Next Generation Mobile Networks
NGMN Liaison Statement to 3GPP

Title: Liaison Statement from NGMN Alliance to 3GPP on Test of Technology Building Blocks phase of the Trial and Testing Initiative.

Source: NGMN Alliance

To: 3GPP TSG RAN, 3GPP TSG SA

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About the NGMN Alliance

The NGMN Alliance (see www.ngmn.org) was founded by leading international network operators in 2006. Its objective is to ensure that the functionality and performance of next generation mobile network infrastructure, service platforms and devices will meet the requirements of operators and, ultimately, will satisfy end user demand and expectations. The NGMN Alliance will drive and guide the development of all future mobile broadband technology enhancements with a focus on 5G. The targets of these activities are supported by the strong and well-established partnership of worldwide leading operators, vendors, universities, other industry players (like software companies, vertical industry representatives) and by successful co-operations with industry organisations.

NGMN 5G Work-Programme and the NGMN Trial and Testing Initiative with the Test of Technology Building Block phase

In February 2015 the NGMN Alliance published its 5G White Paper providing consolidated 5G operator requirements. Subsequently in 2016, NGMN published a number of deliverables to detail on the requirements and architecture as well as business principles, including views on the vertical industry applications. In June 2016, NGMN started a further extension of its 5G-focused work-programme with the launch of new additional work-items for the coming years: 5G Trial & Testing Initiative, End-to-end Architecture Framework, and the V2X Task-Force. Missions of the Trial and Test Initiative can be summarized as below:

- Enable global collaboration of testing activities to support an efficient, successful, and in-time 5G technology and service introduction
- Consolidate contributions and report on industry progress in order to ensure the development of globally aligned 5G technology and service solutions
- Identify, test, and promote new business opportunities and use-cases with industry stakeholders (e.g. from vertical industries)

Test of Technology Building Block is the first phase work in the Trial and Test Initiative and it aims to identify and test performance of 5G candidate technology building blocks with pre-standard equipment.

NGMN Trial and Test Initiative / Test of Technology Building Block work has led to identify a set of building blocks as promising candidates for NR (New Radio) Phase 1 standardization and/or implementation activity. This set can be found in the Annex.

NGMN would like to share with 3GPP the current outcomes of this activity.

The Test of Technology Building Block phase plans to deliver to 3GPP, before RAN#76 Plenary meeting, test results regarding building blocks in order to further support the NR standardization process.

Annex: Identified 5G Building Blocks with their description

Building Block	Description
OFDM waveform with improved guard band	The proposed solutions consider OFDM transmission with bandwidth utilization improved beyond 90% (that is the nominal utilization in case of LTE), e.g. F-OFDM, CP-OFDM ...
Technical Proposal on Massive MIMO	Massive MIMO on 2.6GHz measurement results are provided, based on field trials conducted in more than 50 sites. Spectrum efficiency and Resource utilization rate are considered as KPI during testing activities.
Technical Proposal on mmWave	Indoor and outdoor measurement results, based on two mmWave prototypes, working at 15GHz and 28 GHz bands, are provided. Throughput is considered as KPI during testing activities.
MU-MIMO	Different MU-MIMO schemes (Beam management and Multi-site beamforming) are tested in outdoor measurement activities. Both sub-6GHz and mmWave will be considered. BLER and Throughput are considered as KPI during testing activities.
Massive MIMO System Performance Testing	This test focuses on in-lab system performance testing to test performance and gains of massive MIMO under various channel conditions. A technology building block for these tests is RF Channel Emulators capable of supporting massive MIMO. Throughput is considered as KPI during testing activities.
Technical Proposal on mmWave	RF front-end including Tx and Rx working at 38GHz for massive MIMO is considered for both indoor and outdoor testing. Beam tracking, coverage and throughput will be tested. Throughput and SNR are considered as KPI during testing activities.
Polar code for small block sizes	A new channel coding scheme (Polar code) for control channel will be tested in a lab environment. BLER, SNR and MCS are considered as KPI during testing activities.
Grant free multiple access	Grant free multiple access for uplink transmission is considered. Connection number, Packet Loss Rate and Uplink Latency are considered as KPIs during testing activities.
Self-contained subframe	Self-contained subframe, with an opportunity for DL control, data transmission (DL or UL) and immediate feedback from the UE in a downlink slot, will be considered. Throughput, HARQ and application latency are considered as KPI during testing activities.
Full Duplex Base Stations, Half Duplex TDD Clients	A full duplex base station, able to co-schedule half duplex clients in a TDD system and increase the system capacity, will be considered in the testing activities.
Flexible Duplex	Flexible duplex operation in both paired and unpaired spectrum is considered and system level simulation results will be provided.
mmWave	Measurement campaign on mmWave using a channel sounder is proposed.

Propagation Study	Initially measurements will be conducted in the 28GHz band but they will be extended to 39Ghz and 70GHz. Various channel model parameters will be considered as KPI (like SNR, Receive signal strength). This is intended as complementary to the scenarios considered in the NR study item TR.
Layer 2 Protocol Design Proposal	- *Distributed MAC header*: In this contribution it is proposed to place the MAC header before its corresponding MAC control element, MAC SDU, or padding. From one MAC PDU point of view, MAC header is placed distributed. - *Single L2 Sequence Number*: In this contribution it is proposed that, for non-split bearer in NR, RLC doesn't attach RLC Sequence Number (SN) but reuses PDCP SN for ARQ operation. - *PDCP ARQ*: In this contribution it is proposed that, for NR, ARQ needs to be supported in PDCP in order to support various types of radio bearer and CU-DU split.
QoS Support Proposal	- *Finer granularity of BSR/SR*: In this contribution it is proposed that, for NR, BSR and SR are supported with finer granularity (i.e. per logical channel) compared to what is specified for LTE. - *QoS specific cell operation*: In this contribution it is proposed, for NR, to restrict specific radio bearer transmission only by a specific set of cells, in order to better control the QoS. - *QoS guaranteed PDU construction*: In this contribution in order to have better support of QoS control it is proposed, for NR, to introduce proper signaling to avoid to multiplex data having different QoS requirement into one MAC PDU.
Performance analysis of functional split between central and distributed unit in RAN	The proposal of this contribution is to test one or multiple functional splits between the CU and DU, among the possible ones currently under discussion in 3GPP and gain understanding of their characteristics in terms of transport requirements and impact to end-user performance.
Network MIMO	A TDD system is considered, implemented in TI-based and Intel X86 hardware platforms. The system supports joint transmission using TM 8. Throughput and SINR are considered as KPI during testing activities.
EPS-5GS Interworking	Network simulation results will be provided, showing the performance of 4G-5G inter-system handovers and EPS/5GS interworking. A loose interworking solution is proposed. The performance metrics would be handover interruption time, latency, signalling overhead, etc
Coordinated Interference Cancellation	A coordinated interference cancellation scheme is proposed where the transmitter performs the staggered transmission operation and the receiver performs successive interference cancellation and sliding-window decoding. System level simulation results will be provided. UE Throughput is considered as KPI during simulation activities.