10th Anniversary

GISC 2026

Global ICT Standards Conference 2026

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6G Global Standardization Trends and the Future of Mobile Networks

Younsun Kim, 3GPP TSG RAN Chair
Samsung

ICT Standards and Intellectual Property:
Shaping the Physical AI

주최 과학기술정보통신부 지식재산처 주관 국립전파연구원 TTA IITP KEA kista ETRI

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02 6G Standardization

Abstract

This presentation provides an overview of the ongoing 6G mobile communication standardization activities in 3GPP. In particular, it covers key topics under discussion in RAN (Radio Access Network), including 6G use cases and scenarios, technical requirements, various device types, AI support, coverage enhancement solutions, migration strategies, energy saving techniques, and non-terrestrial networks (NTN).

What is 3GPP (3rd Generation Partnership Project)?

3GPP is a global consortium of seven telecommunications standards development organizations that creates technical specifications for mobile networks

ARIB Japan

TTA Korea

atis USA

TTC Telecommunication Technology Committee

tsdsi India's Telecom SDO India

China CCSA

ETSI Europe



- Established in 1998, it is currently participated by ~800 member companies/organizations
- It's estimated that 35~40 billion devices with 3GPP technology (3G/4G/5G) have been shipped globally

3GPP Structure

3GPP consists of 3 Technical Specification Groups with 16 Working Groups

System Architecture

TSG SA

Radio Interface

TSG RAN

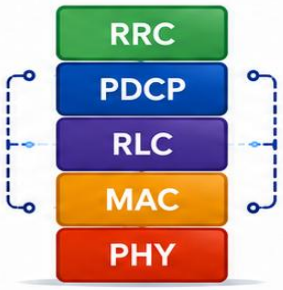
Core network protocols & signaling

TSG CT



3GPP RAN1

Physical layer



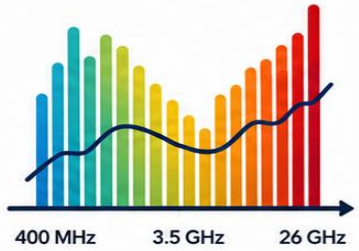
3GPP RAN2

Radio Interface architecture & protocols



3GPP RAN3

RAN architecture & NW interfaces



3GPP RAN4

Performance/RRM requirements & RF specifications



3GPP RAN5

Terminal conformance testing

3GPP is a Consensus Driven Organization

Consensus is general agreement among a group of people, reached through discussion in which all or most members accept a decision or position, even if they don't fully agree with every detail.



Busan, Korea
May 2018



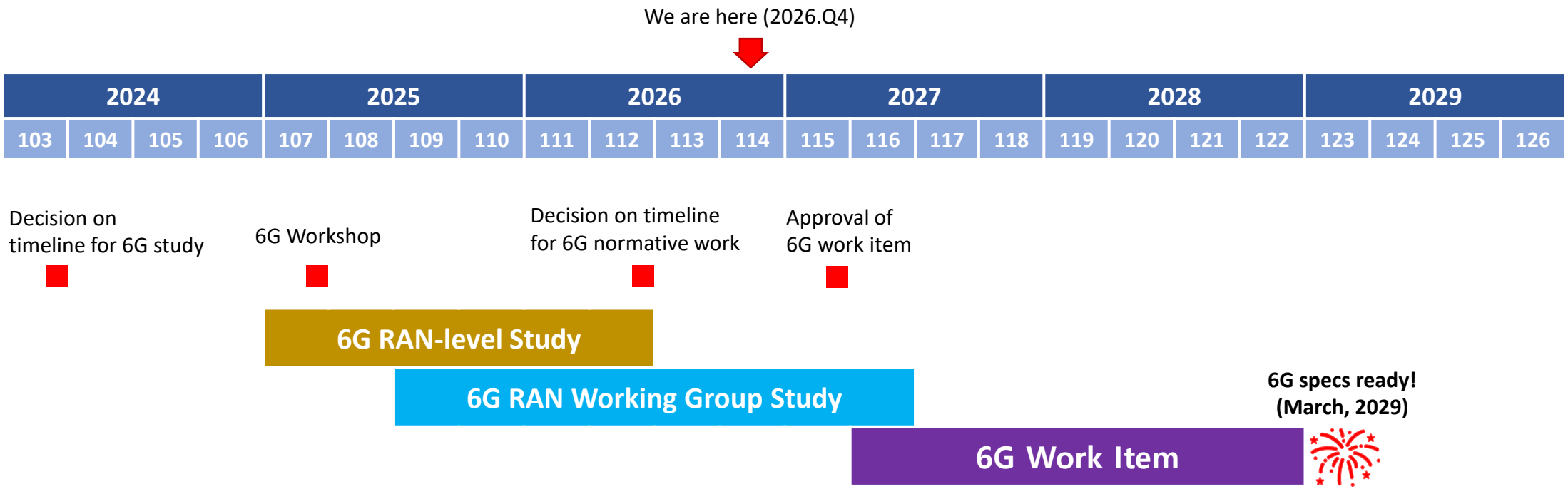
Reno, USA
November 2017



3GPP 6G Timeline

Target completion date for the first 6G release is March, 2029 (ASN.1 completion)

- RAN study item on 6G Scenarios and Requirements was completed in June, 2026
- RAN WG study item on 6G Radio is currently underway – to be completed in June, 2027
- Work item (actual specification development) will be approved in March, 2027



Study on 6G Scenarios and Requirements

In response to the development of 6G Framework by ITU-R Working Party 5D (WP5D), the RAN plenary study was initiated in 2025.Q1 (completed in 2026.Q2)

- Following aspects were studied:

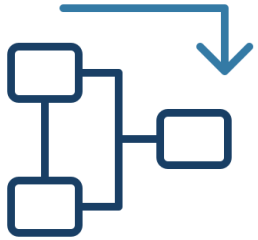
Deployment Scenarios



Key Performance Indicators



Architecture and Migration



Operational Requirements



Services



Outcome of the study is documented in 3GPP technical report TR38.914

Study on 6G Scenarios and Requirements

Some aspects of deployment scenarios from TR 38.914







Study on 6G Scenarios and Requirements

Sample requirements from TR 38.914

CAPACITY & EFFICIENCY

PEAK DATA RATE
36 / 18
Gbit/s
DL / UL theoretical

PEAK SPECTRAL EFF.
60 / 30
bit/s/Hz
DL / UL peak spectral

USER DATA RATE
300 / 50
Mbit/s
5%-ile (Dense Urban)

AREA CAPACITY
40
Mbit/s/m²
DL (Indoor Hotspot)

* 36/18 Gbit/s is derived assuming 600 MHz aggregated bandwidth; 600 MHz itself is not part of the requirement.

LATENCY & RELIABILITY

UP LATENCY — IC
4 ms
Interactive Comm.
User-plane target

UP LATENCY — HRLLC
1 ms
High-Rel. Low-Lat.
User-plane target

C-PLANE LATENCY
20 ms
Control-plane Latency
Connection setup

RELIABILITY
1 – 10^{-5}
within 1 ms (32B PDU)
Indoor Factory edge

SCALE & COMPOSITE EXPERIENCE

CONNECTION DENSITY
10^6
devices / km²

VEHICULAR MOBILITY
500 km/h
High-speed class

DENSE URBAN COMPOSITE TARGETS

COMPOSITE REQUIREMENT	TARGET
Data rate	DL 30 / UL 10 Mbps
Latency	DL 10 / UL 30 ms (40 ms total)
Packet success probability	99%
Users per TRxP	6
Satisfied users ratio	≥ 90%

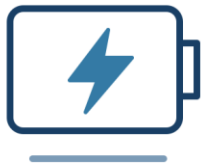
Source: TR 38.914 §§5.1.1–5.1.12 and §5.1.16.

Study on 6G Radio (RAN Working Groups)

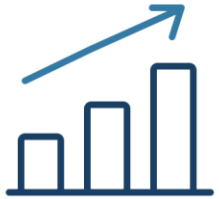
The working group study aims to develop a non-backward compatible radio access technology (hereafter "6GR") to meet a broad range of use cases, and requirements as defined during the RAN requirements study

- Initiated in 2025.Q3 and to be completed in 2027.Q2
- Some of the key technical aspects studied to meet 6G requirements:

Energy Efficiency / Saving



Spectral Efficiency



Coverage



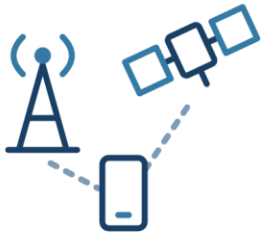
Diverse Device Types



Spectrum Utilization and Operations

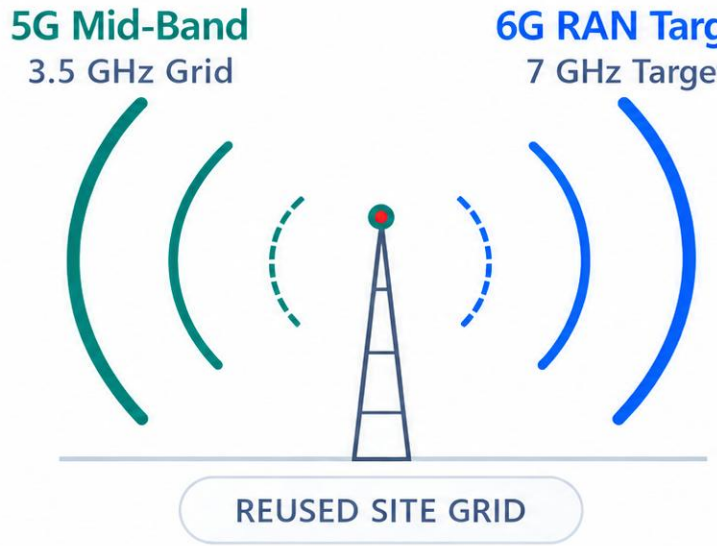


Harmonized Design for TN and NTN



Study on 6G Radio (RAN Working Groups)

Support 6G coverage so that ~7GHz deployments can reuse existing ~3.5GHz site grids



143 dB
Basic MaxCL

153 dB
Extended MaxCL

- **Initial Access**
  Same coverage as 5G mid-band
- **Data Channels**
  Comparable coverage at same rate

Common signals & DL/UL control channels must perform adequately at target MaxCL.
Source: TR 38.914 §§5.1.13, 5.1.20

Study on 6G Radio (RAN Working Groups)

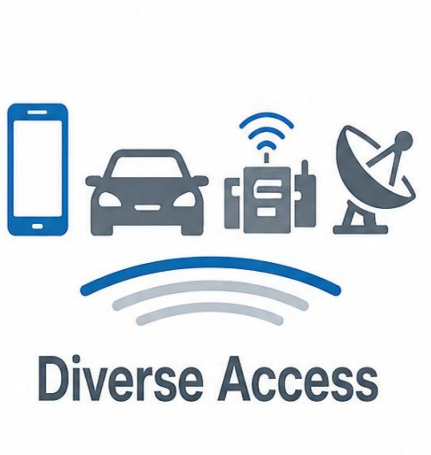
- Diverse NTN proposals were submitted and discussed in the course of the 6G studies
- Support of NTN in 6G needs careful consideration of the on going NR-NTN commercialization and needs of the market



NTN and TN designed as one system from 6G Day-1



Flexible radio design, deployment options, architecture migration



Handheld, IoT, vehicle, VSAT, and multiple frequency ranges

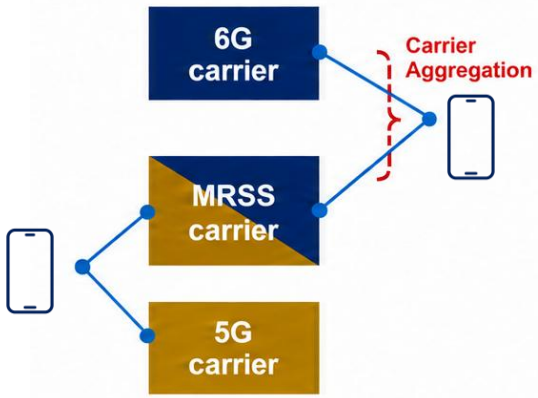


Supporting more services beyond connectivity

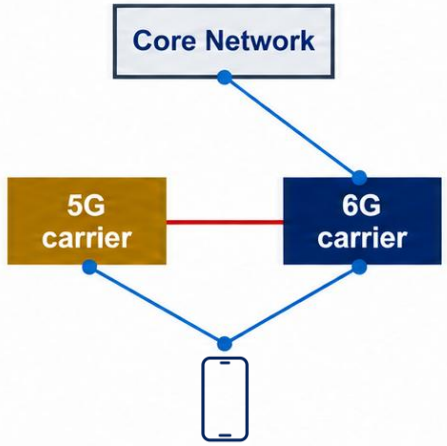
Study on 6G Radio (RAN Working Groups)

One of the key decisions to be made in the coming RAN meeting is the additional migration options other than MRSS (Multi-RAT Spectrum Sharing)

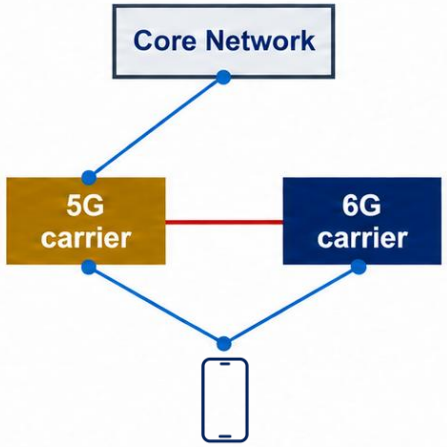
MRSS (Multi-RAT Spectrum Sharing)



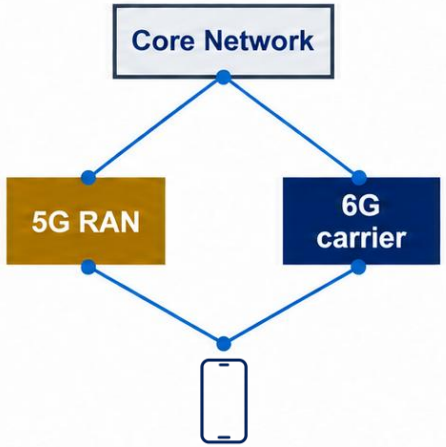
Option 1 (6G as anchor)



Option 2 (5G as anchor)

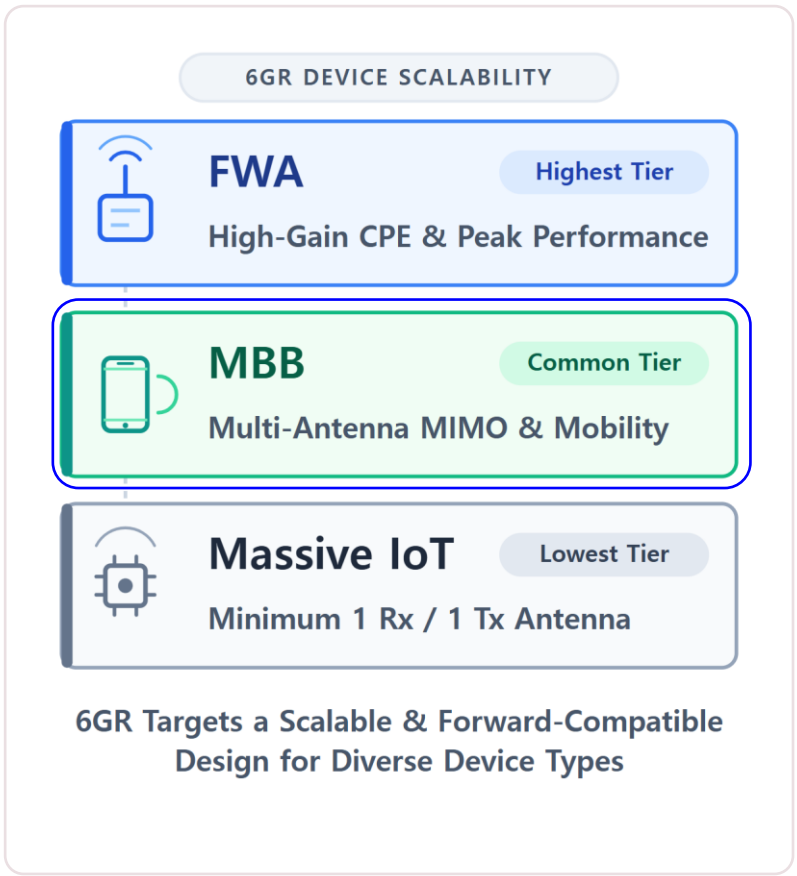


Option 3 (dual stack)



Study on 6G Radio (RAN Working Groups)

6G radio will enable diverse device types with different combination of features and capabilities



Single-Carrier Capability

Single-Carrier Scope: non-CA / one physical carrier capability

≤ 6 GHz	> 6 GHz	FR2-1
Sub-6 GHz Band	excl. FR2-1 (Upper Mid)	Millimeter-Wave Band
MAX DL RF/BB BW [200] MHz	MAX DL RF/BB BW [400] MHz	MAX DL RF/BB BW [400] MHz
MAX UL RF/BB BW [100] MHz	MAX UL RF/BB BW [200] MHz	MAX UL RF/BB BW [200] MHz

RAN1 ANCHOR BAND — Around 7 GHz (Single CC Consideration)

MAXIMUM CC BANDWIDTH

DL: 400 MHz UL: 200 MHz

Single CC Operation Considered in RAN1

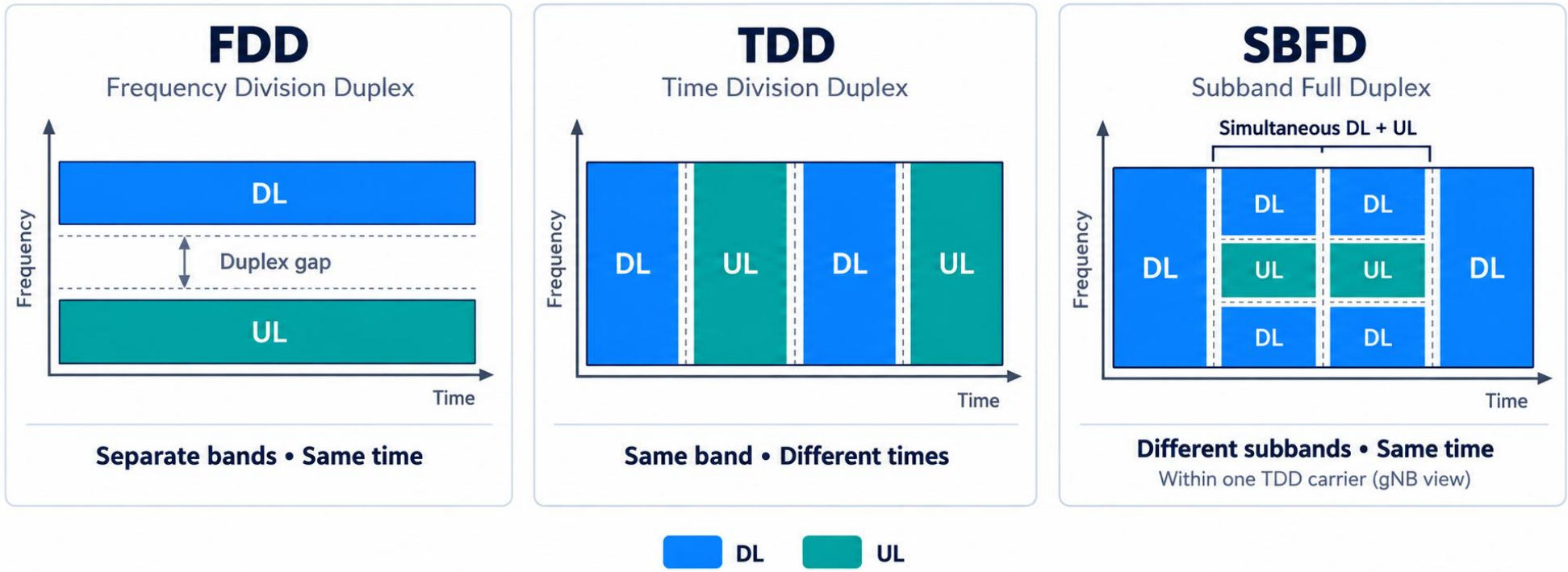
SPECTRUM PLACEMENT

Flexible UL Frequency Placement

Flexible UL placement within DL bandwidth

Study on 6G Radio (RAN Working Groups)

- For duplexing, 6G will support FDD (frequency domain duplexing), TDD (time domain duplexing), and SBFD (subband full duplex) as baseline



Study on 6G Radio (RAN Working Groups)

AI-related work in 3GPP aims to enhance the capabilities of the 6G radio interface (AI for RAN) and enable it to support future AI applications and services (RAN for AI)

Some examples of how AI is being used to improve the performance of 6G radio interface

- CSI compression including Joint source/channel coding and modulation (JSCM)
- Time-domain CSI prediction w/ UE-side model
- Beam prediction in the time and spatial domain
- Joint CSI estimation from SRS and CSI feedback
- CSI prediction for CSI-RS overhead reduction
- Demodulation reference Signal (DMRS) overhead reduction

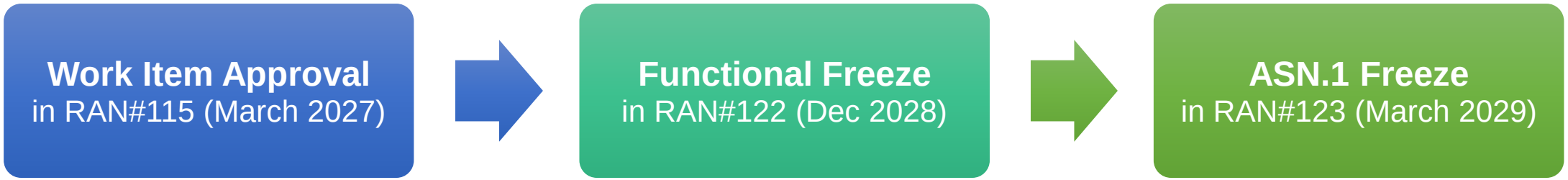
Study on 6G Radio (RAN Working Groups)

Some key decisions made on critical aspects of 6G radio interface design

Waveform	CP-OFDM for DL and CP-OFDM/DFT-s-OFDM for UL as defined in 5G NR for 6GR
Modulation	• 1K QAM for 6G uplink will be supported, 4K QAM will not be supported in Rel-21 6GR • Modulation shaping will not be supported in Rel-21 6GR
Channel coding	A new base graph (BG3) will be supported for LDPC in addition to BG1 and BG2 from 5G NR
Channel Bandwidth	Maximum CBW of 400MHz in downlink and Maximum CBW of 200MHz in uplink
RAN-CN interface: P2P vs SBI	• For connectivity services, the RAN-CN interface shall be specified as a point-to-point (P2P) interface • For services other than connectivity services, target is to conclude by end of 2026.Q4
RAN internal interfaces	• 6G RAN Architecture shall support HLS Architecture to enable smooth migration from 5G to 6G Split Architecture. • 6G HLS shall support both CU-DU, CU-CP & CU-UP separation and standardized open interfaces to support inter-operability
Migration options	To be further discussed in RAN#114 (December 2026)

6G Moving Forward

3GPP internal process to develop the first set of 6G specifications



Submission to ITU-R

- Study Item on Self-Evaluation for 6G submission to ITU-R is to be approved in RAN#114 (Dec 2026) for completion by RAN#122 (Dec 2028)
- RAN aims to submit the final self-evaluation results to the Feb 2029 ITU-R WP5D

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- 감사합니다 -

Younsun Kim, 3GPP TSG RAN Chair, Samsung

younsun@samsung.com

ICT Standards and Intellectual Property:
Shaping the Physical AI

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