TSG-RAN Working Group 4 (Radio) meeting #97-ER4-2016928

Electronic Meeting, 2nd – 13th November 2020

**Title: LS on Phase noise and other RF Impairment modelling**

**Response to: RAN WG1: R1-2005196,** **LS to RAN4 on Phase noise and other RF Impairment modelling**

**Release: Rel-17**

**Work Item: FS\_NR\_52\_to\_71GHz**

**Source: TSG RAN WG4**

**To: TSG RAN WG1**

**Cc:**

**Contact person: Torbjörn Elfström**

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**Send any reply LS to: 3GPP Liaisons Coordinator,** [**mailto:3GPPLiaison@etsi.org**](mailto:3GPPLiaison@etsi.org)

**Attachments:**

[1] R4-2014976, “On 52.6 to 71 GHz phase noise characteristics, TP to TR and draft LS to RAN1”, Ericsson

[2] R4-2016533, “On PN model for 52.6~71GHz”, Huawei, HiSilicon

[3] R4-2015443, “Phase noise and RF impairment considerations”, Nokia, Nokia Shanghai Bell

# 1 Overall description

RAN WG4 received the incoming LS from RAN WG1 on Phase noise and other RF Impairment modelling considering RAN WG1 studies on Evaluation Methodology for the Study on supporting NR from 52.6 GHz to 71 GHz. In the LS, WG RAN1 states that Phase noise (PN) modelling is necessary in the RAN1 evaluation of applicable numerology including subcarrier spacing and channel BW and requests timely feedback from RAN WG4 on the applicability of the two PN models provided in TR 38.803 (Ex-1 and Ex-2 developed during rel-15 NR study item) to NR in the 52.6 to 71 GHz frequency range.

Additional information has been presented in RAN4. Inputs include the latest published [1]low-power PLL phase noise performance, based on which a phase noise model both for BS and UE including reasonable implementation margin for UE has been proposed. In addition, a comparison between PLL input data, new company proposals and Ex-1 and Ex-2 were investigated [1, 3] as well as qualitative analysis of phase noise characteristics was discussed.

Some companies in RAN4 have concluded the PN models in TR 38.803 example 2 (frequency scaled from FR2) reflect the hardware performance and are most appropriate for use.

A new phase noise model for UE was also presented in RAN4 [2].

A qualitative analysis over different phase noise models (existing and new models based on recent information) was made in RAN4 and RAN WG4 concluded may continue work to define a representative PN model.

Thus, RAN4 respectfully propose RAN1 to use following combinations:

* Alternative 1: BS and UE phase noise model set presented in [1].
* Alternative 2: Set based on BS phase noise model based on TR 38.803 Ex 2 and UE phase noise model presented in [2].
* Alternative 3: Set based on TR 38.803 Ex 2 phase noise PN model for both UE and BSs.

RAN4 has made an observation that the UE phase noise is higher compared to BS regardless of the model.

Modelling of other impairments e.g. power amplifier (PA), either directly or approximately via EVM injection, and other RF impairments, such as I/Q imbalance and frequency offset which may be optionally considered in the RAN1 evaluation was not considered in RAN WG4 for base stations. Developing such models for BS will take excessive amount of time.

For UE RF impairments no conclusions have been made yet.

RAN4 also study on performance gain introduced by ICI compensating, both implementation based approach which use the Rel-15 PTRS pattern and new PTRS pattern approach are analysed. It is RAN4’s understanding improvement on ICI compensating is useful to NR beyond 52.6GHz.

# 2 Actions

**To RAN WG1**

**ACTION:** RAN WG4 kindly request RAN WG1 to use the proposed new PN models for numerology evaluation studies on supporting NR from 52.6 GHz to 71 GHz.

# 3 Dates of next TSG RAN WG 4 meetings

3GPP RAN4#98-E, 2021-01-25 - 2021-02-05, Electronic Meeting