Advanced Communications and Electronics Systems Co. Ltd.

Localized development of O-RAN compliant small cells: A neutral host perspective on multi-operator indoor networks

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About ACES

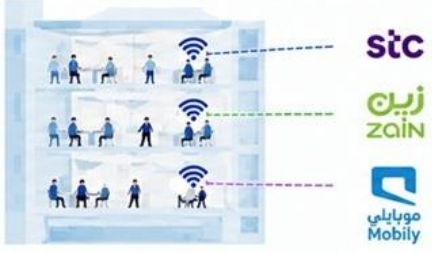
- ACES, a Digital infrastructure **Neutral Host licensed Saudi company** providing In-Building Solutions, Wi-Fi-DAS, Fiber Optics, Data Centers and Managed Services.
- We at ACES design, build, manage and enables Telecom-Operators, Airports, Metros, Railways, Smart & Safe Cities, MEGA projects and large organizations.
- ACES is serving 800+ millions worldwide annual users through its wireless networks that includes airports, stadiums, metro mega projects and more.
- The company's R&D department actively engages with IEEE, 5G, 6G, and Open RAN initiatives.

Industrial Paradigm of Network Requirements

Why Indoor Networks Need a New Approach

01 Indoor Mobile Traffic Growth & Coverage Challenges

02 Scalable Multi-Operator Indoor Deployments



03 O-RAN Enabling Openness and Interoperability

O-RAN ALLIANCE

OPEN Interface

DISAGGREGATED Architecture

INTELLIGENT Automation

04 Localized Innovation and Ecosystem Development

Indoor user density is increasing and the macro cell coverage for the indoor is insufficient to meet the requirement due to building penetration losses.

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INDOOR MOBILE DATA TRAFFIC GROWING EXPONENTIALLY

~5X

Growth in Indoor Data Traffic (2023–2030)

INDOOR vs OUTDOOR MOBILE DATA TRAFFIC SPLIT

80% INDOOR

20% OUTDOOR

INDOOR COVERAGE CHALLENGES

High User Density in offices, malls, airports, venues

3–10x

Weak Macro Coverage Indoors

70–90%

Building Penetration Loss Reduces signal strength

20–35 dB

Increasing Demand for High-Speed Connectivity

10x+

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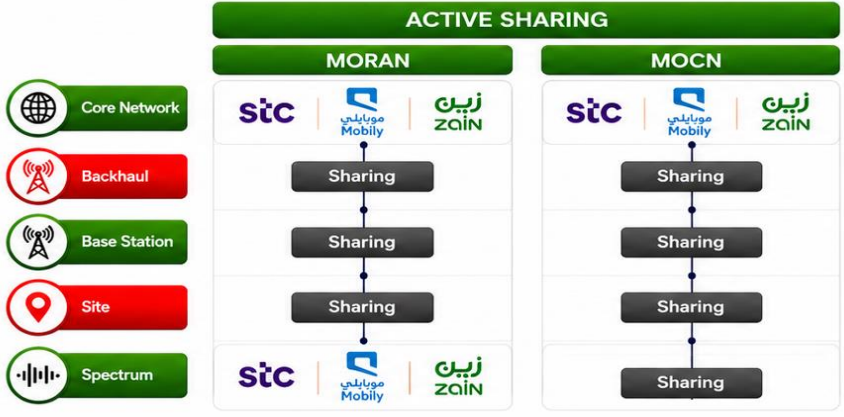
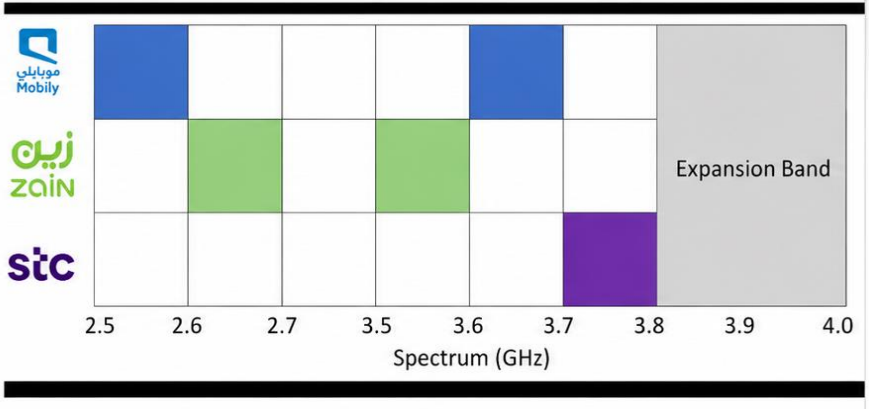
ACTIVE SHARING MODELS



SPECTRUM SHARING



BENEFITS OF NETWORK SHARING

Reduction in CAPEX

- ✓ Shared infrastructure & sites
- ✓ Lower investment in equipment
- ✓ Reduced civil works & power costs

Reduction in OPEX

- ✓ Lower energy consumption
- ✓ Reduced operational overhead
- ✓ Efficient maintenance & management

Lower Costs
Higher Efficiency

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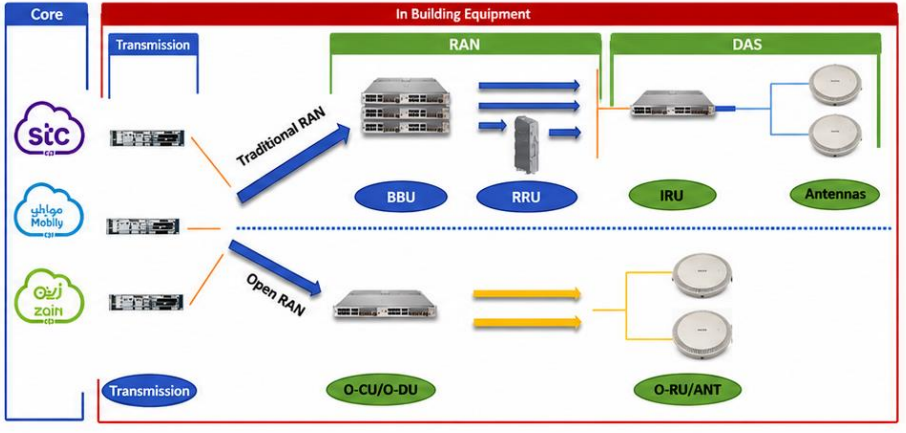
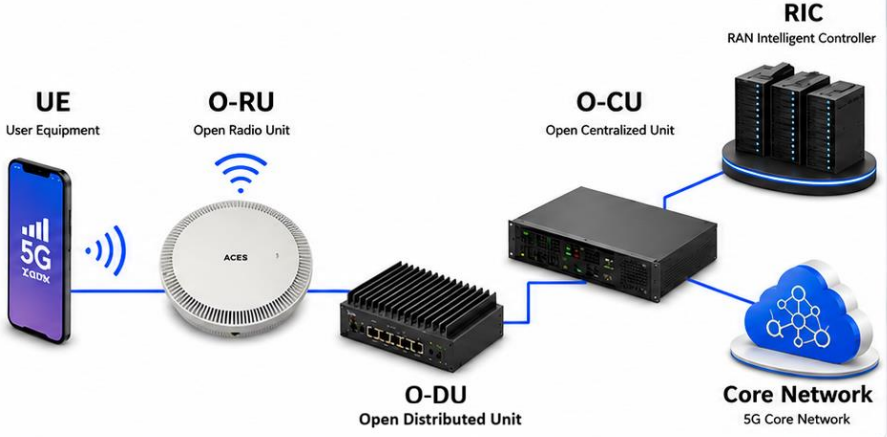
DISAGGREGATION & MULTI-VENDOR INTEROPERABILITY



OPEN RAN ARCHITECTURE



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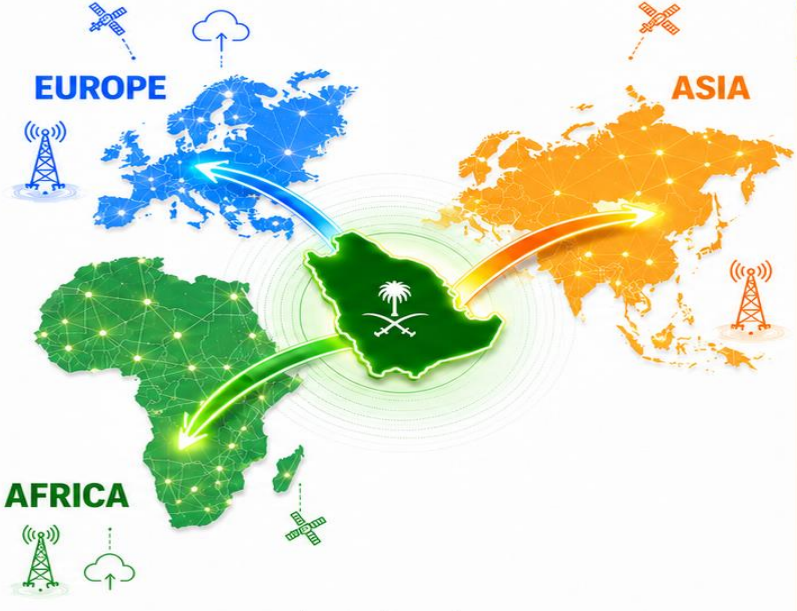
SAUDI EXPORT TO 3 CONTINENTS

- *Central hub for technology export*
- *Strong strategic location*
- *Export of telecom technology and solutions*



VISION رؤيـــة 2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

HOW ACES ENABLES LOCALIZATION THROUGH INNOVATION

ACES

ACES Tracks

SMALL CELL FORUM – GLOBAL ENABLER OF SMALL CELLS

SCF

Small Cell Forum

Solving the Small Cell puzzle.

- Global Industry Collaboration
- Interoperability & Best Practices
- Accelerating Small Cell Ecosystem
- Enabling Smart, Connected Communities

3GPP STANDARDS – ENABLING SMALL CELLS

3GPP A GLOBAL INITIATIVE

- Standards for Small Cell Architecture & Interfaces
- Optimized for Dense Deployments
- Performance & Efficiency Enhancements
- Reliable, Secure & Interoperable Solutions

JOTS

Joint Operators Technical Specification

Operator-driven specifications to ensure practical, interoperable small cell deployments.

Operator Collaboration

Co-created by mobile operators to address real deployment needs.

Implementation Guidance

Provides detailed requirements and best practices for consistent deployments.

MOCN PoC In Collaboration with CST and NOKIA

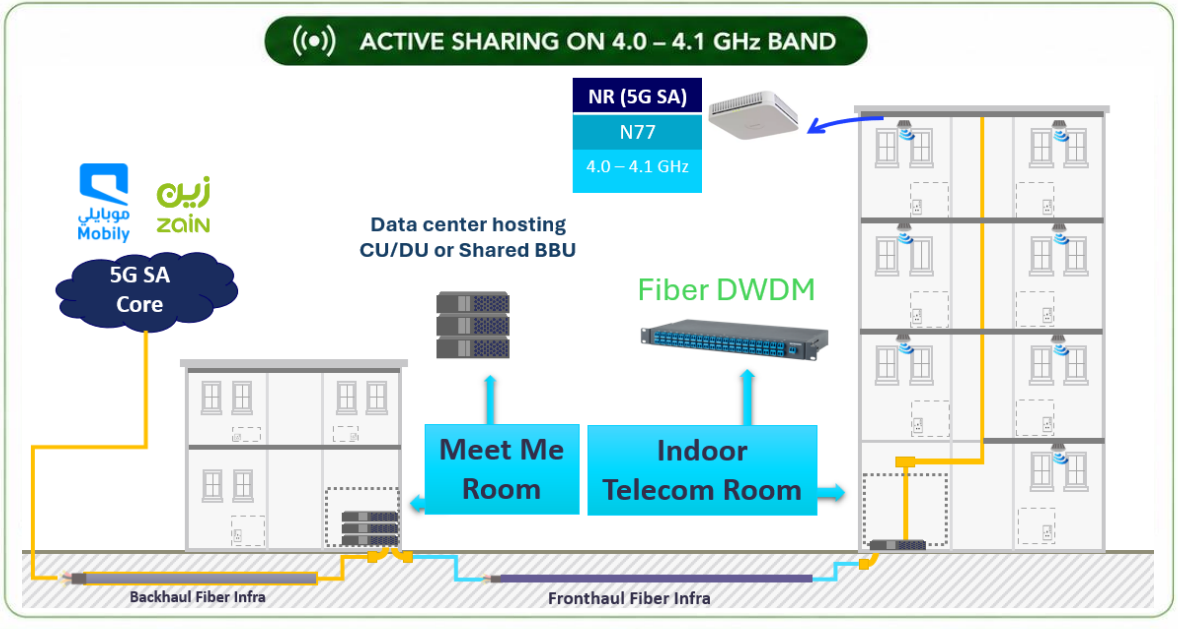
ACES | MOCN PoC
Multi-Operator Core Network Sharing

NOKIA | موبايلي Mobily | زين zain KSA | CST هيئة الاتصالات والفضاء والتقنية Communications, Space & Technology Commission

INDUSTRY-FIRST ACHIEVEMENT

- Industry first pilot deployment of 5G SA indoor coverage using sharable indoor spectrum
- Completed by **Nokia, CST, ACES NH, Mobily and Zain KSA**

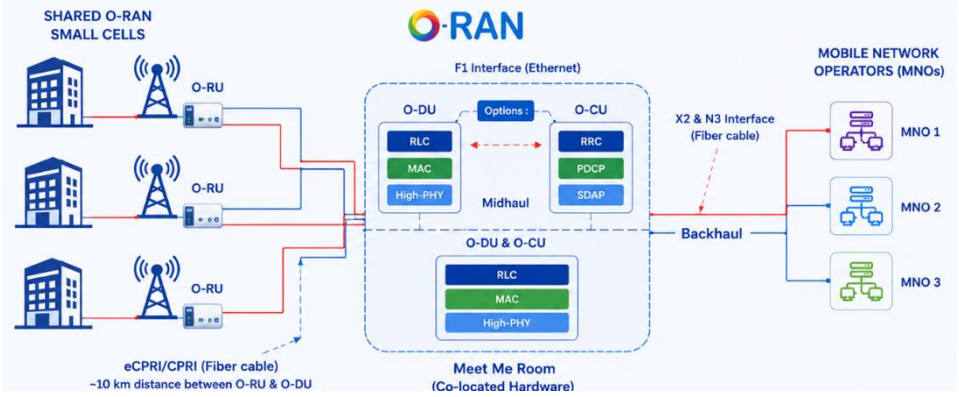
SCWS – 2025 Award Winning



INDUSTRY-FIRST IMPACT

- Shared indoor coverage from a single 5G site
- Seamless experience for Mobily & Zain KSA users
- Active sharing on 4.0 – 4.1 GHz band
- Cost-optimized, future-ready solution
- Enabling digital Saudi Arabia

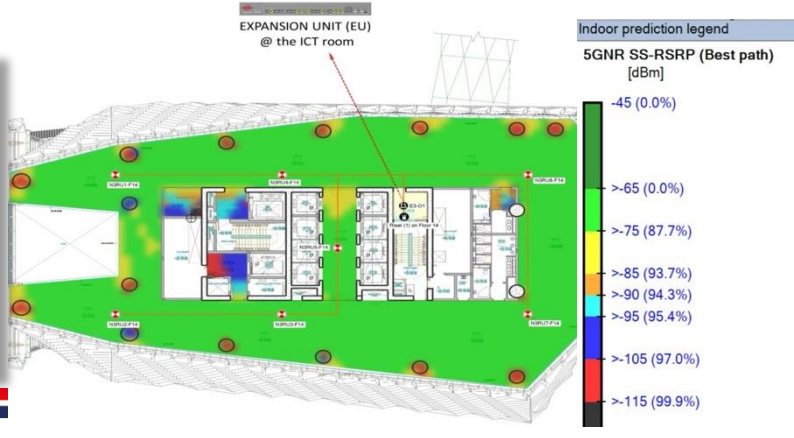
ORAN Proof-of-Concept at KAFD



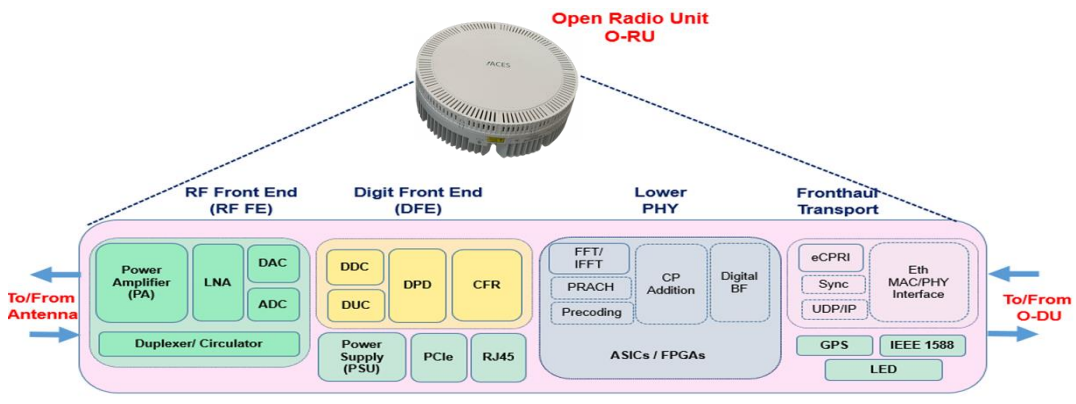
TECHNICAL SPECIFICATIONS									
Technical Specs	5G			4G			4G		
	Freq. Band	BW	MIMO	Freq. Band	BW	MIMO	Freq. Band	BW	MIMO
	3.7 to 3.8	100 MHz	4x4	1800 (B3)	20 MHz	2x2	2100 (B1)	20 MHz	2x2

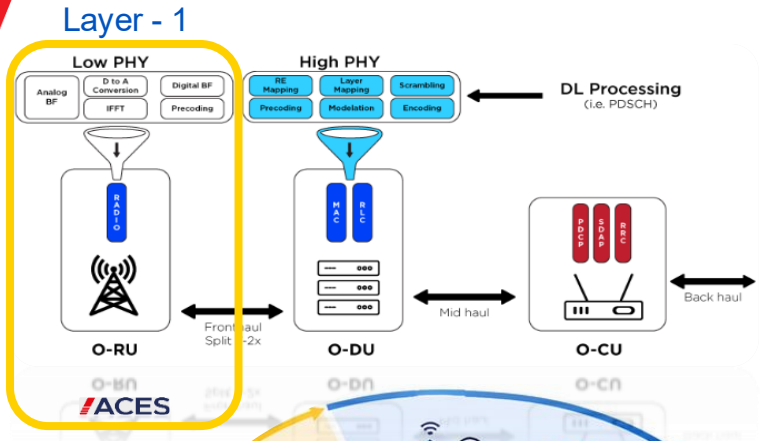
Site Name	KAFD 4.06
Floor	13
Lat, Long	24.765265, 46.654928

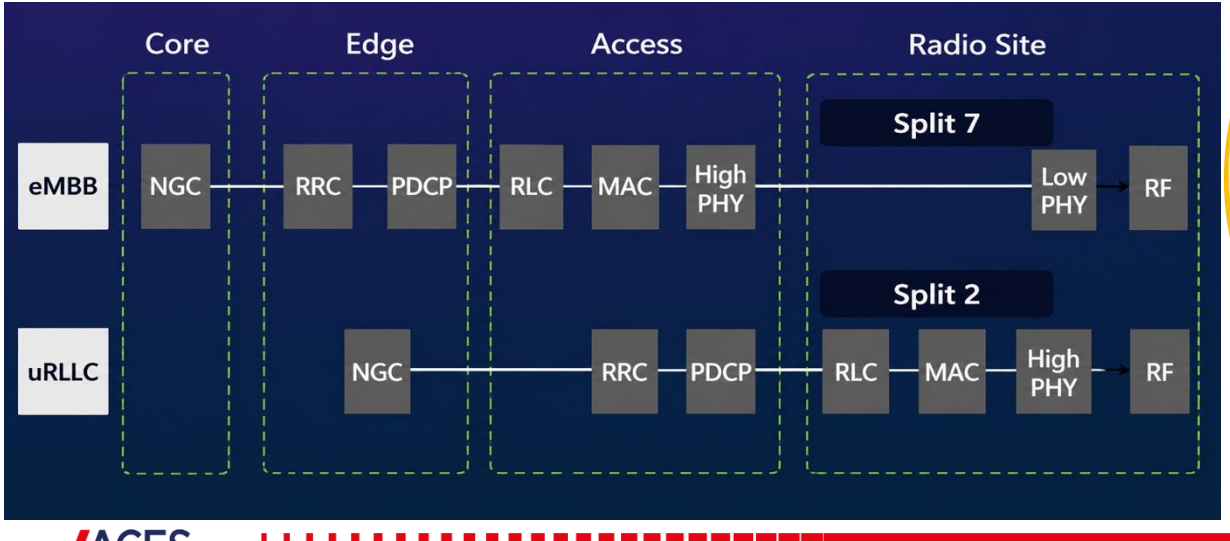
Comparison			
KPIs	Traditional RAN	O-RAN Compliant C-RAN	% Savings
Power	2,000 Amperes	400 Amperes	80%
Space	300 meter Square	75 meter Square	75%
Number of Meet me Room	5	1	80 %
Average Integration Time	8 Months	1 Month	87.5 %

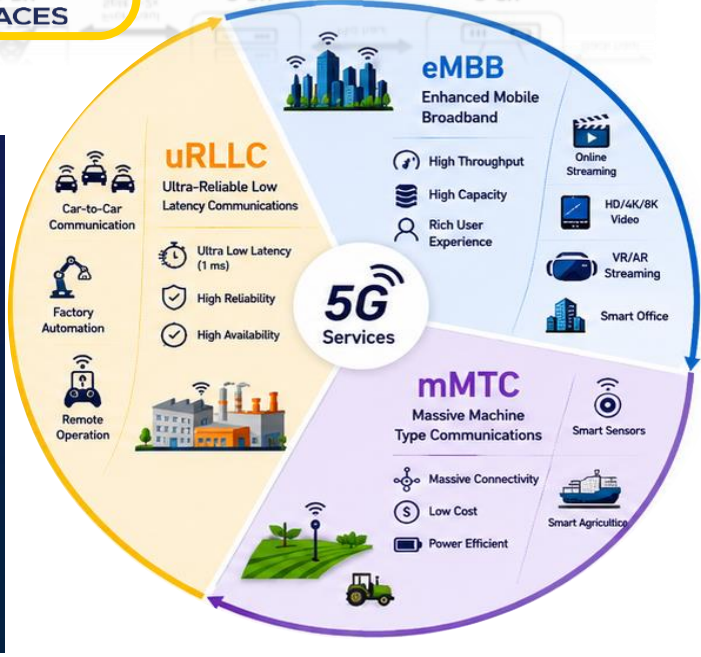


RAN Split Options – Flexible deployment, optimized performance





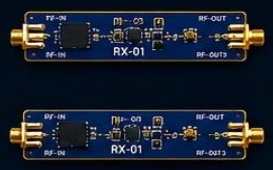




Recent Contribution : RFFE & 5G Antenna Designs

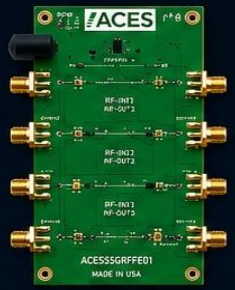
1. SINGLE CHANNEL RF MODULES

TX-01 / RX-01



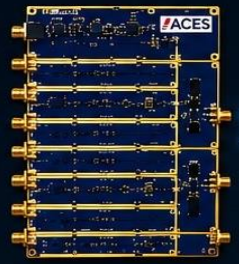
- Single Channel RF Modules
- Compact & Optimized

2 × 2 RFFE BOARD



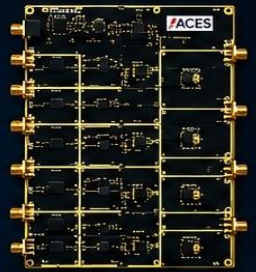
- Dual Channel RF Chain
- Improved Isolation & Performance

4T4R RFFE BOARD



- 4T4R Architecture
- Wideband Operation

LATEST DESIGN MULTI-CHANNEL RFFE BOARD



- Scalable Multi-Channel Design
- 5G Small Cell Ready

PATENT CONTRIBUTION

Reconfigurable RF Front-End Module for Multi-Band Wireless Systems

RESEARCH PUBLICATIONS

Design and Implementation of Multi-Channel RF Front End for Performance Analysis in srsRAN Based ORAN 5G Small Cell Network

IEEE | 2024

- Multi-Channel RFFE Design
- srsRAN Integration
- Performance Analysis

MORAN Enabled O-RAN Split 7.2 5G Indoor Small Cell with srsRAN and Custom RF Front End

IEEE | 2025

- O-RAN Split 7.2 Implementation
- Custom RFFE Integration
- System Validation on srsRAN

1 TRAPEZOIDAL ANTENNA

SPECIFICATIONS

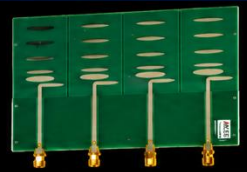
- Frequency Range : 3.3 – 4.2 GHz
- Peak Gain : 7 dBi

2 MIMO UWB ANTENNA

SPECIFICATIONS

- Frequency Range : 2.0 – 4.5 GHz
- Peak Gain : 4.1 dBi

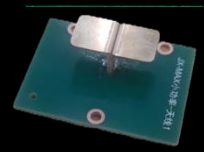
3 PLANAR MIMO ANTENNA



SPECIFICATIONS

- Frequency Range : 3.3 – 4.0 GHz
- Peak Gain : 5 dBi

4 FLARED-SHAPED ANTENNA



SPECIFICATIONS

- Frequency Range : 3.3 – 4.0 GHz
- Peak Gain : 4 dBi

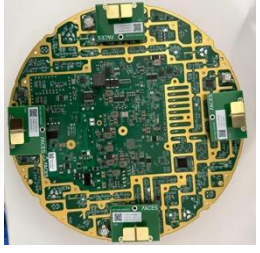
RESEARCH PUBLICATIONS

All antennas' research published in IEEE conferences.

KPI's Dashboard

Shareable 5G Small Cell (O-RU) Product

- An advanced indoor radio unit with internal antenna
- Integrated omni antennas to support 4x4 MIMO
- Support multiple carriers in N78 (3500-3800 MHz)
- 300 MHz instantaneous bandwidth (IBW)
- 500mW output power per antenna branch

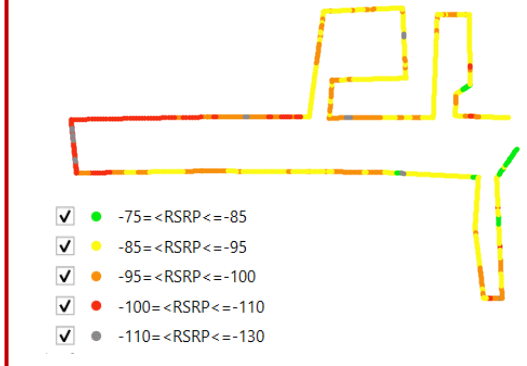


ACES Shareable 5G Small Cell Product

RSRP (dBm)	ACES %	3rd Party %	ACES	3rd Party
Excellent (-65 to -75)	14%	2%	✅	
Good (-75 to -85)	61%	32%		✅
Fair (-85 to -95)	23%	52%	✅	
Weak (-95 to -100)	2%	13%	✅	
Poor (-100 to -110)	0%	2%	✅	

Benchmarking

ACES Prototype



ACES Product

Grants, Awards & Ecosystem Enablement

AWARDS RECEIVED

01

RDIA 6G Challenge Award

02

SCF MOBILE NETWORK AWARDS 2025

SCF Award 2025

03

Honourable Mention in IEEE Future Networks

OUR IMPACT IN INNOVATION

5G Small Cell Sub Systems (RFFE)

1st Saudi vNOR Activated in ACES Lab

Shareable Small Cell (300 MHz)

5

IPs Registered

KPI's Dashboard

15

Research Papers

Research grants

01 NTDP Next ERA

02 NTDP Bridge grant for international expansion

03 RDIA Open RAN and 6G Challenge

04 KACST collaboration for RIC development

ACES & SCF Contributions

SCF

01 Regulatory & Policy Frameworks

02 Enterprise 5G and SCN Ecosystem

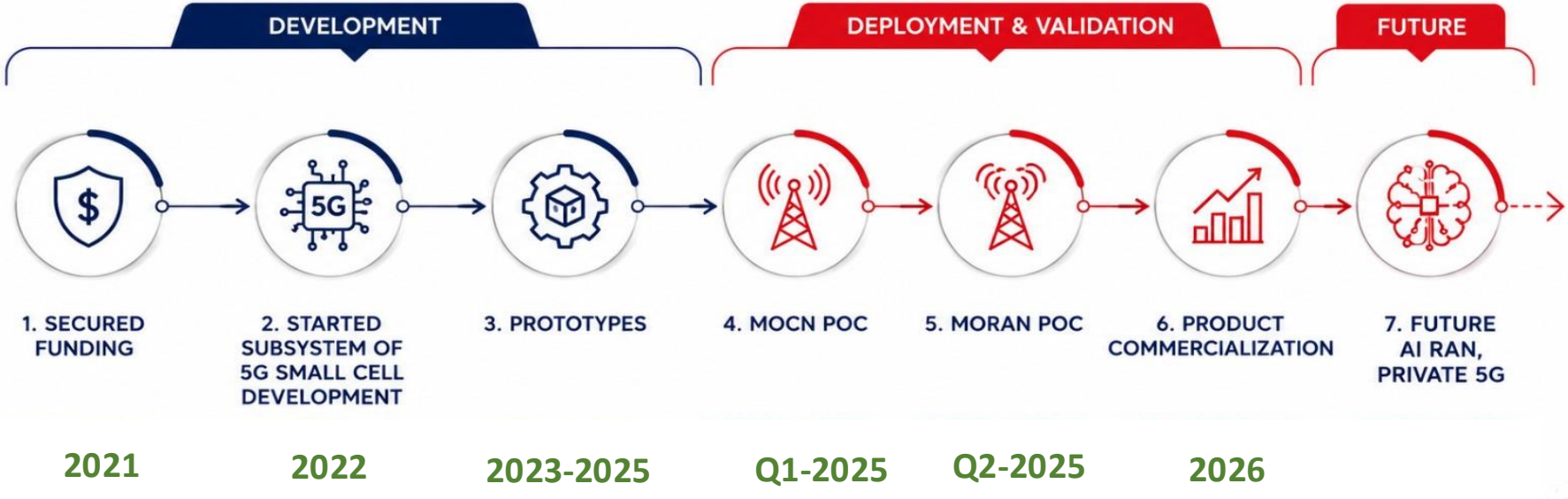
03 Non-Terrestrial Network Initiatives

04 6G Innovation Taskforce

05 DARTs Platform Collaboration

ACES JOURNEY

Building | Validating | Delivering | Innovating



From Innovation to Impact – Strengthening Networks, Empowering the Future

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Thank You

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