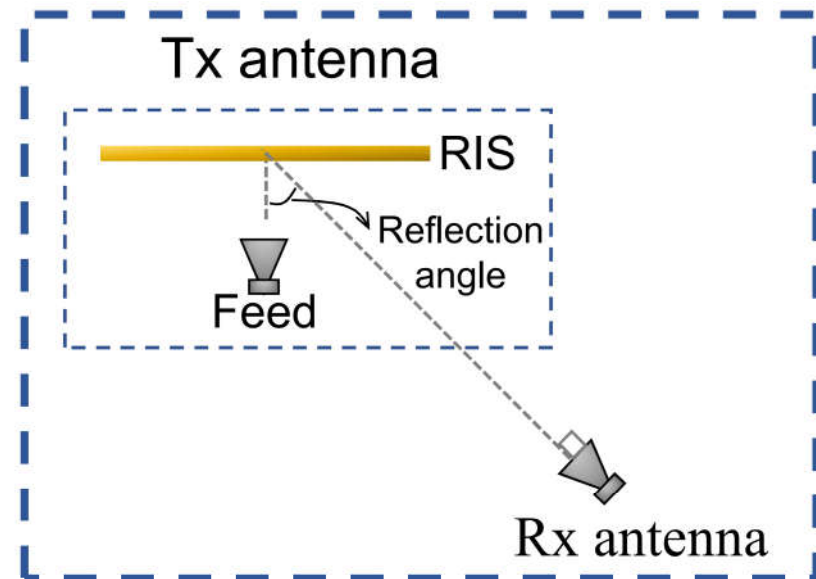
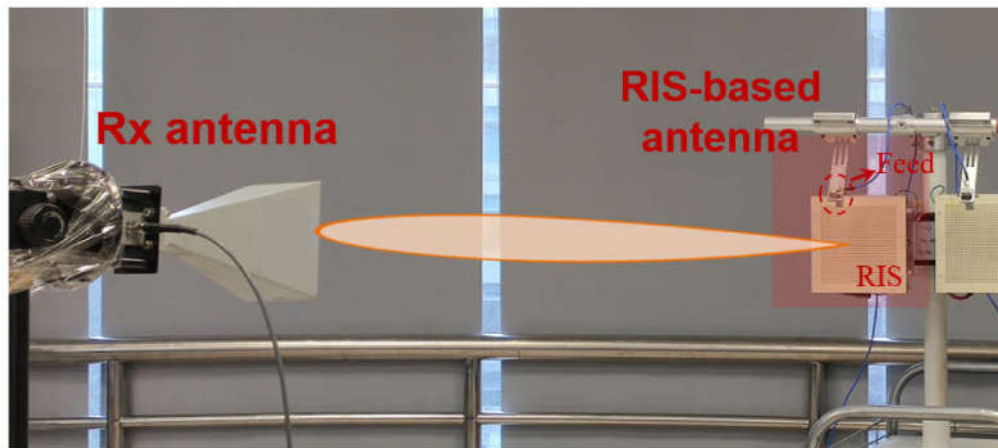
- **Communication Prototype**
  - **One Transmitter**
    - Vector signal generator (SMW200A): **generate** signal
    - One RIS-based antenna
  - **One Receiver:**
    - Horn antenna
    - Lower noise amplifier (30dB)
    - Spectrum analyzer (FSW): **measure ACLR and EVM**



# RIS-based antenna: Single stream transmission performance

- **Experimental setup**

- In a meeting room
- Transmit power: 1 dBm
- Transmit bandwidth: 400MHz
- Adjacent channel bandwidth: 400MHz for each side



# RIS-based antenna: Single stream transmission performance

- **Experimental results**

- EVM (Reflection angle=0°, @25.2 GHz)

Tx-Rx distance (m)	4	8	12	16	20
EVM (%)	2.9	3.42	4.26	4.39	4.8

- ACLR (Tx-Rx distance=4m)

Reflection angle (degree)	0	30	60
ACLR (dBc)	-33.36	-35.51	-30.44

**Table II.** ACLR vs. reflection angle, with center frequency=25.2GHz

Reflection angle (degree)	0	30	60
ACLR (dBc)	-30.05	-31.0	-30.1

**Table III.** ACLR vs. reflection angle, with center frequency=26.8GHz

- **Conclusion:** RIS-based antenna can support **single stream communication** with **required ACLR and EVM** under a wide range of Tx-Rx distances and reflection angles.