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 which include the latest published low-power PLL PN performance, based on which PN models both for BS and UE including implementation margin for UE has been proposed. In addition, a comparison between PLL input technical data, new additional information [1, 2, 3] and Ex-1 and Ex-2 were investigated [1] as well as qualitative analysis of PN characteristics was discussed.

Some companies in RAN4 consider that the PN models in TR 38.803 Ex-2 (frequency scaled from FR2 to 52-71 GHz) reflect the hardware performance and can be appropriate for use. A new PN model for UE was also presented in RAN4 [2].

Thus, RAN4 respectfully informs RAN1 of following combinations:

* Set based on BS and UE PN model presented in [1].
* Set based on BS PN model based on TR 38.803 Ex-2 and UE PN model presented in [2].
* Set based on TR 38.803 Ex-2 PN model for both UE and BS.

None of the models have been agreed in RAN4. RAN4 has made an observation that the UE PN is higher compared to BS regardless of the model.

A qualitative analysis over different PN models (existing and new models based on recent information) was made and RAN WG4 concluded to continue to develop a representative PN 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 studied performance gain introduced by ICI compensating, both implementation-based approach which use the Rel-15 PT-RS pattern and new PT-RS pattern approach are analysed. While RAN4 sees enhancements to PT-RS may be useful for >52.6 GHz frequencies, it is RAN1 responsibility and up to RAN1 to decide the design.

# 2 Actions

**To RAN WG1**

**ACTION:** RAN WG4 kindly request RAN WG1 to take the additional information above into account.

# 3 Dates of next TSG RAN WG 4 meetings

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