3GPP TSG RAN#108 **RP-250871**

Prague, Czeck Republic, 9th -13th June 2025

Agenda Item: **16.2**

Source: **VIAVI**

Title: **VIAVI Views on Release 20 RAN WG SIs for 6G**

Document for: **Discussion**

1 Introduction

This document provides VIAVI's view on RAN topics to be included for 6G study in Release 20 building upon document 6GWS-250132 presented at the Incheon 6G Workshop [1]. The topics covered are artificial intelligence (AI) for the air interface, multiple access schemes, integrated sensing and communications (ISAC), non-terrestrial networks (NTN), and quantum safety. A proposal is included for each topic containing elements to be considered for inclusion within the scope of the appropriate study item.

2 Topics for Release 20 RAN WG 6G Study

2.1 AI for Air Interface

Release 18 studies revealed that AI could help enhance performance of the air interface for several use cases, namely channel state information (CSI) feedback enhancements, beam management, and positioning accuracy enhancements. In addition to the work in 3GPP, there have been various research initiatives running in parallel that explore the potential role of AI for other aspects of the air interface, including constellation design, transmit precoder/beamformer design and receiver design [2]. It would be valuable for 3GPP to now evaluate such techniques as part of a RAN WG-level 6G study item. In addition to considering the performance gain, appropriate testing methods should be thoroughly evaluated to ensure deployment is feasible and robust.

Proposal 1 **3GPP to evaluate the use of AI counterparts (e.g. deep neural networks) for replacing or enhancing different transmit and receive functions within the air interface as part of a Release 20 RAN WG 6G study item, considering the potential for enhanced throughput, reduced reference signal overhead and reduced energy consumption. Some examples to consider within scope for the relevant study item include constellation design, transmit precoder/beamformer design and receiver design.**

Proposal 2 **For the multiple-input multiple-output (MIMO) case, consider evaluating the following:**

- **a. Transmitter 1 (T1): AI-based constellation design**
- **b. Transmitter 2 (T2): AI-based transmit precoding/beamforming design**
- **c. Full AI transmitter with joint design of T1 and T2**
- **d. Receiver 1 (R1): AI-based unified receiver design replacing channel estimation, equalization and symbol de-mapping operations**
- **e. Receiver 2 (R2): AI-based decoding**
- **f. Full AI receiver with joint design of R1 and R2**
- **g. Two-sided end-to-end AI transceiver considering T1, T2, R1 and R2**
- **h. Use 5G NR as a benchmark with different pilot schemes (including pilotless) studied to reduce the pilot overhead**

2.2 Multiple Access

5G NR combines orthogonal frequency-division multiple access (OFDMA) and space-division multiple access (SDMA) to serve multiple users in the network. The performance of SDMA, also known as multi-user MIMO (MU-MIMO), can degrade significantly when CSI quality is low. New or improved multiple access techniques have the potential to increase robustness for these low-quality CSI conditions and provide higher levels of spectral efficiency, which would be particularly beneficial for use cases with crowded areas. Recognising the interest from industry, ETSI recently established an Industry Specification Group (ISG) for multiple access techniques (MAT), which would serve as valuable and complementary input to a 3GPP RAN WG 6G study item [3].

Proposal 3 **3GPP to evaluate new multiple access schemes as part of a Release 20 RAN WG 6G study item that consider a large number of user terminals under a range of spatially correlated and mobile conditions. The following techniques should be considered with each evaluated against 5G NR MU-MIMO performance in both the downlink and uplink:**

- **a. Rate splitting multiple access (RSMA)**
- **b. Power domain non-orthogonal multiple access (NOMA)**
- **c. Code domain multiple access schemes such as sparse coded multiple access (SCMA)**

2.3 Integrated Sensing and Communications (ISAC)

The RAN1-led ISAC study in Release 19 has been defining channel modelling aspects to support object detection and/or tracking (as per the SA1 meaning in TS 22.137). In Release 20, a logical progression would be a RAN WG 6G study item that considers architecture and physical layer procedures.

Proposal 4 **3GPP to evaluate transmitter/receiver architectures and physical layer procedures for ISAC as part of a Release 20 RAN WG 6G study item. Specifically, the following aspects should be included within the scope of a study for all six sensing scenarios defined by 3GPP (mono/bi-static, with gNB and/or UE as Tx or Rx):**

- **a. Waveform and pilot design (including existing waveforms and pilots used for communications)**
- **b. Transmit precoding/beamforming design (codebook or non-codebook-based options)**
- **c. Receiver combining/beamforming design (codebook or non-codebook-based options)**
- **d. Sensing related feedback design at the receiver (base station or user equipment)**
- **e. Synchronization issues for bi-static scenarios**
- **f. Self-interference issues for mono-static scenarios**

2.4 Non-Terrestrial Networks

The NTN Ku Band in 5G is the first band to fall within “frequency range 3” (FR3) ahead of any terrestrial network (TN) definitions. To avoid confusion or fragmentation of future 6G specifications, 3GPP should consider how to define FR3 such that it accommodates the existing NTN Ku Band work whilst ensuring clarity with the test requirements.

Proposal 5 **3GPP to consider how to define FR3 within the Release 20 RAN WG 6G study phase such that it accommodates the existing NTN Ku Band work whilst ensuring clarity with the test requirements.**

2.5 Quantum Safety for 6G

It is expected that a 6G network will be based on both an AI and cloud-native architecture and, as such, a zero-trust network (ZTN) is assumed as essential. In addition, the 6G network must be Quantum Safe leveraging appropriate technologies such as QKD (Quantum key distribution) and PQC (Post-quantum cryptography).

Proposal 6 **3GPP to consider how to adopt Quantum Safe technologies in 6G RAN as part of a Release 20 RAN WG 6G study item.**

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3 Proposals

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Proposal 6 **3GPP to consider how to adopt Quantum Safe technologies in 6G RAN as part of a Release 20 RAN WG 6G study item.**

4 References

[1] 6GWS-250132, VIAVI's vision & priorities for 6G radio technologies, 3GPP 6G Workshop, March 10th-11th, 2025

[2] "Samsung Electronics Demonstrates AI-RAN Technologies, Paving the Way for Convergence of Telecommunications and AI", Samsung Newsroom, https://news.samsung.com/global/samsung-electronics-demonstrates-ai-ran-technologies-paving-the-way-for-convergence-of-telecommunications-and-ai, December 31st 2024

[3] "ETSI Launches New Group on Multiple Access Techniques for 6G Networks", ETSI, https://www.etsi.org/newsroom/press-releases/2484-etsi-launches-new-group-on-multiple-access-techniques-for-6g-networks?jjj=1747931470458, January 28th 2025