3GPP TSG RAN Meeting #108 **RP- 251248**
Prague, Czech Republic, June 9-13, 2025

Agenda item: **16.2**

Source: **Telstra, Reliance Jio, Telefonica, Cohere, Bell, Spark NZ, BBC, Telus**

Title: **Views on new RAN WG SI on 6G**

Document for: **Discussion and Decision**

1 Introduction

The 3GPP 6G workplan and timelines [1] was noted at the 3GPP 6G workshop held in Incheon in March 2025. The timeline calls for the approval of RAN 1 working group Study Item at RAN#108, June 2025. This submission offers insights and proposals for consideration.

2 Justification

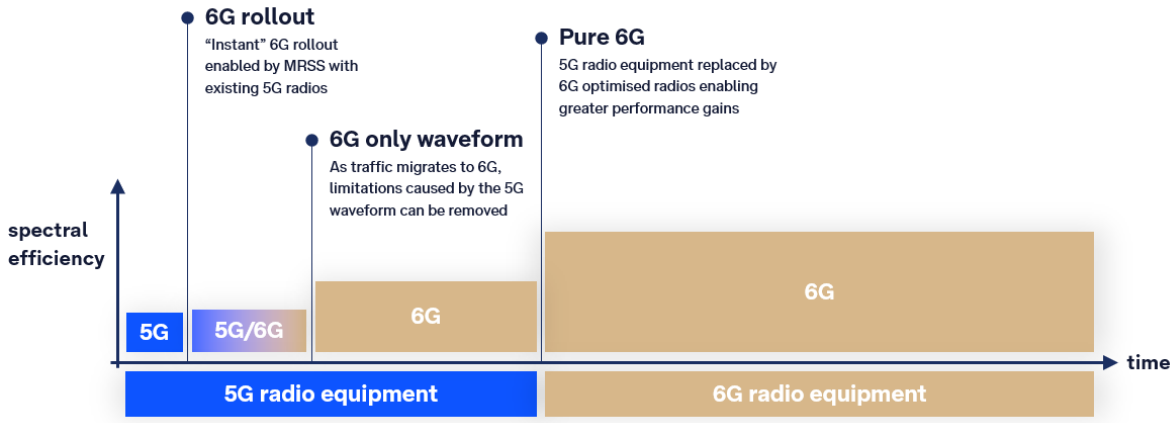
Every ten years, our industry offers the world a step change in mobile network capability, which has – without exception – unlocked extraordinary new use cases and societal benefit. Mobile network operators (MNOs) are facing unprecedented challenges with declining revenues in the face of growing community expectations for greater data allowances at faster and more reliable speeds. This means that the efficiency of existing spectrum and mobile network infrastructure is more important than ever before.

So that we can meet the expectations of the community, 3GPP should ensure that 6G significantly improves the efficiency of spectrum and infrastructure. It is reasonable to assume that, after twenty years of service, OFDM has matured and is unlikely to yield significant further gains. The task for RAN1 is to resolve two requirements in tension:

- Research and evaluate new waveforms that can significantly improve spectral efficiency by addressing any of OFDM's shortcomings; and
- Ensure that the chosen waveform can be supported by 5G radios while also carrying 5G and 6G traffic simultaneously

Whilst finding a new waveform with impactful change may seem to conflict with the need to support 6G on 5G infrastructure, we believe the answer lies in understanding the full lifecycle of radio equipment. Supporting 5G infrastructure will enable MNOs to roll out 6G as software on existing 5G infrastructure, which will be further enhanced with MRSS to enable efficient dynamic sharing of spectrum between 5G and 6G.

However, as 6G matures, 5G traffic will decline, meaning that the need to dynamically share spectrum between 5G and 6G will be relatively short lived. In addition, 5G radio infrastructure will be replaced for lifecycle reasons over time. This gives the industry an opportunity to take the benefits of a new 6G waveform in a targeted way, with increasing benefit as the technology lifecycle proceeds [2]. Importantly, this provides MNOs the opportunity to invest in technology improvement driven by need: some sites will continue with 5G radio equipment for many years, while others will benefit from early 6G radio investment to address local capacity needs.



OFDM has several well recognised limitations that stem from characterising the radio channel in the time / frequency domain. Time frequency domain measurements have a short coherence time (particularly in instances of high Doppler spreads), meaning that measurements transmitted over the air are limited in resolution to avoid overloading signalling channels. In addition, time frequency measurements have a narrow coherence bandwidth (particularly under large delay spread channels) and are valid only for the measured frequency.

It is therefore important that 3GPP embarks on an open and transparent study of the RAN physical layer, including the evaluation of new waveforms.

2 Objectives

The following text is proposed for addition to the Objectives of the Study Item.

Proposal 1: Guiding principles for the new RAT

A set of standardisation principles for 6G, supported by a mix of global operators and equipment vendors was presented at RAN#107 [3]. The proponents of this proposal feel that these principles should be included in the approved 6G working group study items as a high-level guidance of what should drive the development of 6G technologies. A subset of relevant principles for the new RAT

(1) The new RAT SI shall capture the following principles:

- Drive extreme efficiency of 6G radio and network on both existing and new spectrum, allowing much-improved TCO and cost per GB. Enable easy macro 6G deployments on both existing and new spectrum with efficient aggregation of carriers.

- Full performance of 6G is understood to be realized with RAN infrastructure refresh in existing or new bands as driven by operator business needs. Deployment of software-based 6G features should be possible on capable 5G RAN infrastructure in legacy bands including leveraging efficient 5G-6G MRSS, whilst ensuring a single branch of 6G standards development.

- Design for high 6G radio performance through a revolutionary leap in performance by exploiting UE-non-backwards compatible 6G radio design, prioritising improved median & cell edge performance.

- Strive for architectural simplicity, optimized spectrum sharing (MRSS) with 5G, macro deployments using the existing macro sites, native support for legacy services (e.g. eMBB, Voice, FWA, etc…), and aggregation to achieve competitive 6G user experience, as determined by the results of the study items.

- Scalable 6G RAT that supports diverse device types ranging from the lowest capability device (e.g., 3GPP LPWA) to higher capability devices in the first release. Ensure a globally aligned meaningful minimum set of capabilities and normatively specified testing and certification procedure for 6G RAT.

- Introduction of 6G native IoT technology, including LPWA technology, in the first release that facilitates long term commercial obligations that may outlive the 6G RAN.

- All digital (and non-digital) industries strive for much improved levels of sustainability and energy efficiency. Standards shall enable the mobile industry to reach its committed sustainability goals and dramatically reduce its energy usage and carbon footprint.

Proposal 2: Study of fundamental physical layer signal structure for new RAT

(2) The new RAT SI shall capture and focus on the following areas:
- Waveform based on OFDM
- Evaluate other candidate waveforms and multiple access techniques, including but not limited to:
  - Orthogonal Time Frequency Space (Zak-OTFS) [4]
  - Rate-Splitting Multiple Access (RSMA) [5]
- Waveform evaluations shall be conducted in line with TR 38.914 [6], across new and legacy spectrum. Evaluations shall consider at least:
  - Spectral efficiency
  - Energy consumption, both RAN & UE, including device/receiver complexity & PAPR minimization
  - Capacity impact of pilot (eg lean carrier, reduced physical layer overheads)
  - Ability to simultaneously use the same spectral resources for both sensing & communication for ISAC
  - Minimisation of performance degradation when operating 5G & 6G simultaneously (MRSS) and/or operating on 5G RAN infrastructure
  - Capacity & performance for NTN, including spectrum reuse with TN
  - Ability to support all device types and capabilities, eg FWA, MBB, NTN, ISAC, IoT, etc
  - Capacity and performance gains offered by FDD reciprocity beamforming and MU-MIMO pairing
- Basic frame structure(s)
- Channel coding scheme(s)

References

[1] 6GWS-250240: 3GPP 6G workplan and timelines

[2] 6GWS-250091: Telstra's Vision and Priorities for 6G RAN

[3] RP-250771: 6G Standardization – Principles, "T-Mobile USA, AT&T, BT, Ericsson, KPN, KT, MediaTek, Nokia, NTT DOCOMO, Qualcomm, Rakuten, Samsung, Softbank, Telstra"

[4] 6GWS-250233: Cohere's view - Enabling Waveform Innovation in 6G[5] 6GWS-250104: A BBC View on MAT for 6G

[6] TR 38.914: Study on scenarios and requirements for next generation access technologies