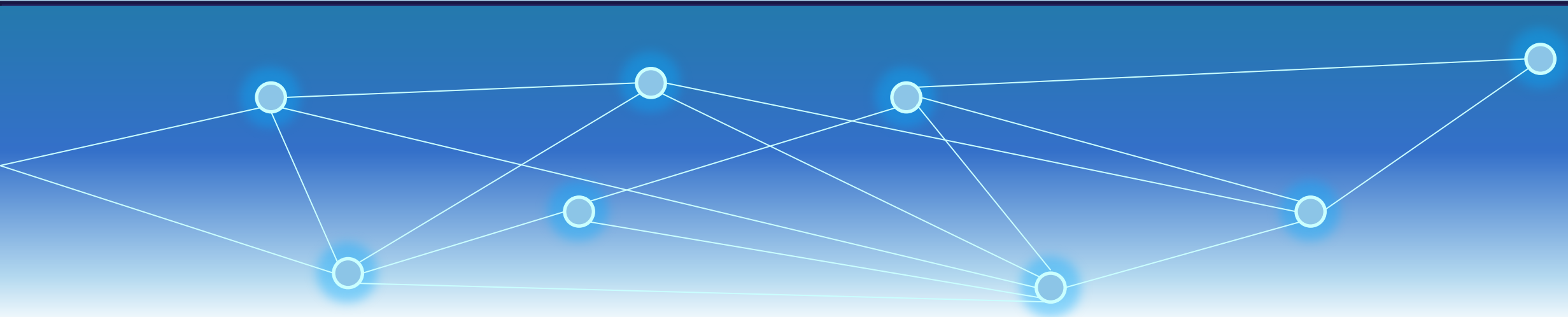


6G Upper-Midband Higher- Order MIMO Mobile Communication Systems

Prof. Wan-Jen Huang
National Sun Yat-sen University
wjhuang@facultly.nsysu.edu.tw

6G SNS ICE

Smart Networks and Services International and European Cooperation Ecosystem

6G Upper-Midband Higher- Order MIMO Mobile Communication Systems

Antenna System Technology

- Porf. Kin-Lu Wong

Reconfigurable Intelligent Surface Technology

- Prof. Tsung-Hsien Lin (Photonics)
- Dr. Fu-Kang Wang

Baseband Technology Based on Artificial Intelligence

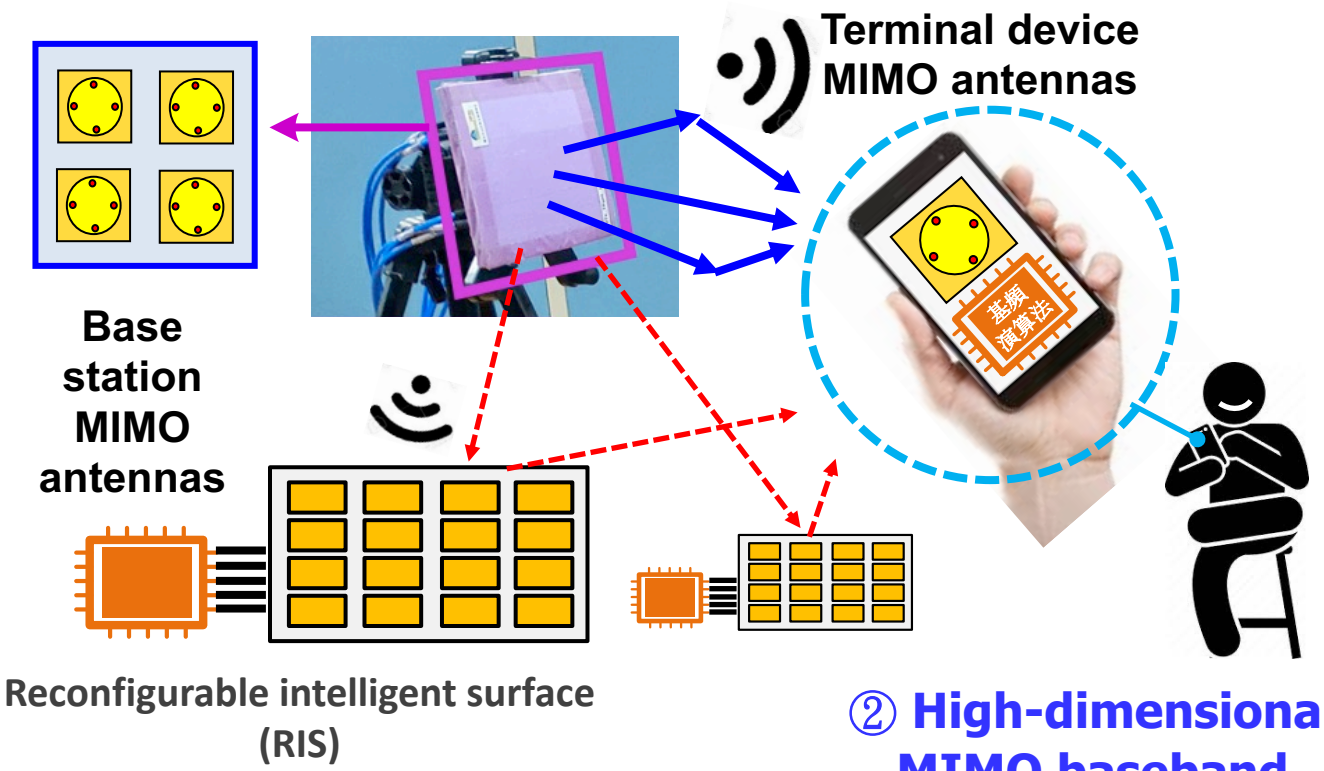
- Dr. Yen-Ming Chen
- Dr. Fan-Shuo Tseng
- Dr. Wan-Jen Huang
- Dr. Keshav Singh
- Dr. Ka-Cheong Leung

Channel State Information Feedback Technology Based on Artificial Intelligence

- Prof. Chao-Kai Wen

6G Vision: Ubiquitous MIMO for eMBB

① Small base station/terminal device integrated/conjoined broadband MIMO antenna array technology



② High-dimensional MIMO baseband technology

③ RIS assisted MIMO technology

Goal

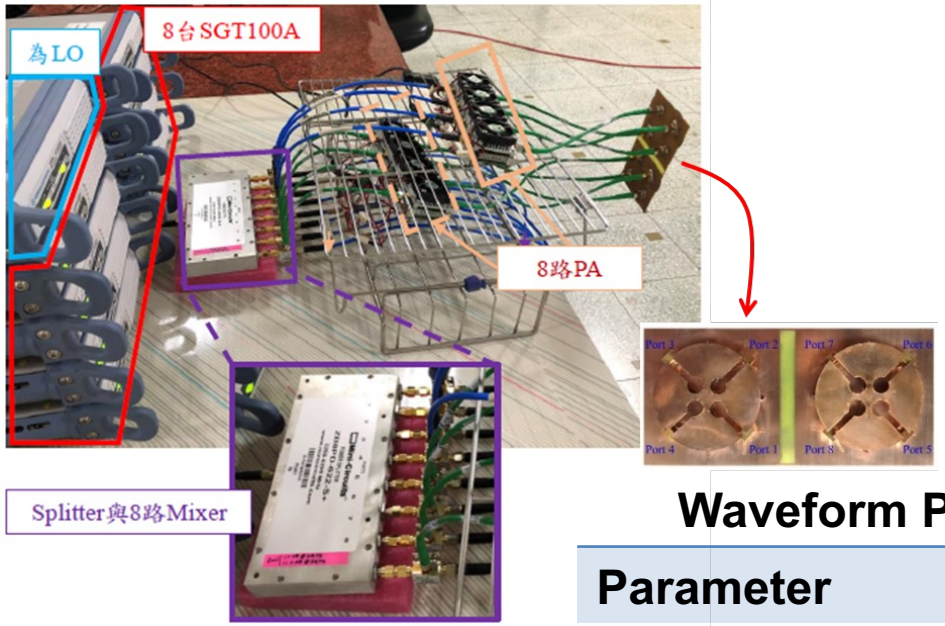
"Terminal Devices" Spectrum Efficiency

> 60 bps/Hz

Strategy

- Maximization of the number of antennas
- Advanced MIMO baseband technology
- Reconfigurable intelligent surface

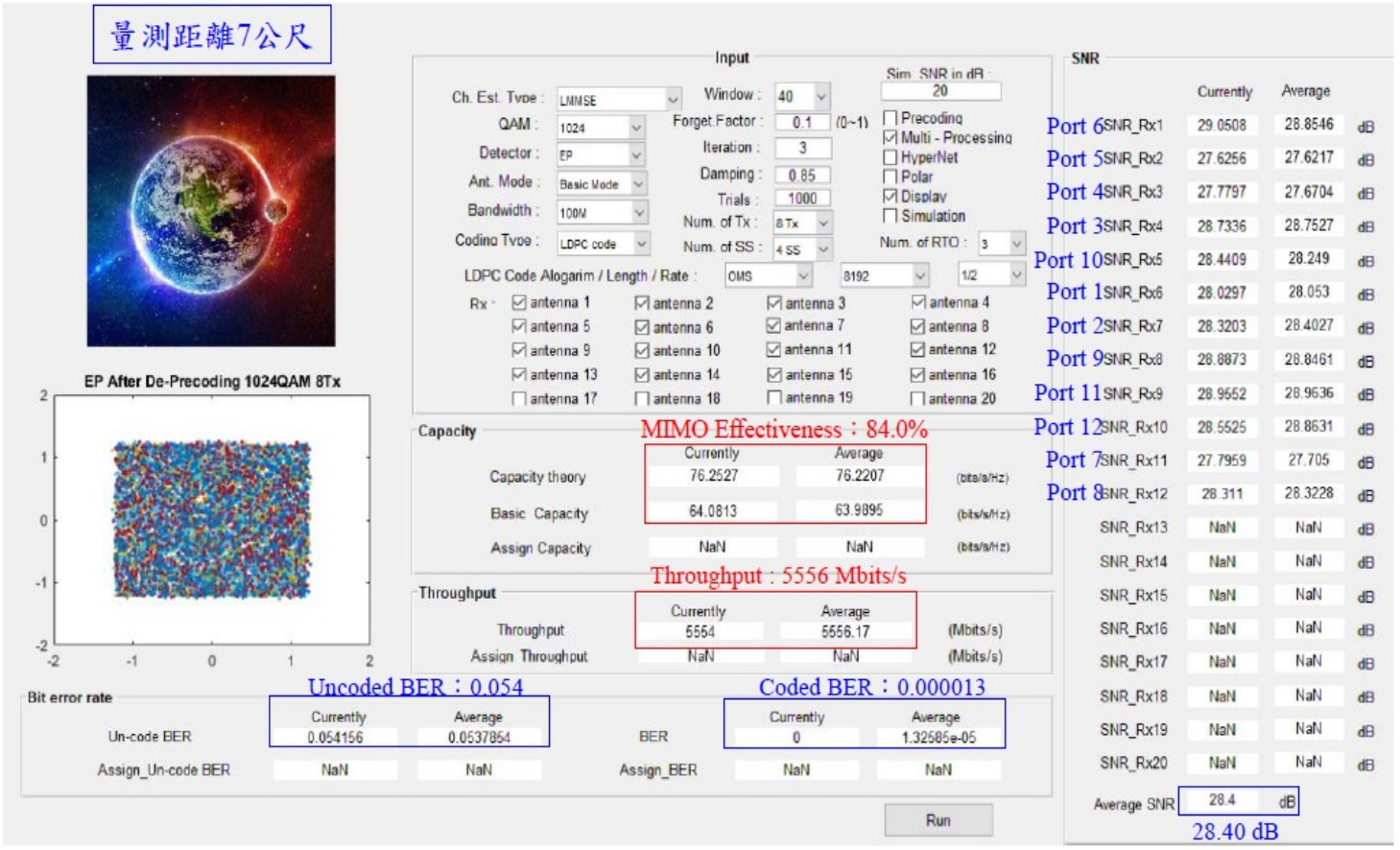
UMB High-order MIMO Testbed



(a) 8Tx MIMO-OFDM Tx

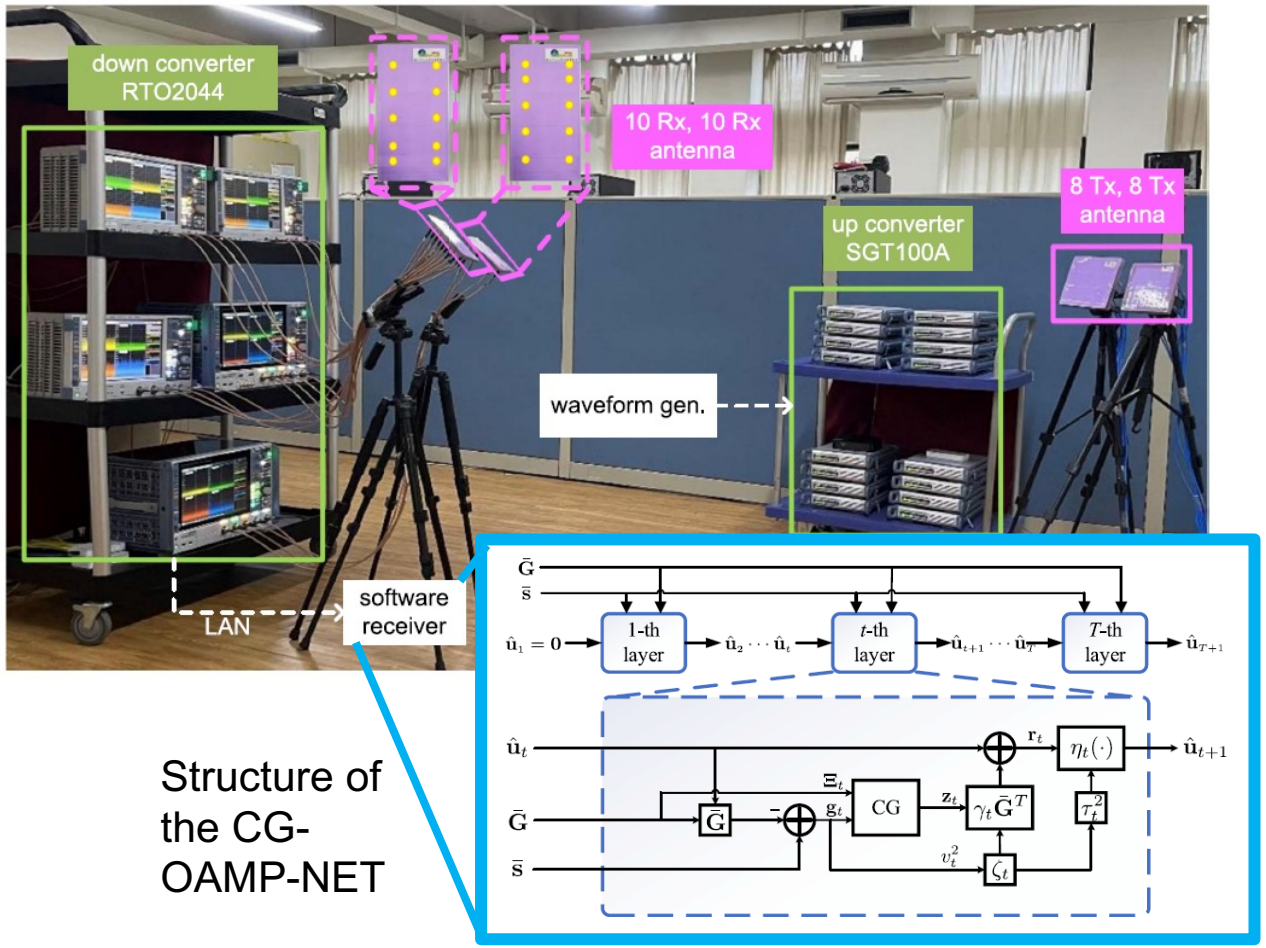
Waveform Par

Parameter	V
Carrier Frequency	7
System Bandwidth	1
Sampling Frequency	1
Subcarrier Spacing	60 KHz
Frame Duration	10 ms
OFDM Symbol Duration	16.67 μs
Resource Block	100
No. FFT	2048

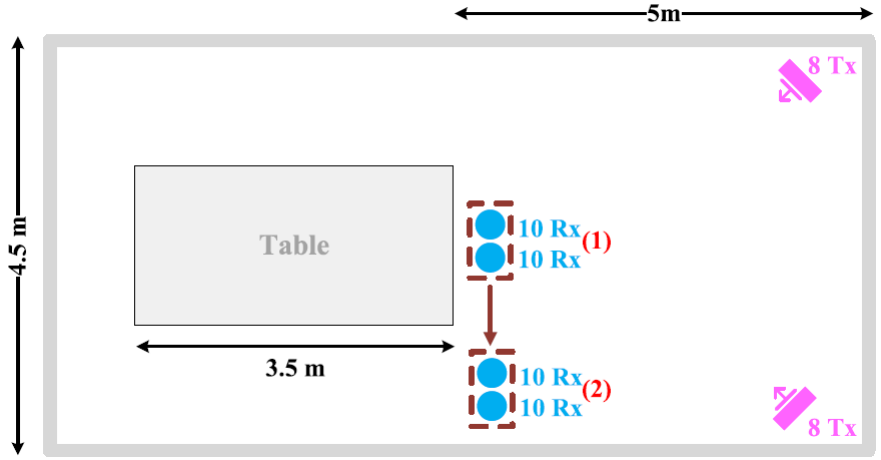


(b) 12Rx MIMO-OFDM Rx

Learning-based MIMO Detector



Structure of the CG-OAMP-NET



BER PERFORMANCE FOR MIMO-OFDM SYSTEM IN THE MEASUREMENT SCENARIOS

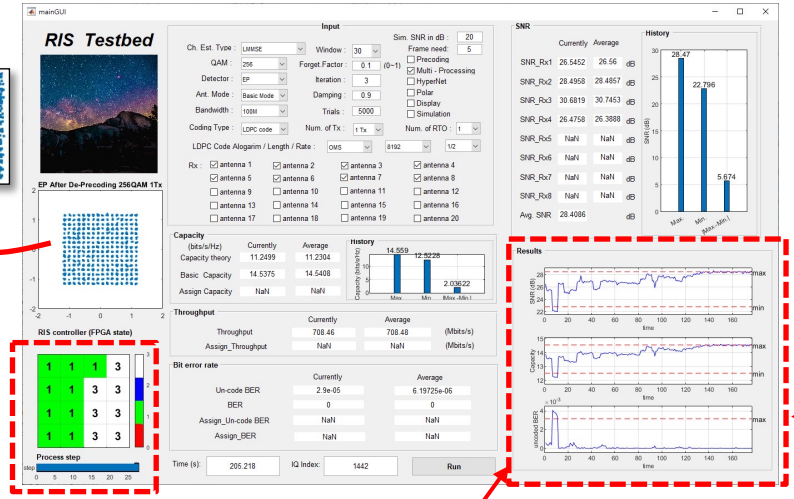
Modulation	Algorithm	i. RX (1)	ii. Walking	iii. 30 min	iv. Angle 1	v. Angle 2	vi. RX (2)
QPSK	OAMP	1.74e-4	1.74e-3	6.45e-5	2.47e-4	5.69e-4	4.27e-5
	CG-OAMP	1.75e-4	1.74e-3	6.54e-5	2.47e-4	5.51e-4	4.32e-5
	MAMP	2.61e-2	3.52e-2	1.73e-2	1.55e-2	2.61e-2	6.71e-3
	OAMP-NET	**5.60e-6**	**1.99e-4**	**3.30e-6**	**1.90e-5**	**3.16e-5**	**9.00e-7**
	CG-OAMP-NET	**5.71e-6**	**1.84e-4**	**3.30e-6**	**1.91e-5**	**3.20e-5**	**1.40e-6**
64QAM	OAMP	2.47e-3	2.46e-3	5.32e-4	1.99e-4	1.05e-3	3.28e-4
	CG-OAMP	2.48e-3	2.46e-3	5.86e-4	1.90e-4	1.17e-3	3.50e-4
	MAMP	3.82e-1	3.36e-1	3.65e-1	3.77e-1	3.89e-1	3.62e-1
	OAMP-NET	**1.07e-3**	**1.35e-3**	**1.50e-4**	**1.44e-4**	**6.12e-4**	**1.23e-4**
	CG-OAMP-NET	**1.24e-3**	**1.52e-3**	**1.76e-4**	**1.38e-4**	**7.59e-4**	**1.19e-4**

[3] X. Zhou, J. Zhang, C. -W. Syu, C. -K. Wen, J. Zhang and S. Jin, "Model-Driven Deep Learning-Based MIMO-OFDM Detector: Design, Simulation, and Experimental Results," IEEE TCOM, 2022.

RIS-Assisted MIMO Testbed

w/o RIS

GUI



RIS Stage

Performance Monit.

Through the RIS phase search algorithm, the system performance (SNR, Capacity, BER) is gradually improved